Section I

The five financial building blocks

CHAPTER

1

Building block 1: Economic value

Summary

This chapter will provide the first of the five building blocks that are necessary in order to understand the language of business and play an active part in financial decision taking in a company. It is in four parts. The first part introduces some basic theory concerning the time value of money. In part 2 we will move into the practical realm of calculating value. Part 3 will work through three case studies in order to demonstrate further how the value technique can be applied in practice. Finally, part 4 will set several work assignments. It is anticipated that readers will work through these examples themselves. Specimen answers along with some additional comments on issues raised are given in Appendix I at the back of this book.

Part 1: The basic question

Would you rather receive $100[1] now or $100 in one year's time? The rational answer to this question is to take the money now.[2] If, however, the offer

[1] This book is intended for an international audience and so there is an inevitable question concerning what currency to use in any examples. Throughout the book the default currency in examples will be the US dollar. I have to ask readers for whom this is not their normal currency to swap, in their minds, references to US dollars to references to their own currency. Unless an example refers to two or more currencies I do not intend readers to take account of any currency conversion issues.

[2] It is possible to invent scenarios where the logical answer might be to take the money later, but these will concern unusual situations. For example, a scenario where two people are held at knife point and expect to be asked to give up all their possessions. One says to the other, 'Can I pay you back that $100 that I owe you?' The logical reply here might be to ask for the money later! I only say 'might be' because if you were insured you might think that taking the money now was the smart thing to do.

This is the first and last time in this book that I will invent an extreme example that apparently disproves a simple and generally true assertion. Business, in my view, is not a pure science and rules have exceptions. Part of the skill of business is to know when to trust to a rule and when to realise that the old adage that 'the exception proves the rule' must be applied.

concerned the choice between $100 now but an anticipated $200 in a year's time, many, but not all, would be prepared to wait. In principle, for a situation such as this there is a sum of money that you anticipate in the future which will just compensate you for giving up the certainty of receiving money now.

This simple question of money now versus money later is at the heart of most financial decisions. Take for example the decision to invest in a new piece of machinery. How should an organisation decide whether or not to invest money in the hope of getting more back later? What about the decision to sell a business? This concerns receiving money now but then giving up the uncertain flow of cash that the business would have generated in the future. In this section I will set out an approach which can be adopted to give answers to such questions. It is called the economic value model. Through it we are able to make rational choices between sums of money at different times in the future.

This economic value model has its most obvious uses in companies that are quoted on stock markets because it allows decision making to be clearly aligned with the best interests of shareholders. It is, however, of more general use. It makes sense for individuals to consider important financial decisions from this perspective. It is also used in the public sector. A good example comes from the UK. Here, HM Treasury's so called Green Book sets out the recommended approach for appraisal and evaluation in central government. This too, applies the economic value model albeit that it uses an alternative name for it, namely 'discounting'.

The time value of money

Let us return to the question of an individual deciding between $100 now and $200 a year later. How do you think the decision would be made? If you were faced with this question, what factors would you want to consider? Please think also about whether you would consider yourself typical of others. Can you see how different categories of people and different situations could lead to different decisions? Now think also about a similar transaction only this time where an individual was borrowing $100 today but had to repay $200 the following year. How do you think he or she would decide about this?

My guess is that the longer readers think about these questions, the more possible answers they will come up with. There are, however, likely to be some generic categories of answers. One category will concern the financial situation of the individual to whom the offer is made. Is he/she desperately short of money or will the cash simply make a marginal improvement in an already healthy bank balance? The second category of answer will concern the risks associated with the offered $200 in the future. Just how sure are you about this sum of $200 in a year's time? Is this a transaction with your trusted rich Uncle Norman or your fellow student Jake who you know is about to go off backpacking around the world and is seeking a loan to fund the purchase of the ticket for the first leg of the journey? Uncle Norman *will* pay whereas Jake will do so only if he can afford it! Then, when it comes to borrowing money, categories of answer are likely to concern things like the use to which the money will be put, the alternative sources of cash and, crucially, the consequences of failure to repay.

So we can see there are many reasons why the exact trade off between money now and money later may change. In any situation, however, there should be a sum of money in the future that balances a sum of money now. I will call the relationship between money now and a balancing sum of money in the future, the time value of money.

Quantifying the time value of money

The time value of money can be quantified as an annual interest rate. If the initial sum of money (traditionally called the principal) were termed P and the interest rate were r% then the balancing sum in one year's time would be:

$$\text{Balancing future sum} = P \times (1 + r)$$

In the $100 now or $200 in a year's time example above, the implied annual interest rate is 100%. Had we felt that a 15% time value of money was appropriate we would have been indifferent between $100 now and $115 in one year's time.

Quoting the time value of money as an annual interest rate creates a common language through which investments can be compared. If we did not express things in a common way we would face the practical difficulty that we could only compare investments that were over the same period of time. In this section we will consider the formula which governs how the time value of money works. We can then use this formula as one means of quantifying what our time value of money is.

Readers will hopefully be familiar with the difference between compound interest and simple interest. With compound interest, when interest is added it then counts towards the balance that earns interest in the future. With simple interest the interest is only paid on the original sum. So with compound interest at 10% an initial investment of $100 grows to $110 after one year and $121 after two years. By contrast, with simple interest it only grows to $120 after two years. The extra $1 in the compound interest case comes as a result of earning interest on interest.

The time value of money works exactly like compound interest. This is because with each year of delay the sum of money we anticipate in the future has to grow at the time value of money. The formula for it is:

$$FV = PV \times (1 + r)^n$$

Where:

PV is the sum of money now (termed the present value);
FV is the balancing sum of money in the future (termed the future value);
r is the time value of money expressed as an annual percentage;
n is the number of years in the future that the balancing sum will be received.

This means that if we can decide on the future value that balances a present value a given number of years in the future, we can calculate the implied time value of money. So, for example, if we know that in a particular situation we are indifferent between $100 now and $112.5 in three years' time we could calculate our time value of money as 4.0%.[3]

This book will devote a lot more attention to the topic of setting the time value of money in later chapters. It is sometimes called different things such as the cost of capital or the discount rate. At this early stage in our journey towards financial expertise, however, all that is needed is an acceptance of the principle of the time value of money and that this works exactly like compound interest. This principle holds that for any situation there is a balancing point where future expectations are just sufficient to justify investing today. The balancing point is characterised by the position where a decision maker is indifferent between a sum of money now and a sum of money later. Once we have identified a balance, we can back-calculate from it the implied time value of money.

Armed with this time value of money we could then assess similar trade offs that involved different amounts of money and different time periods. We could, for example, use this single time value of money to apply to any offers

[3] Don't worry if the maths behind this looks a little complex at this stage. We will have plenty of opportunities to learn how to do the sums as this chapter progresses. For the time being, if you are not sure you could have calculated the 4% figure, simply check it is right by doing the sum $100 \times 1.04 \times 1.04 \times 1.04$.

from our rich Uncle Norman while we would probably have a different, and almost certainly higher, rate for any offers involving backpacking student friends like Jake.

The concept of value

The value concept allows us to translate any sum of money at one point in time into an equivalent amount at another time such that we would, in theory, be exactly indifferent between the two sums. One initial point to stress is that to count as 'a sum of money' in this context, the money must be immediately available to spend.[4]

So the concept of value refers to an equivalent amount of money that can be spent. It needs to be qualified by adding a reference to when the money can be spent. Hence present value refers to money that can be spent now while future value is money that cannot be spent until some time in the future. The term future value only has precise meaning when it is made clear exactly when in the future the money is available.

The time value of money formula allows us to convert future sums of money into their equivalent now. We have already introduced a special name for this. We call it the present value. We have defined the present value of a future amount of cash as the amount that we would be indifferent to receiving today compared with the future amount given all of its particular circumstances.

Using value to take decisions

So if value is the equivalent of cash in hand at a specified time, then present value is cash in hand now. Now the nice thing about cash in hand now is that it is very easy to count. Furthermore, if offered two amounts we can say that we would always prefer the greater amount. Contrast this with two different values, one corresponding to one year ahead and the other two years ahead. How could we decide between these? It would not be right simply to compare the two amounts and select the larger. The value approach is to convert each future value into its present value and then compare these. So when we are

[4] Cash is only really of use if you have it available to spend. If you want to test this statement out, try telling a bus driver who asks you to pay the fare that you have the cash but it is at home. This simple scenario will, hopefully, illustrate the difference between owning money and having money immediately available to spend. The value calculation only takes account of money when it is available to spend.

faced with two possible alternatives, if we were to express both in terms of their present value we would have a very simple way to make decisions:

Always select the option with the highest present value.

It is important to note the reference to using *present* value when making decisions. Would it be correct to make decisions based on maximising value at some point in the future? For example, what about a decision rule that required one to select the option with the highest value at the end of the current year? What do you think?

Well, the general answer is that such a decision rule would not be a good one although there is a special circumstance when the answer could be that it was.[5] There are two reasons for future values not being a safe basis for decision taking. First, there may be different cash flows between now and the point in time being considered and second, the time value of money may be different.

The point about different cash flows is fairly obvious. Suppose you are choosing between two options that offer either $150 or $100 at the end of this year. Your first thought will be that $150 is better. But suppose this option requires you to spend $50 now in order to gain the right to the $150 later while the $100 option requires no initial investment. In this situation the $100 option would clearly be preferable. The discount rate point is also quite simple. If the $150 was very risky compared with the $100 we might associate a higher value today to the low risk $100. Note, however, that when the clock has moved forward to the end of the year, we should take decisions based on what would *then* be the present value but today we take decisions based on value today, i.e. present value.

Taking stock and defining some terms

We have seen how money now is preferable to money later. We have associated the term *time value of money* with the concept of an amount of money receivable in the future such that we are indifferent between it and the alternative amount of money now. We have introduced the term *value* to emphasise the difference between money owned and money that is available to spend. Finally, we have seen how *present value* can be used as a financial decision making tool and we understand the distinction between this and any *future value*.

[5] This special situation is where the options being considered have the same time value of money and the same net cash flow between the present and the point in time in the future where you are assessing value. In this situation one could adopt a rule of maximising a future value.

I will give this approach a name and call it the *economic value model*. The economic value model gives a means of calculating the present value of any option or situation.

The following picture shows how it works.

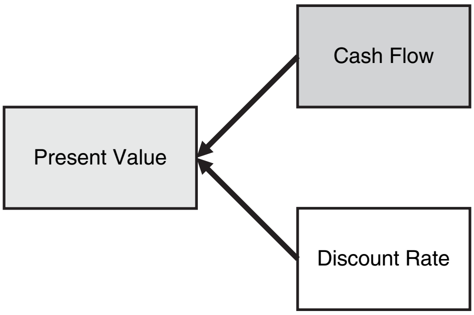

Fig. 1.1 The economic value model

There are a few more bits of jargon to learn:

- The process of adjusting a future cash flow to its present value equivalent is called *discounting* or *discounted cash flow analysis*. The abbreviation *DCF* is also used.
- The *time value of money* can also be called the *discount rate* or the *cost of capital*.[6]

One important aspect of the economic value model concerns the way that it treats the cost of any money that is used. This is allowed for via the discount rate and so any finance charges such as interest are not deducted from cash flow since to do so would serve to double count them. The basic principle is that one considers the cash flows which are required or generated *before* any finance charges are allowed for. We will return to this point later in the book.

The power of present value lies in two things first: in its intuitive and computational simplicity and second in how it provides a link between decision taking and how companies are valued. We will deal with both of these points later in this book. At this stage all we need to know is that values are things that can meaningfully be added up and that it is generally accepted that the market price of an asset is set by its value calculated via the economic value model.

[6] The term discount rate is obviously related to the concept of discounting. The reason for using the term cost of capital is not obvious at this stage in the book. For the present, please just accept it as all will be explained later.

For the remainder of this chapter we will concentrate on using the model to make simple financial decisions.

Part 2: Calculating present values

Now that we have some basic theory in place we can move to the more practical topic of calculating value. The following sections will introduce some simple approaches to calculating net present value.

Given the importance of present value it makes sense to rearrange the time value of money formula so that present value is the subject. Hence:

$$PV = \frac{FV}{(1+r)^n}$$

Note that the formula works irrespective of whether we are dealing with cash inflows or cash outflows. A cash inflow is given a positive sign while an outflow is negative. The objective is always to choose the option with the highest present value. A positive number is higher than a negative one and a small negative number is higher than a large negative number. So if we have a commitment to pay \$100 now but are given the choice of paying \$120 in three years' time we can choose which option is better once we know our time value of money. If our rate was 7% the calculation would look like this:

Immediate payment

$$PV = -\$100$$

Delayed payment

$$PV = \frac{-\$120}{(1.07)^3}$$

$$= \frac{-\$120}{1.225}$$

$$= -\$97.96$$

In this case we can see that the highest value is –\$97.96 and so we can conclude that delayed payment is the better option.

Up to now we have only worked with whole numbers of years. It is easy to conceptualise the idea of, say, $(1.07)^3$. What should we do if the payment was, say, two years and ten months into the future? Well, the formula works for non-integer values of *n* as well. Ten months is 0.833 of a year so the equation would be $(1.07)^{2.833}$. The arithmetic might appear a little complicated to those who are not familiar with mathematics but today's spreadsheets and even many calculating machines can make the calculation easy. The spreadsheet formula 1.07^2.833 tells us the answer is 1.211. So the present value would be −\$120 ÷ 1.211 or −\$99.07. So we could conclude that it would still pay to elect for the late payment option, but this time the present value benefit of doing so has reduced from \$2.04 to \$0.93.

Introducing the idea of discount factors

We can make a useful simplification if we introduce the idea of a *discount factor*. A discount factor is the amount by which you must multiply a future value in order to compute its present value. The equations are:

$$PV = FV \times DF$$

where *DF* is the discount factor calculated as:

$$DF = \frac{1}{(1+r)^n}$$

In the days before spreadsheets and electronic calculating machines, financial analysis depended on so-called discount factor tables. These listed the discount factor for different values of *r* and *n*. They can still be useful for doing quick calculations without having to fire up a spreadsheet. An example follows:

Discount factors – year-end cash flows

	Number of years into the future – *n*									
r	1	2	3	4	5	6	7	8	9	10
1%	0.990	0.980	0.971	0.961	0.951	0.942	0.933	0.923	0.914	0.905
2%	0.980	0.961	0.942	0.924	0.906	0.888	0.871	0.853	0.837	0.820
3%	0.971	0.943	0.915	0.888	0.863	0.837	0.813	0.789	0.766	0.744
4%	0.962	0.925	0.889	0.855	0.822	0.790	0.760	0.731	0.703	0.676
5%	0.952	0.907	0.864	0.823	0.784	0.746	0.711	0.677	0.645	0.614
6%	0.943	0.890	0.840	0.792	0.747	0.705	0.665	0.627	0.592	0.558
7%	0.935	0.873	0.816	0.763	0.713	0.666	0.623	0.582	0.544	0.508
8%	0.926	0.857	0.794	0.735	0.681	0.630	0.583	0.540	0.500	0.463
9%	0.917	0.842	0.772	0.708	0.650	0.596	0.547	0.502	0.460	0.422
10%	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386