Unit 3.8 Investment Appraisal (HL)

1. Discounted cash flow

Discounted cash flow (DCF) is a technique based on the concept of the **opportunity cost** of money and future cash flows.

Suppose you had the option of receiving a university scholarship to the value of $30,000 in either one lump sum today or over a three-year period. Which would you opt for? Most people would go for the first option rather than the deferred payment option. The reason is linked to the popular phrase 'time is money'. Money received today can be invested (or simply saved in a bank to earn compound interest) whereas money received in the future will have lost some of its value.

Example 1

If you have $100 and decide to place it into a bank account paying 5% interest, at the end of the year you will have $105. Therefore, the **present value** of $1 as in a year's time is $100.

$105 in a year's time is worth the same as $100 today.

If the money was saved for a further year, then the present value would be $110.25 (i.e. $105 plus another 5% interest).

Discounted cash flow is used to calculate today's value of the estimated future net cash flows from an investment project. **Discounting** cash flow is the reverse of calculating compound interest.

A **discount factor** or **rate** is used to convert the future net cash flow to its present value today. Given that receiving money today is worth more than it is in the future, the discount factor can represent either inflation or interest rates.

Years	Discount rate				
	4%	6%	8%	10%	20%
1	0.9615	0.9434	0.9259	0.9091	0.8333
2	0.9246	0.8900	0.8573	0.8264	0.6944
3	0.8890	0.8396	0.7938	0.7513	0.5787
4	0.8548	0.7921	0.7350	0.6830	0.4823
5	0.8219	0.7473	0.6806	0.6209	0.4019
6	0.7903	0.7050	0.6302	0.5645	0.3349
7	0.7599	0.6651	0.5835	0.5132	0.2791
8	0.7307	0.6271	0.5403	0.4665	0.2326
9	0.7026	0.5919	0.5002	0.4241	0.1938
10	0.6756	0.5584	0.4632	0.3855	0.1615

Discount table – Appendices, IBO Business and Management Guide, 2007

Example 2

Suppose an organization expects to receive $10,000 in three years' time whilst today's interest rate is 6%. What is the present value of the $10,000?

From the discount table, the discount rate for 6% interest over 3 years is 0.8396

Hence, the present value of $10,000 in three years' time is
= $10,000 × 0.8396
= $8,396

Whilst DCF can be a useful decision-making tool, even small changes in interest rates can result in a large change in the value of future net cash flows.

2. Net present value

Net Present Value (NPV) takes discounted cash flows one step further. Money received in the future is worth less than if it were received today, i.e. the longer the time period under consideration, the lower the present value of that future amount of money. The NPV is calculated by the sum of all future expected net cash flows minus the investment cost:

NPV = Sum of Present Values - Cost of Investment

The original amount invested is often referred to as the principal. The Net Present Value will be positive, i.e. greater than the principal, if the discounted (future) cash flows are enough to justify the initial investment. Likewise, if the NPV is negative, then the investment project is not worth pursuing.

Example 3

Suppose that new mechanization for a firm is estimated to cost $400,000 and should last for five years. It will cost an estimated $50,000 per annum to maintain but will increase the value of the firm's output by an estimated $150,000. Base interest rates are currently 6%. Work out the NPV on the proposed investment.

The net cash flow in each year is : total cash inflow - the total cash outflow
= $150,000 - $50,000
= $100,000

Year	Net cash flow ($)	Discount rate	Present value ($)
1	100,000	0.9434	94,340
2	100,000	0.8900	89,000
3	100,000	0.8396	83,960
4	100,000	0.7921	79,210
5	100,000	0.7473	74,730
Total	500,000		421,240

Using the formula:

NPV = Sum of Present Values - Cost of Investment
= $421,240 - $400,000
= $21,240

Since the NPV is a positive value of $21,240, the investment should go ahead.

However, the business must take care not to over-rely on the NPV figure, as it would be reduced if interest rates were to go up during the next five years.

Note:

Without using DCF the estimated return would be much higher at $100,000 (i.e. $500,000 - $400,000).

In reality, however, the NPV method shows us that each of the $100,000 net cash flow received in the future is worth less than the value today, i.e. the real return is lower at only $21,240.

Disadvantages

The disadvantages of this method are :

(1) calculations can be complex, and

(2) results are only comparable if the initial investment cost is the same between projects.

Question 1

(a) Calculate the Net Present Value by completing the data in the table below. Discount rate for 5% are given to 4 decimal places. Both projects cost $300,000. Explain which project should be pursued. [5 marks]

Year	project A			project B		
	Net cash flow ($)	Discount factor	Present value ($)	Net cash flow ($)	Discount factor	Present value ($)
0	(300,000)	1.0000		(300,000)	1.0000	
1	50,000	0.9524		100,000	0.9524	
2	100,000	0.9070		200,000	0.9070	
3	200,000	0.8638		200,000	0.8638	
4	200,000	0.8227		50,000	0.8227	
NPV						

(b) Comment on what other information you would consider before making a final choice over which investment project to pursue. [5 marks]

Question 2

(a) Study the data below and answer the question that follows. Each project costs $30.000. You will need to refer to discount table for the relevant discount factors. Assume the average interest rate is 4%. Calculate the Net Present Value. [5 marks]

Year	Net cash flow ($)	
	Project A	Project B
1	10,000	10,000
2	12,000	20,000
3	15,000	15,000
4	20,000	10,000
Total	57,000	55,000

(b) Using other relevant investment appraisal methods. recommend which of the above projects would be the most attractive to investors. [8 marks]

Acknowledgements

Paul, Hoang, *Business and Management*, Victoria: IBID Press, 2007