1. *Decisions, Decisions*

Objectives

When you have studied this chapter you should be able to:

1 Define "cashflow" and explain its importance in financial decision making.
2 Build a simple financial case from a given set of data.
3 Explain the importance of determining which cashflows are relevant to the investment being evaluated.
4 Describe the concept known as "discounted cashflow" and apply it to a simple financial case.
5 Explain what is meant by "cost of money" and "opportunity cost".
6 Describe the relationship between interest rates and inflation, and explain its relevance to financial decision making.

What is Cashflow?

Many things in business finance have a parallel in personal life. Since we usually take the trouble to try to understand those things that affect us directly, drawing the parallels can provide an insight into the business equivalents.

From time to time we do what we call back-of-envelope calculations to test whether a particular idea is worth pursuing or not. For example, should we stay in this house, which is cheap to run but involves expensive commuting costs, or move nearer work, but to a more expensive area? Should we keep the old car that is getting expensive to maintain, or replace it with a newer one that will involve an initial cost but will be cheaper to run? Most such decisions, personal and business, have the following characteristics:

- There is a choice of two actions – stay as we are, or make a change.
- We are strongly, though not exclusively, influenced by the effect on our cashflow.

Cashflow means the movement of money (cash) to or from an individual, or into or out of a business.

Table 1.1 New car versus old – the data

	Old car £	New car £
Cost of old car three years ago	3500	
Trade-in value of old car today	1000	
Cost of new car today		5000
Trade-in values three years from today	300	2000
Running costs in first year (then increasing at 5% per annum):		
fuel	1200	800
maintenance	800	400
road tax	150	150
insurance	300	300

A Financial Case

We shall use as an example the decision about whether to keep the old car or to change it. We would decide on a reasonable evaluation period, perhaps three years, and then jot down estimates of the costs of each alternative. The estimates might look like those in Table 1.1. Please look at it. We would usually try, by taking into account expected price increases, to estimate the amounts of actual cash that will have to be spent on these costs.

If you have an envelope handy, please now use the back of it to work out which of the alternatives you think is the best deal over three years. Should you keep the old car or trade it in for the new one? Table 1.2 will show you an answer.

The "Whole Project" Approach

However you did the calculations, they probably look something like those in Table 1.2. If we wanted a commonly used term that describes Table 1.2, we could call it a "financial case". What does it tell us? If we keep the old car our net cash expenditure over the chosen period will be £7425. If we trade it in, it will be only £7203. By trading in, we should therefore be better off in cash terms by £222. Note the phrase "in cash terms". Whether this means that the trade-in is actually the best deal from the financial point of view remains to be seen. Meanwhile, a few comments about Table 1.2 itself will be helpful – how it is set out, what it contains and what it excludes.

First, Table 1.2 probably looks much like the back of your envelope, except possibly for one thing. In the case of the "new" project I have separated (into "Year 0") those cashflows – the initial expenditure and receipt – that could be said to represent the start of the "project" from the others, such as running costs, that represent the consequences of a decision to proceed with it. This is both a conventional and convenient way of setting out project cashflows, for reasons that will become clear later.

Second, just as you probably did, I have excluded the original cost of the old car. Why? One reason is that it would be the same in both cases. However, another reason is that we can only make decisions about the future, not the past. We may possibly regret having spent £3500 on the old car three years ago, but nothing can bring that

Table 1.2 New car versus old – the "whole project" approach

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Keep old car					
Fuel		–1200	–1260	–1323	–3783
Maintenance		–800	–840	–882	–2522
Road tax		–150	–158	–166	–474
Insurance		–300	–315	–331	–946
Sell after three years				300	300
Net cashflows		–2450	–2573	–2402	–7425
Trade in for new					
Cost now	–5000				–5000
Sell old now	1000				1000
Fuel		–800	–840	–882	–2522
Maintenance		–400	–420	–441	–1261
Road tax		–150	–158	–166	–474
Insurance		–300	–315	–331	–946
Sell after three years				2000	2000
Net cashflows	–4000	–1650	–1733	180	–7203

money back. Past expenditure, whether of £3500 or £3.5 billion, that cannot be recovered is called a "sunk cost". For those who had to make decisions about whether to continue with it, once started, the Channel Tunnel would have provided a constant reminder of the meanings, both real and metaphorical, of "sunk cost".

Sunk costs are irrelevant to decision making and should therefore be excluded from cashflow estimates designed to assist it. They are, of course, relevant for other purposes. For example, we may wish to know the total costs incurred on the old car from when we bought it until today. Although these are *all* sunk costs, they are relevant for that particular purpose. However, they are not relevant for the purpose of deciding on a future course of action. We shall come across other examples of things that should be excluded from financial cases that are to be used as aids to decision making.

The third thing to notice about Table 1.2 is that it shows two cashflow estimates, one for each course of action. This is not the shortest way of setting out project cashflows; neither is it the most convenient, especially when, as in this case, there are only two alternatives. However, it may be the only practicable approach when there are more than two alternatives to consider. Aptly, it is sometimes called the "whole project" approach.

The "Combined" Approach

There is, however, a shorter and more convenient way of producing cashflow estimates. With the car "project", as with many business examples, we are comparing

Table 1.3 New car versus old – the "combined" approach

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Cashflows arising from trading in old car for new					
Cost of new now	–5000				–5000
Trade-in of old now	1000				1000
Fuel					
old costs avoided		1200	1260	1323	3783
new costs incurred		–800	–840	–882	–2522
Maintenance					
old costs avoided		800	840	882	2522
new costs incurred		–400	–420	–441	–1261
Proceeds of sale after 3 years:					
old – benefit forgone				–300	–300
new – benefit gained				2000	2000
Net incremental cashflows	–4000	800	840	2582	222

only two alternatives – "continue as we are" or "do something different". Where this is the case, we can combine everything into one case to answer the single question "What would be the incremental effect on cashflow of making the change?". Not only is this – the "combined" approach – shorter, but when we come to consider more complex business examples it is usually easier to use and more informative than the total project approach.

One form of the combined approach is shown in Table 1.3. Please look at it. It lies between the whole project approach and the fully "incremental" approach that we shall consider shortly. With one exception, Table 1.3 contains the same level of detail, and of course gives the same result, as did the "whole project" approach. However, similar items are now paired, thus making it easier to compare them.

The exception referred to in the previous paragraph is that both road tax and insurance have been excluded. They could have been included, but to do so would be a waste of space, because they are the same in each option. Whichever option is chosen, they would be unchanged by the decision. We have thus identified something else that should be excluded from financial cases to be used as aids to decision making – things that, although they are cashflows and although they are in the future, will be unaffected by the decision.

The "Incremental" Approach

Given a choice of more numbers to look at or fewer, most people would choose fewer. The fully incremental approach, illustrated in Table 1.4, allows us to present the cashflow estimates with a minimum of detail. It shows only the incremental changes

Table 1.4 New car versus old – the fully "incremental" approach

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Incremental cashflows arising from trading in old car for new					
Cost of new, less trade-in	–4000				–4000
Fuel		400	420	441	1261
Maintenance		400	420	441	1261
Proceeds of sale after 3 years				1700	1700
Net incremental cashflows	–4000	800	840	2582	222

to cashflows that would occur if the "new" project were to be decided upon. "Old" and "new" numbers could be used to emphasize the difference in the case of a particular item. A glance at Table 1.4 will, I think, prove the point that it is easier to read and digest than the other formats, while giving the same result.

Both the "combined" and the "incremental" forms – Tables 1.3 and 1.4 – have the added advantage over the "whole project" form that their bottom lines show the net changes to cashflow year by year. They show in which years we shall need more cash, and how much. From this we can determine how much we shall have to borrow, or by how much our own cash resources will be depleted, and when. We can see when we can expect higher cash inflows that will allow borrowings to be repaid or cash mountains to be replenished.

Checkpoint

So far in this chapter we have covered the first three of its objectives. In particular:

- We have defined "cashflow".
- We have used three possible approaches to setting out financial cases.
- We have identified the two main characteristics of cashflows that are relevant to decision making – they will occur in the future, and they will differ among the alternatives.

What is Discounted Cashflow?

Whichever of the three approaches we choose, if our estimates prove to be exactly right (which would of course be extremely unlikely), then by trading in, we should be better off in cash terms by £222 compared with keeping the old car. I raised earlier the question of whether this means that the trade-in is actually the best deal from a financial point of view. It would be a pity to have done all this work (or the much greater amount of work involved in evaluating a real IT investment) only to use it inappropriately in making the decision.

Table 1.5 Similar amounts receivable (or payable) today, but in different currencies

	£	$	Fr
Amounts receivable (or payable)	100	100	100

Table 1.6 Using exchange rates to convert cashflows occurring in different currencies

	Ref	£	$	Fr	Total £
Amounts receivable (or payable)	a	100	100	100	
Conversion factors (exchange rates)	b	1	2	10	
Amounts receivable (or payable) in pounds (a/b)		100	50	10	160

What Does "Better Off" Mean?

You might ask how there could possibly be any ambiguity. The numbers show clearly that by trading in we should be £222 better off in cash terms. Indeed they do. However, we have first to seek the answers to two questions: what do we mean by "better off", and what do we mean by "pounds"? In the answer to the second question lies the answer to the first, so: what do we mean by pounds?

Please look closely at Table 1.5. It shows three amounts of money, 100 units each, receivable today. But units of what? The answer is 100 each of pounds, dollars and francs. It may be nice to know that we are to receive these sums, but we should also like to know what it all amounts to in pounds today. So we apply conversion factors – exchange rates – to convert units of foreign money to pounds. Please now look at Table 1.6. Supposing there are currently $2 to a pound, and Fr10 to a pound, we can now see the answer to what we wanted to know. Expressed in the units that tell us how much better off we shall be today, namely pounds, the answer is £160.

By looking at the headings in Table 1.5 we knew immediately that we were dealing with amounts that were being expressed in unlike units. We knew, therefore, that to make sense of what they might mean to us in real terms, we would have to convert them all to a single unit of our choosing, using appropriate conversion factors. The obvious single unit to choose was pounds.

When is a Pound Not a Pound?

What, you may wonder, was the point of that rather trivial little exercise? To answer that question, now please look at Table 1.7. It too represents three amounts of money, 100 units of each. However, unlike Table 1.5, in which the amounts were all receivable today but in different currencies, now the amounts are all receivable in pounds but at different times – today, one year from today and two years from today.

Table 1.7 Similar amounts receivable (or payable) at different times

	Yr 0	Yr 1	Yr 2
	£	£	£
Amounts receivable (or payable)	100	100	100

The question is – do we have a similar problem to the one we faced in Table 1.5? Indeed we do, but the nature of the problem is less obvious. In Table 1.5, we *knew* we were dealing with unlike amounts because they had different signs. In Table 1.7, *the same units (£s) are being used to represent values that are in fact as different in real terms as they would be if they were in different currencies*. Why are the values different? The reason is that money received (or paid) in the future is not worth as much as money received (or paid) today. If it were, and I were offering to give you £100, you would be indifferent whether you received it today, a year from today, or ten years from today.

The Cost of Money

The fact is, however, that you would *not* be indifferent to when you received my £100; you would like it now, thank you very much. But why? The reason is as follows. Suppose you have an overdraft of £100 from a bank that is charging you 10% per annum interest. We could say that your current "cost of money" is 10% per annum. However, let us also suppose that you would like to pay off the overdraft. If you received my £100 today you could do so; if you did not receive it until a year from today you could not. The reason is that a year from today the overdraft will have grown, with interest, to £110, while my gift will not.

Present Value

So, £100 today will enable you to extinguish exactly a debt that would be £110 one year from today. We could say, therefore, that £100 today is worth exactly the same to you as £110 would be worth one year from today, if your cost of money is 10% per annum during the intervening period.

Putting it the other way round, we could say that if your cost of money is 10% per annum then £110 received one year from today is actually worth only ten elevenths (100/110) of what it would have been worth had it been received today. The same holds true, of course, if the £110 were payable one year from today rather than receivable. Finally, we could generalize and say that if the cost of money is 10% per annum, then any sum receivable or payable one year from today is actually worth only ten elevenths (0.9091) of what it would have been worth had it been received or paid today.

Not all jargon is bad. If it were, we IT people would be high on the list of culprits. Financial people use a few shorthand phrases that shorten considerably the last sentence in the previous paragraph. They would use "future value" to mean the amount of cash receivable or payable in the future; they would use "present value" instead of the rather long-winded "what it would have been worth had it been received or paid today"; and they would use the term "discount" to describe the process of taking a larger number and turning it into a smaller one.

So, with respect to our specific example, financial people would say that the present value of £110 receivable one year from today, discounted at 10%, is £100. To describe the generalization they would say that the present value (PV) of a cashflow one year from today, discounted at 10%, is equal to 0.9091 (ten elevenths) of its future value (FV). Notice that the phrase "discounted at 10%" is not strictly accurate, but it is widely used, and generally understood, to mean "reduced to ten elevenths". If the discount rate used had been 8%, then "discounted at 8%" would mean "reduced to eight ninths", and so on.

Nothing But Simple Arithmetic

Tedious it may have been, but in the above example and its explanation we needed nothing but simple arithmetic, and that is the most difficult mathematics that you will encounter in the whole book. Finance is not a difficult subject, and I intend to keep proving the point. It is true that the numbers were easy. The arithmetic would certainly have been more tedious if the cashflow had been £537, the cost of money 14.25% and the period 17 years.

To cater for the majority of situations, where the numbers are indeed not so easy, tables of discount factors have been developed. You will find such a table – Table A1.1 – in Appendix 1, which also gives the formula from which the table was derived. Table 1.8 shows a subset of the table of present values. Please look at it now.

If we did not already know the answer, and we wanted to use the discount table to solve the problem discussed above, the question, to remind you, would be this: what is the present value of £110 receivable or payable one year in the future if we are discounting at 10%? The way to use the table is to look down the left-hand side until you come to the 10% row, then to look along until you come to the "one year" column. The number that you find is 0.9091. What answer do you get if you then multiply 110 by 0.9091? The answer, of course, is 100.

Now please glance back to Table 1.7. It showed three amounts of £100 receivable (or payable) respectively today, a year from today and two years from today. While in cash terms, the value of the amounts in total is of course £300, we now know that, in real terms, it is rather less. How much less depends on the "cost of money" of the receiver or payer. Supposing this to be 10%, you may like to work out the answer for yourself. Table 1.9 shows the solution.

A Common Currency

The use of discount factors in the above example was analogous to the use of exchange rates in the previous one. Exchange rates were the means whereby we were able to represent cashflows expressed in unlike currencies (and therefore having different values) in a single common unit – pounds. Discount factors are the means

Table 1.8 Present value of a lump sum of £1 receivable or payable *n* periods from today

%	Periods 1	2	3	4	5	6	7	8	9	10	11
5	0.9524	0.9070	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446	0.6139	0.5847
6	0.9434	0.8900	0.8396	0.7921	0.7473	0.7050	0.6651	0.6274	0.5919	0.5584	0.5268
7	0.9346	0.8734	0.8163	0.7629	0.7130	0.6663	0.6227	0.5820	0.5439	0.5083	0.4751
8	0.9259	0.8573	0.7938	0.7350	0.6806	0.6302	0.5835	0.5403	0.5002	0.4632	0.4289
9	0.9174	0.8417	0.7722	0.7084	0.6499	0.5963	0.5470	0.5019	0.4604	0.4224	0.3875
10	0.9091	0.8264	0.7513	0.6830	0.6209	0.5645	0.5132	0.4665	0.4241	0.3855	0.3505
11	0.9009	0.8116	0.7312	0.6587	0.5935	0.5346	0.4817	0.4339	0.3909	0.3522	0.3173
12	0.8929	0.7972	0.7118	0.6355	0.5674	0.5066	0.4523	0.4039	0.3606	0.3220	0.2875
13	0.8850	0.7831	0.6931	0.6133	0.5428	0.4803	0.4251	0.3762	0.3329	0.2946	0.2607
14	0.8772	0.7695	0.6750	0.5921	0.5194	0.4556	0.3996	0.3506	0.3075	0.2697	0.2366
15	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323	0.3759	0.3269	0.2843	0.2472	0.2149

Table 1.9 Using discount factors to convert cashflows to present values

	Discount rate	Ref	Yr 0 £	Yr 1 £	Yr 2 £	Total £
Amounts receivable (or payable)		a	100	100	100	
Conversion factors (discount factors)	10%	b	1	0.9091	0.8264	
Amounts in "today pounds" or "present values" (a×b)			100	90.91	82.64	273.55

whereby we can represent cashflows occurring at different times (and therefore having different values) in a single common unit – "today pounds" or present values. Understanding this concept is vital if you are to understand what follows. It is even more important if you are to make sound judgments, or understand the judgments of others, about IT investments in which you are involved.

Checkpoint

Since the previous checkpoint we have covered one further objective of this chapter – objective 4 and part of objective 5. In particular:

- We have discussed the main principles of discounted cashflow, and have seen how they are applied to a financial case.
- We have discussed what is meant by "cost of money" and its importance in discounted cashflow calculations.

We can now return to our little problem of whether to keep the old car or trade it in for a newer one. Please turn back to Table 1.4 on p. 7. You will recall that in cash terms the numbers tell us that trading in old for new is the best option.

The Real Cost of Trading in

Now assume that you expect your overdraft to cost 13% per annum for the next three years. Let us now ask again: which is the best option financially – to keep the old car or to trade it in? A comparison of the cash numbers told us that the trade-in option would be cheaper by £222 than would keeping the old car. Taking into account what we now know about what is often called the "time value of money", is £222 the number upon which we should base our decision? I think not. What number should our decision be based on? Table 1.10 shows the solution, but try to avoid looking at it before you have attempted the answer for yourself. Assume for this exercise, and in practice for most present value calculations, that the cashflows in each year occur on the last day of that year.

Now please look at Table 1.10. First, notice that in order to work out the answer, we only need to use the bottom line of numbers from Table 1.4 – the totals of the incremental cashflows. For the purpose of present value calculations, the detail from which those totals were derived has become irrelevant. If you enjoy this kind of thing, you could work out the present value of each individual cashflow and then add up all the answers. However, your final answer would be the same, so such an approach would need to be strictly for enjoyment.

What we did was to look up the 13% discount factors for one, two and three years and multiply the net cashflows in each year by the respective discount factors. Note that the discount factor for any cashflow paid or received today is, of course, 1. The result was the present values of the cashflows in each year. We then added together those present values to arrive at a total. This total is called the "net present value (NPV)", because it is the sum of a series of individual present values, of which some are positive and some are negative. The NPV of these cashflows, discounted at our cost of money of 13%, is –£844.

Before we ask what that number actually means, let us perform one check on its correctness by doing present value calculations on the total cashflows of the two separate projects that we compiled earlier using the "whole project" approach. Refer back to Table 1.2 and do the calculations yourself if you would like more practice at them. The result is shown in Table 1.11. Not surprisingly, the result is –£844, the same as the one obtained by using the incremental method.

Table 1.10 New car versus old – applying discounted cashflow ("incremental" approach)

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Incremental cashflows arising from trading in old car for new					
Net incremental cashflows	–4000	800	840	2582	222
Discount factors @ 13%	1	0.8850	0.7831	0.6931	
Present values (PV)	–4000	708	658	1790	-844

Table 1.11 New car versus old – applying discounted cashflows ("whole project" approach)

	Ref	Yr 0	Yr 1	Yr 2	Yr 3	Total
		£	£	£	£	£
Keep old car						
Net cashflows			–2450	–2573	–2402	
Discount factors @ 13%		1	0.8850	0.7831	0.6931	
Present values (PV)	a	0	–2168	–2015	–1665	–5848
Buy new						
Cost now		–4000	–1650	–1733	180	
Discount factors @ 13%		1	0.8850	0.7831	0.6931	
Present values (PV)	b	–4000	–1460	–1357	125	–6692
Difference between PVs (b–a)		–4000	708	658	1790	–844

Interpreting Present Values

The question is – what does that number –£844 actually mean? Remember that we are looking at two alternative projects – continue as we are (keep the old car) or do something different (trade it in). Remember also that we used the "incremental approach". This was in order to determine the incremental effect on cashflows of trading in rather than choosing the alternative. Remember, finally, that by discounting the cashflows at our "cost of money" we have taken into account that cost. By doing so, we have reflected the fact that later cashflows are worth less than earlier ones. In *cash terms* we worked out that we should be better off by £222 trading in old for new. The net present value (NPV) of –£844 tells us that by contrast, in *real terms,* we should actually be £844 worse off by trading in, and that therefore we should keep the old car. "In real terms" means after taking into account what the money being used is costing us.

Why is there such a big difference, in this case as in many real ones, between the net incremental cashflow of (+) £222, and the net present value of (–) £844? The following factors in this particular example have contributed to it. First, 13% is quite a high cost of money. Second, the biggest number in the financial case is the cash outflow of £4000 in Year 0 – today. Because it occurs today it is not discounted. By contrast, the biggest net inflow, of £2582, does not occur until Year 3, and it is therefore discounted quite heavily. This is an example of an unfortunate fact – that the universe was not constructed in a way that favours long-term projects. Why are the dice loaded against projects? It is because usually, although not necessarily, most of the big costs occur at or near their beginning, and so are discounted hardly at all. By contrast, most of the benefits occur later in time, and they are therefore discounted more heavily.

Why We Assumed an Overdraft

In the examples considered so far we have assumed that the individual evaluating the project has an overdraft. This is because our ultimate purpose will be to apply these principles to real business, specifically real IT, investment evaluations. As we shall discuss shortly, all the money that any business has at its disposal is "on loan" in one way or another. Businesses, and organizations in general, may certainly own the assets that they use, in the sense of having legal title. However, they do not "own" the money – the financial resources – used to acquire them. They are custodians of money invested or lent by others.

However, since we as individuals can and do own money, it is reasonable to ask how we should evaluate the car project were we "cash-rich" (as the jargon has it) – if we were using our own, rather than borrowed, money? If we were using our own money, could it be said to have a "cost" for the purpose of doing present value calculations? The answer is that all money has a cost. This is most obvious if it is borrowed, but it is equally true if it is owned.

Opportunity Cost

If money is owned, it is capable of earning interest by being invested (whether it is actually invested or not). The cost of using owned money to invest in something else, such as a new car, is therefore the lost opportunity of earning interest in the best alternative investment. The cost of this lost opportunity is usually called the "opportunity cost".

Suppose that the best currently available investment of acceptable risk for your money is a high-interest building society account paying 7% per annum, and that you would use this money to finance the new car. At what rate, then, should the project cashflows be discounted? The answer would appear to be 7%; that is, until we recall that tax is payable on interest received. What matters to us ultimately is not the quoted rate of interest, but what is left after tax, and that will be nearer 5%. You may like to do the calculation, using a 5% discount rate, and see if it makes any difference to the "advice" offered by the financial model. Table 1.12 shows the answer. As you will have discovered, the NPV is still negative, but it is a much smaller negative number. It is a fact, although hardly a surprising one, that the smaller the discount rate, the smaller will be the discount. The smaller the discount, then the smaller the difference between the cash numbers and their net present values. The subject of tax, in the context of IT investment, is dealt with in Chapter 6.

Table 1.12 New car versus old - the effect of a lower discount rate

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Incremental cashflows arising from trading in old car for new					
Net incremental cashflows	–4000	800	840	2582	222
Discount factors @ 5%	1	0.9524	0.9070	0.8638	
Present values (PV)	–4000	762	762	2230	–246

Table 1.13 Illustration of "financial cashflows"

	Yr 0	Yr 1	Yr 2	Yr 3	Total
	£	£	£	£	£
Financial cashflows arising from the car project					
Loan received from the bank	4000				4000
Interest paid @13% (simple interest because assumed paid each year)		–520	–520	–520	–1560
Loan repaid to the bank				–4000	–4000
Net cashflows	4000	–520	–520	–4520	–1560
Discount factors @ 13%	1	0.8850	0.7831	0.6931	
Present values (PVs)	4000	–460	–407	–3133	0

"Financial Cashflows"

Assuming that you did not do so earlier, it would be reasonable to ask why we have not included in the car project the "cash inflow" from the bank of £4000, representing the increased overdraft if we were to buy the new car, and the "cash outflows" represented by the interest payable and the eventual repayment of the loan. It could be argued that these are indeed cashflows attributable to the project. The answer is that they could be included, but that it would be pointless to do so because, as Table 1.13 illustrates, they would be cancelled out by the discounting process. Please look at the table and make sure that you agree.

Inflation

So far we have not considered inflation. What is inflation? A working definition is that inflation is the erosion over time of the purchasing power of money. Suppose you lend £1 for a year at an interest rate of 8%, how much money will you have at the end of the year when the loan is repaid? The answer is, of course £1.08. If, during the year of the loan, inflation was 5% per annum, how much have you gained in terms of the purchasing power of your money? It is tempting to say 3 pence (8 pence less 5 pence) and that is very nearly right. In fact, the answer is about 2.85 pence, because the calculation is not 1.08 minus 1.05, but 1.08 divided by 1.05. The reason is that percentage rates of things such as interest and inflation are always applied multiplicatively.

Consider the following example. Suppose you are thinking of taking out an IT maintenance contract for three years. The first year costs £4000, payable today. It is not a fixed price contract, but you believe that payments will increase in line with inflation, which you assume will average 5% over the period. You could produce your cashflow estimate in either of two ways, as follows:

Table 1.14 Inflation, and how to handle it when discounting cashflows

	Yr 0	Yr 1	Yr 2	Total
	£	£	£	£
Maintenance contract – cashflows include inflation, discount rate includes inflation				
Cashflows inflated at 5%	–4000	–4200	–4410	–12610
Discount factors @ 12%	1	0.8929	0.7972	
Present values (PV)	–4000	–3750	–3516	–11266
Maintenance contract – cashflows exclude inflation, discount rate excludes inflation				
Cashflows uninflated	–4000	–4000	–4000	–12000
Discount factors @ 6.67% (1.12/1.05)	1	0.9375	0.8789	
Present values (PV)	–4000	–3750	–3516	–11266

- You could, using your estimate of 5% inflation, work out what the actual future cash amounts payable will be, and it is these that you would then put into your financial case. If your cost of money is, say, 12%, then you would use 12% as the discount factor in discounting the cashflows. That is exactly what we did in the car example, and it is usually the simplest method to adopt.
- Alternatively, you could ignore inflation and use current, uninflated, numbers in your cashflow estimate. In this case, since the cashflows exclude inflation, the discount rate should exclude inflation too, otherwise you would not be comparing like with like. If your cost of money is 12% and inflation is 5%, then what is your "real" cost of money? 1.12 divided by 1.05 comes to 1.0667, so the answer is that your real cost of money is 6.67%. This is not a nice number to work with, but it is nevertheless the one that you should use in this case to discount the uninflated cashflows.

Table 1.14 demonstrates both of these approaches and shows, as one would expect, that both give the same present value (PV) for the cashflows. This means that you can use either method, and provided you use each correctly you will get the same answer.

The Importance of Consistency

The important thing is consistency. You can either use quoted or "nominal" cost of money rates to discount "actual money" cashflows, as we did in evaluating the car project; or you can use "real" cost of money rates to discount uninflated cashflows, that is cashflows at today's prices. Whichever method is used there will of course be inconsistencies, because in any real situation not all price increases will be at the general inflation rate, even if we could estimate accurately what that would be.

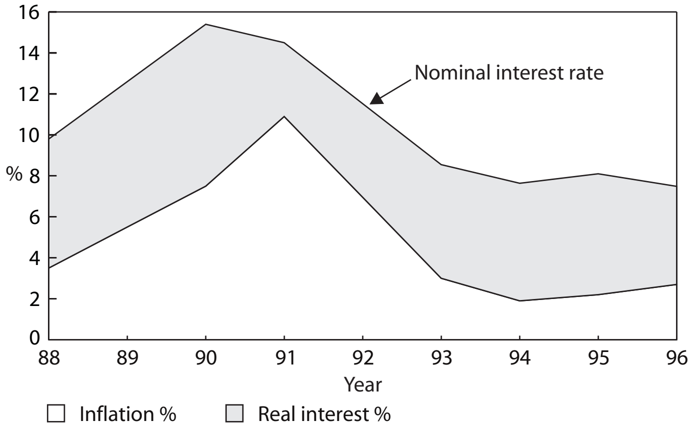

Fig. 1.1 Interest rates and inflation (based on mortgage and inflation rates quoted in *The Daily Telegraph*, 23 March 1996).

Bearing in mind that every figure in a financial case is itself an estimate, such inconsistencies are likely to be something that we can live with.

As an illustration of the relationship between quoted or "nominal" interest rates, inflation rates and the resulting "real" interest rates, Fig. 1.1 shows what they were in the UK between 1988 and 1996.

Summary

The main points covered in this chapter, linked to its objectives, have been the following:

1 "Cashflow" means the movement of cash to or from an individual, or into or out of a business. Cashflow is the foundation of investment decision making.

2 There are three possible approaches to setting out estimates of investment cashflows. They are:
- the whole project approach, suitable where more than two alternatives are to be considered
- the combined approach
- the incremental approach

Of these, where it can be used, the incremental approach is usually the shortest, the simplest and the most informative.

3 The two main characteristics of cashflows that are relevant to the decision process are that they will occur in the future and that they differ among the alternatives being considered.

The three main kinds of cashflow that should be ignored in investment decision making are sunk costs, financial cashflows and cashflows that will not be changed by the decision.

4 The "real" value of a cashflow depends on when it occurs. The further into the future, the less the cashflow's real value in today's terms. The way to determine this real value is to discount the cashflow, using as a discount factor the individual's or firm's cost of money.

5 All money has a cost. This is true of both borrowed and "owned" money. The cost of using owned money is the "opportunity cost" – the benefit foregone by not investing it in the best available alternative.

6 Either discount "actual money" cashflows using a quoted or "nominal" discount rate, or discount uninflated cashflows using the equivalent "real" discount rate. Compare like with like.