:: Chapter 0

TAKE OFF

You, and your two friends, Debbie Ghosh and Sanjay Rao, have just passed out of the Institute of Chartered Accountants of India. You don't want to slug it out in the corporate sector. It is not as though you think that working for someone else is infra dig; it is just that you feel you are not cut for it. You also don't want to break your bread in the audit and accounting profession because while you are convinced that there is a major road ahead for the profession, you believe that it wouldn't take you to your destination. You have a larger dream. You want to build a community of knowledge seekers. You want to develop a portal that would cater to their requirements -- a website that would bring to them the many things that you needed when you were yourself an articled trainee but couldn't find. You want the site to become a knowledge village squatting in cyber space. You want it to be a place that would peddle anything and everything that someone doing his chartered accountancy would need. You don't know whether it would hit off, whether you would become the next Sabeer Bhatia, but you are willing to take your chances. So, what do you do? Well, many things.

Like, you will first make out what is the amount of money that will have to go into establishing this portal. Obviously it will involve a cost. You cannot set up a portal, that too a state of art one, unless you get the right kind of people associated with you, both technical and otherwise. You will need the infrastructure. You will also have to line up content providers -– top-notch professionals from the world of audit and accounting. And these guys are not going to come for free. Yes, you will have to invest heavily into infrastructure and people. Your ball park estimate is that it will cost you Rs 2 crores to get this up and going in the next 12 months. Should you spend that kind of money? Would it bring in the right returns? Enter Investment decision.

Now where will you get all that Rs 2 crore? Obviously your parents would find it difficult to hand it over to you; they have already invested quite a lot on you. The bankers aren't going to fall head over heels to give you a loan. They would want security, they would want guarantee; they would want a host of other things as well. Maybe if you can hard sell your idea there would be a few people who might be willing to chip in with cash. May be, you could turn to your friends for help. You will hence have to take a call on whom to turn to for money, what would be the opportune time for raising money and how much would it cost to service it. Enter financing decision.

Money isn't going to come for free. Like economics taught you "there is no such thing as a free lunch". You will have to offer a reward to those who provide you with money. If they are lenders, then of course you will have to make interest payment to them. You

will have no choice in this. But if they are like Debbie Ghosh and Sanjay Rao they will have to be rewarded for the equity investment that they bring in. Here you have a choice. Enter dividend decision.

At the heart of finance then is managing money. Where to invest (Investment Decision), how much to mobilize (Financing Decision) and what rewards to offer (Dividend Decision). What do they mean?

Investment decisions are aimed at committing resources, available either internally or raised externally, to projects. The projects may range from setting up a small shop to purchasing a plant or equipment of significant value. It may even extend to acquiring an existing operating entity. When you buy equipment for your use the focus is on internal growth. Instead when you acquire voting rights in another entity the focus will be on growth potential that is external to the entity. These are all long-term investments; that is economic benefits from such decisions will flow to an entity over extended periods say five or more years. They are also referred to as capital budgeting decisions. Then there are short- term investments as well. For instance, resource allocation for supporting optimum level of inventory or receivables is a short-term investment decision since the time band for conversion of invested funds into cash does not generally exceed three months. These are referred to as working capital decisions.

Investment decisions go to determine how resources that are scarce are committed to projects or purposes.

Financing decisions revolve round answers to three issues. One, wherefrom can funds be obtained and at what cost? Two, what is the impact on the firm's profitability by opting for a particular source of funds. Three, what is the financial risk of deploying money funds originating from a specific source. In resolving these issues, the finance manager not merely reflects on "profits" for the entity, he also distinguishes between profit *per se* and cash flows leading to adequate liquidity to the entity. He also seeks to strike a balance between equity capital and debt. After all, while debt is cheaper than equity, excessive debt carries a high risk for equity holders since debt has to be serviced ahead of equity.

Financing decisions demand a skillful evaluation of risk attributable to lenders and equity holders.

Dividend decisions are linked to financing decisions. It is a decision on the quantum and periodicity of cash reward. If the business organisation is a sole proprietorship or partnership firm this reward is called drawings. If it is a corporate entity it is called dividends. The amount to be paid out and the amount to be retained to take care of future growth are the two elements critical to a dividend decision. These two elements are linked to the expectations of the owners who not merely expect cash rewards from period to period, but also expect the value of their investment stake to grow.

Dividend decision is determination of how much and how frequently cash rewards are to be paid to owners.

Are these three decisions – Investment, Financing and Dividend -- independent of each other? The answer is "no". Investment decisions generally involve selection of new types of projects, or of companies or other securities. Such decisions will be taken in the light of required "rates of return" and estimated "risks". Once investments have been identified as suitable for an entity, the methods of financing them must be selected. Alternatives include new share issues, raising loans and retention of profits. The costs of different sources of finance will be relevant here. The profits generated by an entity may be distributed to shareholders or retained in

the business depending on the needs of business, as also the preferences of shareholders for current income or future capital gains.

All the decisions inter-act with each other. Acceptability of an investment depends not merely on the risks attached to the outcome of the investment but also to the cost of the chosen method of finance. One possible source of finance is retention of profits and hence implies restriction of dividends. Dividend policy may affect an entity's share price and hence this determines the scope for raising finance by share issues. Lenders may lay down certain preconditions on the declaration of dividends. Selection of profitable investments should give scope for dividends in future. Together, these three inter-related decisions help the finance manager accomplish the following:

- Identification of strategies for maximizing an organization's wealth.
- Allocation of scarce capital resources among competing opportunities.
- Implementation of the chosen strategy in order to achieve the stated objective.

In short, the story is about preserving and improving the health of an entity by maintaining a balance between the long term and short-term growth plans, and between the risks and rewards in a business -- all with an unswerving attention on improving wealth. As the corporate's next CFO your objective would be to maximize the value of your firm. You need to create wealth. There is no need to feel apologetic about it. You need to build organizations of the kind N R Naryana Murthy, Azim Premji and Dhirubhai Ambani have built – organizations that reward their stakeholders handsomely. And the only way of doing that is to invest smart, finance shrewd and reward handsomely. That's what is at the heart of corporate finance. Managing Money.

You need to create wealth. You need to build organizations of the kind N R Naryana Murthy, Azim Premji and Dhirubhai Ambani have built - organizations that reward their stakeholders handsomely

Part A

Investments & Rewards

Capital Budgeting Decisions

Cost of Capital

Risk Analysis

Corporate Dividend Policy

CAPITAL BUDGETING - 1

TIME VALUE OF MONEY

Where should you put your money? "Put it where your mouth is", said the wag. In business you should put your money in those assets and those projects that maximize wealth. How do you know that a project would maximize wealth? Enter time value of money and capital budgeting decisions. If you have invested in an asset should you stay wedded to it forever? Enter Replacement Analysis. Does Inflation have any say on what assets we should buy and which we should not? Enter Inflation and capital budgeting. What should you do if money were in short supply? Enter Capital Rationing. And finally, should you invest in a project because there are concessional sources of funding it? May be, if you believe in Adjusted Present Value. This chapter walks you through these.

Time Value of Money is the first and the most important of lessons that you should ever learn in finance. That's because anything and everything remotely connected with finance has to do with the time value of money. A thorough understanding of time value is central to investment decision-making.

THE 8 PRINCIPLES OF TIME VALUE

We shall understand time value of money with the help of 8 principles.

Principle 1: If you were given a choice between receiving Rs 1,000 today and receiving Rs 1,000 a year later, which one would you prefer? "Of-course Rs 1,000 today", you would say. If we were to ask you "Why?" you would probably say, "Hey, I would earn interest while I waited". That means while money may not grow on a tree it grows with time. Simply said it means "money has a time value".

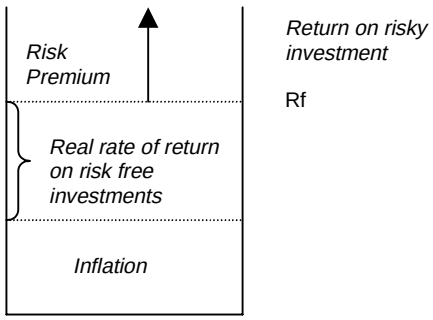
This brings us to the first principle of time value of money. Namely, *"A rupee received today is greater*

	Know It
1.	Rs.100 today is not Rs. 100 a year later
2.	TVM is the reward for postponement of consumption
3.	TVM = Inflation + Real rate of return on risk free investment + Risk premium.
4.	TVM = Return from comparable investment
5.	TVM is different for different people
6.	TVM is different for different investments
7.	Return from a Risky Rupee will be greater than return from a safe Rupee
8.	The value of an asset is the present value of future cash flows discounted at the TVM

than a rupee received tomorrow because money has a time value."

Principle 2: Suppose we compel you to forego the Rs 1,000 today and ask you to take instead the Rs 1,000 a year later. Would you do it? No, you wouldn't. But if we were to offer you a larger amount, say Rs 1,150 a year later, you just might accept. This higher amount is your compensation for postponing the usage of money.

This brings us to the second principle of time value of money. Namely, "*the time value of money is a compensation for postponement of consumption of money.*"



Principle 3: Let's say you have agreed to postpone receiving Rs 1,000 today in lieu of receiving a larger amount a year later. How much should the larger amount be? Should it be Rs 1,075 or Rs 1,150 or what? This depends on your perception of the time value of money. We believe that three factors determine the time value of money.

a. The expected inflation rate: Inflation is the fall in the purchasing power of money. It makes money cheaper and the product costlier. Suppose you can buy 25 litres of petrol with the Rs 1,000/- that you receive today. Suppose inflation is 5% so that a year later you need Rs 1,050 to buy the same 25 litres of petrol. Hence, the minimum compensation that you would require for postponing the consumption of Rs 1,000 is Rs 1,050. Therefore, the minimum time value of money would be the inflation rate. In our example it is 5%.

b. Real rate of return from a risk free investment. Suppose you were to receive the Rs 1,000 now and you decide not to buy petrol. Instead you decide to invest the money in a risk free investment that will give you 8%. A year later you will receive Rs 1,080, buy your 25 litres of petrol with the Rs 1,050 and become richer by Rs 30 or by 3%. This three percent is called the real rate of return on risk free investment. It is the difference between the rate earned on the risk free investment and the inflation rate. You would now no longer want 5% as the time value of money; instead you would want 8%.

c. Risk premium. Suppose you decide to invest not in the risk free investment but in a risky investment. For taking that risk you would want to earn an extra return. This extra return, over and above the risk free return, is called the risk premium. Higher the risk on an investment, higher would be the risk premium.

This brings us to the third principle of time value of money. Namely, "*Time value of money is the aggregate of inflation rate, the real rate of return on risk free investment and the risk premium".*

Principle 4: A little while ago we said that the amount that you would like to receive on your investment is "your perception of the time value of money". We also said that this amount would depend on the risk premium that you want to earn. How do you decide that premium? Simple. If a comparable investment gives you a certain risk premium you would expect the same premium from this investment as well. In other words, if someone as reliable as us (or as unreliable as us!) were to offer you a 3% premium over the risk free rate of return of 8% for making an investment with us, you would expect a time value of 11% from that investment.

This brings us to the fourth principle of time value of money. Namely, *"time value of money is the rate of return expected from a comparable investment alternative"*.

Principle 5: Suppose you want to place your money in the fixed deposit of Global Steels Ltd. So does your friend. Will the rate of return (a k a time value of money) that you would expect from this investment be the same as what your friend would expect? The answer is "No". This is because your perception of risk can be different from your friend's perception of risk.

This brings us to the fifth principle of time value of money. Namely, *"time value of money can be different for different people because each has a different desired compensation for postponing the consumption of money."*

Principle 6: Suppose you want to invest in the fixed deposit of India Agro Ltd. Would the rate of return that you would expect be the same as the rate of return that you expected on your fixed deposit investment in Global Steels Ltd? Again the answer is "No". That's because your perception of the risk involved in the first investment can be different from your perception of the risk involved in the second investment.

This brings us to the sixth principle of time value of money. Namely, *"the time value of money can be different for the same individual with reference to differing investments because the risk profile is different for different investments"*.

Principle 7: On which investment would you desire a greater time value of money? Would it be on a "safe investment" or on a "risky one"? It would surely be on the risky one because it carries a higher risk. If Global Steels carries a higher risk than India Agro Ltd, you would want a bigger bang from Global Steels.

This brings us to the seventh principle of time value of money. Namely, *"a safer rupee is greater in value than a risky rupee. Higher the risk higher will be the time value of money."*

Principle 8: Value of an Asset: The concept of time value of money is amongst the biggest discoveries in finance. It helps valuing an asset by bringing all cash flows on equal footing. It is at the very heart of financial management and is used to value any asset – be it stock, or business, or individual. We close this section by laying down our most important principle. Namely, *"the value of an asset is the present value of the future cash flows to be received across the life of the asset discounted at the appropriate time value of money"*.

MANY VALUES AND MONEY VALUES

Now that you know what is time value of money, we proceed to put it to practical use. To do that we need to get a grip of the following ten issues. We must understand that every project has a cash flow stream. This can be a single flow (ie, there is one inflow and one outflow) or it can be multiple flows (ie, many inflows and one or more outflows). The multiple flows can be either an annuity or perpetuity or uneven cash flows!

Single Flow

The term single flow means that there is only one cash flow.

Issue 1: Future value of a single cash flow

Future value is the cash value of an investment at some time in the future. It is tomorrow's value of today's money

Formula 1

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

compounded at the time value of money and is the same thing as the "amount" that you learnt in the compound interest formula at school.

Explanation 1: Suppose you invest Rs 1,000 in a fixed deposit that pays you 10% per annum as interest. At the end of the first year, you will have Rs 1,100. This consists of the original principal of Rs 1,000 and the interest earned of Rs 100. The Rs 1,100 is the future value of Rs 1,000 invested for one year at 10%. Put differently, Rs 1,000 today is worth Rs 1,100 in one year's time if the interest rate is 10%.

Explanation 2: Now suppose you invested the Rs 1,000 for two years. How much would you have at the end of the second year? Well you had Rs 1,100 at the end of the first year. If you reinvest it, you end up having Rs 1,100 × 1.1 = Rs 1,210 at the end of the second year. Thus Rs 1,210 is the future value of Rs 1,000 invested for two years at 10%. This process of reinvesting the interest is called compounding.

Formula 2
FV = Today's investment × FVF
Where FVF is $(1 + r)^n$

In general, if you invest for n years at r% your investment will grow to $(1+r)^n$. The $(1+r)^n$ is called the future value factor. If we multiply this with the principal sum invested we get the future value as at the specified future date.

Textbooks carry tables that give you the future value factors for various years at various time values of money.

Concept Problem 1

You invest Rs 300 in a two-year investment that pays you 12% per annum. How much will you have at the end of two years?

Solution

W.N.1: Value at the end of 2nd year is to be computed. Hence future value formula is to be used.

W.N.2: F V = PV × $(1+r)^n$ = 300 × $(1+0.12)^2$ = 300 × 1.254 = Rs. 376.20

Concept Problem 2

You expect to receive a gift of Rs 10,000 when you qualify as a CA a few months from today. You plan to invest it at 10% until you have 1,50,000. How long will you have to wait from today?

Solution

PV of investment = Rs. 10,000. FV of investment = Rs. 150,000.

FV = PV × $(1+r)^n$ $150,000 = 10,000 \times (1 + 0.10)^n$, and = $(1.1)^n = 15$

From the FVF table for 10% we find that 15 corresponds to approximately 28 years. You will have to wait for about 28-29 years.

Issue 2: Present value of a single cash flow

Future value was tomorrow's value of today's money compounded at the time value of money. Twist that around and we can say present value is today's value of tomorrow's money discounted at the time value of money. In other words, future value and present value are related to each other; in fact, they are the reciprocal of each other.

Formula 3

$PV = FV/(1+TVM)^n$

Explanation 1: Let's go back to our fixed deposit example. You invested Rs 1,000 at 10% to get Rs 1,100 at the end of the year. If Rs 1,100 was tomorrow's value of today's Rs 1,000 at 10%, then Rs 1,000 is today's value (a k a present value) of tomorrow's Rs 1,100 at 10%. In other words, if we want Rs 1,100 a year later we need to invest Rs 1,000 today at 10%.

Explanation 2: Suppose you needed Rs 1,210 two years from today. Suppose you can invest at 10%. How much will you have to invest today? Well, you can compute the present value twice over. We already know that FV = PV × 1.1 × 1.1. ie 1,210 = PV × 1.1 × 1.1. Hence the present value is Rs 1,000.

We can now logically lay down a general-purpose formula.

- We know that FV = Today's investment × FVF.
- We also know that today's investment is called present value.
- Hence FV = Present Value × FVF.
- If we change the subject of the formula we get FV × 1/FVF = Present Value.
- 1 / FVF is called the present value factor. Hence the present value factor is 1/(1+r)^n
- Hence PV = Tomorrow's Value × PVF. This is also called PV = Single Sum × PVF

In compounding, we move from today's value to tomorrow's value. Tomorrow's value is also called future value. In discounting, we revert from tomorrow's value to today's value. Today's value is also called present value. This link between today's value to tomorrow's value and vice versa is the discount rate.

The present value factor is also called the discount factor. It is also the time value of money.

Why we need them?

Consider a situation where Rs 1,000 is received today, Rs. 1,100 is received a year later, 1,210 two years later, 1,331 three years later 1,464 four years later and 1,611 five years later. The total money received is not the sum of these five amounts because they are not expressed in terms of a specific year's value of money. To be made addable they must either be converted to the base year's value (ie Present value) or the terminal year's value (ie Future Value). In short, present value and future value facilitate proper financial evaluation as money received at different points of time is not equal. While evaluation can be done either in cases of PV or FV, the Present Value Method is the method preferred.

Concept Problem 3

You need Rs 10,000 for buying textbooks next year. You can earn 7% on your money. How much do you need to invest today?

Solution

W.N:1 The future value is given and the present value is required to be computed.

W.N:2 $PV = FV \times [1/(1+r)^n]$, ie, $10,000 \times 0.935 = Rs.\ 9,350$

You will need to invest Rs. 9,350/- today.

Multiple Flows

Thus far we focussed on the future value of a lump sum investment or the present value of a lump sum future cash flow. The world of investment is however not that simple. In all probability, we will be faced with not a single but with multiple cash flows. These multiple cash flows can be uniform through out the period or may change from year to year (a.k.a uneven cash flow). How do we compute their present or their future values?

Issue 3: Future value of uneven cash flows

We explain that with an example.

Suppose you receive Rs 1,000 today, another Rs 1,200 a year later and Rs 1,300 two years later. How much will you have three years from today? The position is simple. The Rs.1,000 has been invested at 10%, for 3 years, the Rs 1,200 for two years and the Rs 1,300 for 1 year. Find their future values at the end of 3rd year, 2nd year and 1st year of investment. They would then all be values in terms of year 3 from today. Add those values. Period.

Step 1: Decide the future date. Compute future value of each cash flow.

$1{,}000 \times 1.331 = 1{,}331$
$1{,}200 \times 1.210 = 1{,}452$
$1{,}300 \times 1.100 = 1{,}430$

Step 2: Aggregate

Adding them up gives us Rs 4,213/-.

Issue 4: Present value of uneven cash flows

Do you know what this Rs 4,213 represents beyond knowing that this is the money you will get three years from today? Pretty little. Instead if you were to find today's value of this Rs 4,213 which incidentally is Rs 3,165, would that help? For sure, yes. Because you would know how much petrol Rs 3,165 can buy today! So how does one calculate the present value of an uneven cash flow stream? While there are several methods we would suggest the following

Step 1: Compute the present value of each of the cash flows separately.

$1{,}000 \times 1.000 = 1{,}000$
$1{,}200 \times 0.909 = 1{,}091$
$1{,}300 \times 0.826 = 1{,}074$

Step 2: Aggregate the present values.

Adding them up gives us Rs 3,165.

Concept Problem 4

You can invest Rs 1,000 a year from now and thereafter increase it by Rs 1,000 each year. How much will you have at the end of 5 years if you earn 10% per annum? What is the today's value of the corpus? What is the link?

Solution

Money at the end of Year 5:

YEAR	*Period*	*CF (Rs.)*	*FVF @10%*	*FV (Rs.)*
1	4	1,000	1.464	1,464
2	3	2,000	1.331	2,662
3	2	3,000	1.210	3,630
4	1	4,000	1.100	4,400
5	0	5,000	1.000	5,000
			Total	17,156

Value today:

YEAR	*CF*	*PVF @10%*	*PV (Rs.)*
1.	1,000	0.909	909
2.	2,000	0.826	1,652
3.	3,000	0.751	2,253
4.	4,000	0.683	2,732
5.	5,000	0.621	3,105
			10,651

Link: The present value of Rs 17,156 discounted at 10% for 5 years is Rs 10,651.

When the cash flows in each of the future years are constant, the structure is called an annuity. There are two kinds of annuity – Annuity Regular and Annuity Immediate. In Annuity Regular the first payment or receipt takes place at the end of one period. In Annuity Immediate the first receipt or payment takes place immediately. We first focus on annuity regular (a k a ordinary annuity) and then on annuity immediate.

Issue 5: Future value of an annuity regular

Suppose your dad gives you Rs 1,000 on your birthday every year. If your next birthday is a year later, how much money will you have 5 years from today if you invested the birthday gift of the next 5 years at 10%?

This is an Annuity Regular since the first payment takes place a year later. The computation is simple. Your first Rs 1,000 is invested for 4 years, your second Rs 1,000 for three years, the third Rs 1,000 for 2 years, the fourth Rs 1,000 for 1 year and the fifth Rs 1,000 for no year. If you computed the future value of these amounts for the stated years and then aggregated them you will get the future value of the annuity. In essence, the principle that you used to find the future value of uneven cash flows can be adopted here as well.

That was a long drawn way of doing. There is a shorthand 2-step version.

Know It	
Issue 1:	Future value of a single cash flow
Issue 2:	PV of a single cash flow
Issue 3:	FV of uneven cash flows
Issue 4:	PV of uneven cash flows
Issue 5:	FV of an annuity regular
Issue 6:	PV of an annuity regular
Issue 7:	Annuity Due or Annuity Immediate
Issue 8:	Perpetuity
Issue 9:	Growing perpetuity
Issue 10:	Compounding at faster frequency

Step 1: Compute FVAF using the formula FVAF = $\frac{[FVF - 1]}{R}$ or by referring to the FVAF table.

From the FVAF table we find that the factor for 10%, 5 years is 6.105

Step 2: FVA = Annuity × FVAF

FVA = 1,000 × 6.105 = Rs 6,105

Issue 6: Present value of an annuity regular

Let us take the same example of the birthday gift from your dad. You don't want the Rs 1,000 to be given to you each year. You instead want a lump-sum figure today. Assuming that your dad agrees, will he give you Rs 5,000 (1,000 × 5)? As you must have guessed, the answer is "No". That's because when the other Rs 4,000 (5,000 – 1000) stays with him, he earns interest thereon. The amount that he will give you today will be less than the Rs 5,000/-. By giving you a lump sum today he is accelerating one payment by 5 years, another by 4 years, a third by 3 years, a fourth by 2 years and a last by one. If we compute the present value of these amounts and then aggregated them you will get the present value of the annuity. In essence, the principle that you used to find the present value of uneven cash flows can be adopted here as well.

What is the link?

The link between future value of an annuity and the present value of the annuity is simple. The PVA is the today's value of the FVA. Multiply FVA with the PV factor and you get the PVA!

That was a long drawn way of doing. There is a shorthand 2-step version.

Step 1: Compute PVAF using the PVAF = $\frac{[1 - PVF]}{R}$ or by referring to the PVAF table.

Step 2: Present value of the annuity = Annuity × PVAF.

In this case the PVAF for 10%, 5 years is 3.791. Since the annuity is Rs 1,000, the present value is Rs 1,000 × 3.791 = Rs 3,791

Issue 7: Annuity Due or Annuity Immediate

Annuity regular assumed that the first receipt or the first payment is made a year later. When the first receipt or payment is made today, it is called annuity due or annuity immediate.

There are different ways by which you can crack situations involving annuity due. We are certain that as you pick expertise in time value of money, you will decipher your own little ways. But we present here a quick computational procedure.

Future Value: We know that in annuity immediate the cash flows occur at the beginning of each period. If we assume that cash flows occur at the end of each period when they really occur at the beginning, then we compound each one by one period less. We could rectify this by simply multiplying our result by (1+r) where r is the discount rate. The relationship between the value of an annuity due and an ordinary annuity in the case of Future Value is:

Future Value of an Annuity Immediate = Future Value of Regular × (1+r)

Calculating the annuity due involves two steps.

Step 1: Calculate the future value as though it were an ordinary annuity

Step 2: Multiply the result by (1+r)

We get back to dad's birthday gift for you. Suppose today is your birthday and he plans to give you Rs 1,000 on each of your 5 birthdays including this birthday. If you invest them at 10% how much will you have at the end of the 5^{th} year? This now takes the character of an Annuity Immediate. The future value of the annuity regular was already computed as Rs 6,105. Since annuity immediate involves receiving 1 year sooner, we need to multiply with 1.10. We get Rs 6,715. This is the amount you will have at the end of the 5^{th} year.

Present Value: The procedure changes a shade when the situation involves computing the Present Value of Annuity Immediate. For instance an annuity immediate for 5 years is the same as an annuity regular for 4 years plus an initial receipt or payment in time zero. Hence the PVAF for annuity immediate will be the PVAF of annuity regular plus 1.

Calculating the present value of annuity due involves two steps.

Step 1: Compute the PVAF for annuity regular of 1 year short, and add 1.

Step 2: Multiply annuity with Step 1.

Lets again get to dad's birthday gift. He wants to give you lump sum money today instead of giving you one during each of your birthdays? How much would he give you? Well, you are foregoing an annuity immediate in lieu of the lump sum. You therefore need to compute the present value of the annuity immediate. Now the PVAF for 10%, 4 years is 3.170. In addition there is a payment in time zero. Hence the relevant PVAF is 4.170. Since he pays otherwise Rs 1,000 per annum, the present value of the annuity would be Rs 4,170/-. The correctness is confirmed by comparing the Rs 6,715 with the Rs 4,170/-. The Rs 6,715 is the future value of the single sum of Rs 4,170 for 5 years compounded at 10% ie 1.611 × 4170 = Rs 6,717/- (or say, Rs.6,715)

Concept Problem 5

Niece in b-school: *You need Rs 30,00,000 10 years from today to put your niece in a b-school in the US. You can earn 10% per year. How much do you need to invest each year-end to reach your goal?*

Solution

Value at the end of 10^{th} year	= Rs. 30,00,000.
Let the total amount to be invested at the end of each year be	= Y
Y × (FVAF, 10 years)	= 30,00,000.
Y × 15.937	= 30,00,000.
Y = Rs. 1,88,241 or say	Rs. 1,88,250

Amount to be invested every year-end is Rs. 1,88,250.

Issue 8: Perpetuity

Perpetuity is a special kind of annuity. It is one where the receipt or payment takes place forever. Since the payment is forever, we cannot compute a future value. However we can compute the present value of the perpetuity. We would like to do so because we would like to compare this with alternative options.

For example: You want to institute a prize. You want to give out Rs 100,000 each year to the candidate who bags the all-India first rank in the Management Accounting paper in CA Final. You have two choices. One, you can make out a cheque each year. Two, you can pay a lump sum today and the ICAI will use the interest to pay the prize. How much will you have to give today, if the ICAI can earn 10% per annum?

The answer is simple. You need to know the present value of the perpetuity of Rs 1 lakh per annum at 10%. The result is Rs 10 lacs. If ICAI invests the Rs 10 lacs at 10%, each year it would get Rs 1 lakh. Is there a direct formula for this? Fortunately, yes. It is:

$$\text{PV of perpetuity} = \frac{\text{Perpetuity}}{\text{Time value of money}} = \frac{100{,}000}{0.10} = \text{Rs.}10{,}00{,}000$$

Issue 9: Growing perpetuity

Your prize money of Rs 100,000 looks pretty attractive today. But 25 years from today, thanks to inflation, it would look chicken feed. You want to give out each year a prize amount that would look as attractive as Rs 100,000 looks today. *ie* you would like to cover the prize with inflation. Meaning if inflation is 5%, the prize in the second year will be 105,000; in the third year it would be 105,000 plus 5% etc. So how much will you have to endow today? Here is the direct formula

$$\text{PV of perpetuity} = \frac{\text{Perpetuity}}{\text{Time value of money} - \text{inflation rate}}$$

$$\text{In our example} = \frac{100{,}000}{(10\% - 5\%)} = \text{Rs } 20{,}00{,}000$$

Concept Problem 6

You want to endow a prize that would pay Rs 100,000 per annum. You want to make a one-time payment because you are not sure where you would be during subsequent years. If the time value is 10%, how much will you have to invest today? If you want the prize to increase by 4% each year, how much will you have to invest today?

Solution

(a) If TVM is 10%
Amount to be invested = 100,000 / 10% = Rs. 10,00,000.

(b) If increase of 4% is sought
Amount to be invested = 100,000 / 0.06 = Rs. 16,66,667.

Issue 10: Compounding at faster frequency

The way interest is quoted is important. We need to appreciate it correctly to take proper investment decisions.

If a rate is quoted as 8% per annum compounded annually it means that it fetches 8% in a year. Rs 1,000 will grow to Rs 1,080 in one year. If it is quoted as compounded half yearly it means that an interest of 4% is paid each half year. There are two half years in a year. Hence the Rs 1,000 will grow to Rs $1{,}000 \times (1+0.04)^2$ = Rs.1,081.6. This is the same as 8.16% compounded annually. Thus 8% per annum compounded half yearly is the same as 8.16% compounded annually. In finance, the 8% is called the stated rate while

the 8.16% is called the Effective Annual Rate (EAR). To make investment comparisons we must always compute the EAR.

The general formula is EAR = $[1+(\text{Stated Rate}/m)]^n - 1$ where m is the number of times the interest is compounded during the year.

Concept Problem 7

An investment pays you 16% per annum compounded quarterly. A second investment pays you 16.5% per annum compounded annually. Which would you prefer?

Solution

The investment option which gives the higher EAR should be preferred

Option 1: 16% per annum, compounded quarterly.

EAR = $[1+(\text{Stated return} / m)]^n - 1$

$= [1 + (0.16/4)]^4 - 1 = 1.16986 - 1 = 0.16986$

This is the equivalent of 16.99% per annum compounded annually.

Option 2: 16.5% per annum, compounded annually.

The return under option 1 is greater and should therefore be preferred.

CAPITAL BUDGETING - 2
INVESTMENT DECISIONS

You know how to compute NPV. We will proceed to learn how to put this knowledge to use

What is Capital Expenditure

Capital budgeting, as the very name suggests is budgeting for capital expenditure. Forgetting taxation for a moment, capital expenditure, in the context of financial management, means "making a large outlay of money today in anticipation of benefits (Cash Inflows) which would flow across the life of the investment".

A lot of analysis needs to go in before the CFO commits money for a capital expenditure. This is because:

1. **Large Outlay:** A capital expenditure involves a significant outlay of money. The Reliance Telecom project cost upwards of Rs 50,000 crore. This is not small change.
2. **Irreversible:** A capital commitment is irreversible. May be we are wrong in making that statement. For, that way anything in life, marriage included, is reversible. But because the outlay is large it becomes difficult to reverse a decision once made. For instance you cannot plan to set up a paper mill costing say Rs 1000 crores, then six months later after the project is half way through, change your mind and say, "Hey, I want to start a steel plant."
3. **Future Impact**: Suppose a large project for which you borrowed money. You can't say you won't repay. You will use resources from other projects to meet these commitments. Hence unless we are careful, we would be starving future projects to feed the present project that has gone bad.

So how do we evaluate projects? Simple, we use the NPV method. Towards that you will compute the annual cash flows, identify the time value of money and discount the cash flows at the time value to arrive at net present value. We will have to identify the cash flows from a maze of data, spot which ones are relevant and which are not and then zero in on the right discount rate. This takes us into a series of principles in capital budgeting.

Principle 1. The cash flow principle.

Capital budgeting is concerned with cash flows and not with profits. The reasons are simple. **One**, profits are susceptible to accounting tricks such as depreciation, amortization, stock valuation, splits between capital and revenue etc. Given the same trial balance, ten accountants can come out with eleven profits! The same cannot be said of cash flows. Cash flows are simply the difference between cash received and cash paid. Given a trial balance even the most ingenuous of accountants cannot come out with two different cash

flows. **Two**, we spend cash, not profits. Whether we arrive at cash flows from the profit and loss statement (a k a Indirect Method) or whether we use a projected cash flow statement (a k a Direct Method) is our choice.

5 Principles
1. Cash flow Principle
2. After-tax Principle
3. Incremental Principle
4. Inflation Adjustment Principle
5. Long term fund and reward exclusion principle

Method 1: Indirect Method: We can compute cash flows from the profit and loss statement by adding back depreciation and non-cash charges to the profit after tax. To this number we should adjust the changes in working capital.

Issue 1: ***Why should we adjust depreciation?*** Depreciation and non-cash charges are added back because they do not involve outflow of cash. They are initially deducted because they affect tax payments. As long as depreciation is a tax deductible expense or so long as a company has taxable profits depreciation becomes relevant.

Issue 2: ***Why should we adjust working capital?*** Working capital is the excess of current assets over current liabilities. This working capital needs to be added or subtracted as the case may be to arrive at net cash flow after tax. There are three reasons for this adjustment.

One, all sales may not be for cash. There could be credit sales as well. All credit sales made during the year may not be collected during the year. To the extent uncollected (closing debtors) the profits overstate the cash flows. Similarly opening debtors may have been collected. To that extent profits understate the cash flow. Thus if there is an increase in debtors during the year, the profits overstate cash flows; if there is a decrease in debtors they understate cash flows.

	Increase	*Decrease*
Debtors	Overstate	Understate
Creditors	Understate	Overstate
Stock	Overstate	Understate

Two, stocks purchased are meant for consumption. During the year all stock may not have been consumed. To the extent that stock is available at year-end (closing stock), the profit overstates the cash flow because the profit statement records only consumption and not purchase. Similarly to the extent of opening stock, the profit understates the cash flow. Thus if there is an increase in stock during the year, the profits overstate cash flows; if there is a decrease in stock they understate cash flows.

Three, all purchases may not have been paid for. To the extent unpaid (closing creditors) the profits understate the cash flows. Similarly opening creditors may have been paid. To that extent profits overstate the cash flow. Thus if there is an increase in creditors during the year, the profits understate cash flows; if there is a decrease in creditors, they overstate cash flows.

To sum up: Since working capital is the excess of current assets over current liabilities, an increase in working capital should be deducted from profits and a reduction in working capital should be added to profits to arrive at cash flows. In the language of accounting increase in working capital is an application of funds and decrease in working capital is a source of funds.

Method 2: Direct Method: If you don't like working capital, you still have hope in your pursuit of arriving at cash flow. Simply prepare a cash budget. Of-course you have to still prepare the profit statement so as to compute taxes. The direct method arrives at cash flows by knocking out cash paid during the year from the cash received during the year.

Principle 2. The After-tax principle

The Cash flows must be expressed after tax. The logic is unexceptional. Tax is an outflow and should therefore be recognized as such.

Principle 3. The Incremental principle

It is not the total after tax cash flow but the incremental after tax cash flow after tax that is relevant. Incremental cash flow refers to the difference between the firm's future cash flows with a project and those without the project. Let us explain how this is computed and why it is important.

You have a machine that helps you produce and sell 10,000 books netting a contribution of Rs 25 per book. You are going to buy a new machine that will help you produce and sell 25,000 books netting a contribution of Rs 25 per book. What is the cash flow from the new machine? Is it 25,000 × 25 = 625,000? The answer is "No". That's because you were already producing and selling 10,000 books. Even without the machine you would have continued to produce and sell 10,000 books. The new machine helped you generate an additional 15,000 books. The relevant cash flow is therefore the additional or incremental cash flow of 15,000 × 25 = 3,75,000.

Know It
1. Include Opportunity Costs
2. Forget Sunk Costs
3. Averages could be wrong
4. Remember working capital
5. Consider side-effects

While computing incremental cash flows we must keep in mind the following riders.

Rider 1: Include opportunity costs: There can be occasions when there would be no cash flow in the conventional sense and yet the cost of the resource would be relevant in making an investment decision. Enter opportunity cost.

Opportunity cost requires us to give up a benefit. The typical example is that of a land owned by a company. Suppose the land was bought 10 years ago at Rs 30 lacs and can be now sold for Rs 50 lacs. You want to construct a building on top of the land at a cost of Rs 75 lacs. You cannot consider the land as free just because you already own it. By constructing the building on the land, you are foregoing the opportunity of collecting Rs 50 lacs. This is referred to as opportunity cost ie the cost of foregoing the next best alternative. The cash flow relevant in the construction is hence Rs 125 lacs (Rs 75 lacs of out of pocket cost plus Rs 50 lacs of opportunity). Mark it, what is relevant here is not the cost of the land (Rs 30 lacs) but its realizable value (Rs 50 lacs). However, if the company has no desire whatsoever of ever selling the land then the market value is not relevant because the value then is only paper value! Finally, like all cash flows the opportunity cost too should be computed on after tax basis since the gain foregone is the after tax gain.

Rider 2: Forget sunk costs: Sunk costs refer to costs incurred in the past and which are not recoverable. Such a cost may have already been paid or the liability to pay may already have been incurred. For example, you have incurred Rs 1,00,000 in collating a maze of data on the new machine that you wish to buy. You now have finally zeroed in on three machines. In evaluating these three machines the Rs 1,00,000 is not relevant because it represents a past cost that cannot be recovered. Bluntly stated, whether you buy a new machine or not the Rs 100,000 stays spent.

Consider another example. Suppose Hero Motors hires one of the Big four public accounting firms to help evaluate whether a new model of bike should be launched. When the firm submits its report its fat consulting fee does not appear as part of the cost of the project. The accounting firm is right in excluding it from the project cost because the fee must be paid whether or not the project is actually finally launched. The liability to pay has been incurred and it is hence a sunk cost. Ignoring sunk costs is based on the old adage "let the past, bury the dead." Said differently, only future cash flows that change between alternatives are relevant.

Rider 3: Averages could be wrong: We don't like averages. As the statistician would point, "if a person puts one foot on a hot oven and another in ice cold water, on an average he is comfortable"! Take the case of fixed overheads. Suppose you were incurring a fixed cost of Rs 5 per unit when you were producing 50,000 units. A new machine will help you produce 2 lakh units and the fixed cost would hence drop to Rs 3 per unit. Now, does that mean you have saved Rs 2 per unit on the incremental 150,000 units and thereby reduced cost by Rs 300,000? No way. The earlier cost was Rs 5 × 50,000 units ie Rs 250,000 while the new cost is 200,000 units × 3 ie Rs 600,000. The cost has actually gone up –- by Rs 350,000. We would therefore advise you to be "beware of overheads".

Rider 4: Remember working capital: Capital investments call for working capital investments. It is inconceivable to run a machine without working capital. These are outflows of money and should be considered as such. When the project is closed the working capital investment will be recovered. This recapture of working capital is an inflow and should be considered as such.

Rider 5: Consider side effects: When you undertake an investment it might affect other projects. For instance, suppose a company that is into making pens decides to buy a new machine that would produce an improved version of the old pen. Suppose the volume of new pens to be sold is 100,000 netting a contribution of Rs 3 per pen. Let us assume that consequent to the sale of the new type of pen, the volume of the old type of pens that was netting a contribution of Rs 2.5 per pen will fall by 20,000 units. This fall is on account of the manufacture of the new pen and should be factored. The incremental cash flow will be: (100,000 × 3) – (20,000 × 2.5) = Rs 250,000. This is what marketing buffs call product cannibalization; a situation where a company's product eats into another of the company's products. Corporate strategists suggest this because if you don't cannibalize your products someone else will.

Microsoft cannibalizes Windows. Windows has undergone changes ever since it hit the market in 1995. Newer versions with improved features have come in making the earlier version outdated.

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Side effects can also be positive. For instance, when the prize of computer printers fell like nine pins – from a high of Rs 15000 to a low of Rs 5000 it wasn't a great cause for concern because the big bang came in the consumables viz cartridges and special paper. Similarly, when a project makes a loss, the loss can be adjusted against profits of other projects. The loss goes to reduce the taxable income and hence the tax liability of the firm. This is a positive side effect. Identifying side effects is crucial to investment decision-making.

Concept Problem 8

Which of the following should be treated as incremental cash flows when deciding whether to invest in a new manufacturing plant? The company already owns the site, but existing buildings would need to be demolished. Identify the appropriate rider.
(a) The market value of the site and existing buildings
(b) Demolition costs and site clearance
(c) Cost of new access road put in last year
(d) Lost earnings on other products, due to executive time spent on the new facility
(e) A proportion of the cost of leasing the president's jet airplane
(f) Reduction in corporate tax bill, resulting from tax depreciation of the new plant
(g) Initial investment in inventories of raw materials
(h) Money already spent on engineering design of the new plant
(i) Use of warehouse space owned and currently being rented out
(j) Landscaping for the warehouse.

Solution

S No	*Relevance*	*Reason*
a	Yes	Opportunity cost
	No	If the company has no desire to sell the land
b	Yes	Future cash flows
c	No	Sunk cost
d	Yes	Opportunity Cost
e	No	Apportionment of fixed cost
f	Yes	Future cash flows
g	Yes	Remember working capital
h	No	Sunk costs
i	Yes	Opportunity cost
j	Yes	Incremental future cash flow

Principle 4. The Inflation Adjustment principle

Prices don't stay stagnant; they change. Worse still they don't come down. If there is one thing that defies the law of gravity it is prices! So when we make estimate of future cash flows should we consider inflation or not? While we will explain this with greater detail in a separate section (See Inflation and Capital Budgeting), suffice to say at this point that we could either consider inflation or ignore it; whatever we do, we must do it consistently. If cash flows include inflation the discount rate should also include inflation. If cash flows exclude inflation, the discount rate should also exclude inflation.

Principle 5. Long term fund and reward exclusion principle

Conventional financial wisdom has it that you should segregate the investment decision from the financing decision. What this means is that we must study a project's viability on a stand-alone basis – unmindful of how it is funded. This is called the long-term fund principle. Once the project is found viable, then we should proceed to identify sources of finance. We offer an example to explain this. Suppose one of the new generation banks is offering you a car loan at 3%. Will you buy a car because there is a loan at 3%? Or will you buy it only because you need a car? Obviously you would do only if you need it. So, once you decide to buy a car you will go scouting for sources of financing.

There is a second aspect to it. While arriving at cash flows we should not deduct the amount of loan or the interest payments from cash flow. If interest has been deducted it should be added back adjusted for tax rate because the actual cost of interest is the after tax cost. The logic is simple. In making capital budgeting decision the cash flows will be discounted at the time value of money which is the weighted average cost of capital. Time Value of Money is a proxy for interest. To consider interest once and take time value a second time would amount to a double count.

In analyzing an investment, we should exclude interest, dividend and principal repayment. The investment decision should be separated from financing decision. This does not mean financing is unimportant. It only means that they should be analyzed separately. Not everybody is sold on this idea.

STEPS IN CAPITAL BUDGETING DECISIONS

We now proceed to lay down some easy to use steps for a capital budgeting exercise.

Step 1: Identify Initial Investment:
This consists of:
a. Initial Capital Expenditures
b. Initial Investment in Working Capital

Step 2: Identify In-between cash flow.
This consists of:
a. Operational cash flows
b. Increase/Decrease in working capital
c. Additional investment in capital assets

Step 3: Identify terminal cash flow.
This consists of:
a. Net sale value of asset.
b. Re-capture of working capital

Step 4: Prepare Capital Budgeting Analysis Statement
This consists of the following sub-steps
a. Consolidate the cash flows in steps 1 – 3
b. Compute NPV.
c. If the NPV is positive the project should be accepted.

Concept Problem 9

An automated inventory management system will cost Rs 100 lacs. It will be depreciated on SLM basis over 4 years and this is okay for tax. The system will have a useful life of 5 years. Either at the end of the 4th year or at the end of the 5th year it can be disposed of for Rs 20 lacs. The system will annually save Rs 30 lacs before taxes in inventory related costs. The tax rate is 30%. The new system will free up Rs 10 lacs by way of working capital immediately. This money will have to be put back at the end of the life of the project. Decide, using a discount rate of 10%.

Solution

Step 1: Initial Outflow (Rs Lacs)

a. Capital Expenditure	100
Less: Reduction in working capital achieved	10
b. Net investment	90

Step 2: Operational Flows (Rs lacs)

a. Annual savings	30	d. Tax	3
b. Depreciation	20	e. PAT	7
c. PBT	10	f. CFAT	27

Depreciation = [Original cost – Salvage Value / Life] = (100 –20) / 4 = 20

Step 3: Terminal flow (Rs lacs)

a. Sale of the asset	20
b. Less Increase in working capital	10
c. Net terminal value	10

Step 4:

Capital Budgeting Analysis Statement (Rs. lacs)

Year	*Cash flow*	*DF 10%*	*DCF*
0	(90)	1.000	(90.00)
1-5	27	3.791	102.36
5	10	0.621	6.21
NPV			18.57

Since NPV is positive the project should be implemented.

Key Ideas in Capital Budgeting Decisions

Idea 1: Taxation and Losses

A loss no doubt is bad. But it has a silver lining. It can be set off against taxable profits. It therefore goes to reduce or save tax. In the event of inadequacy of profits it can be carried forward for adjustment in the subsequent year. Called tax shelter, it is computed with the following formula.

Tax shelter = Tax rate × loss adjusted.

It is computed in the year when the tax loss is adjusted. This is what we called Side Effect in Rider 5 of Principle 3.

Concept Problem 10

A company plans to invest in new machinery that would cost Rs 200 lacs. It will be depreciated on SLM basis over 5 years. At the end of its useful life of 5 years, it will be disposed off at an insignificant value. The profit before deprecation and tax in the first year would be Rs 30 lacs while during the next four years it would be Rs 60 lacs per annum. The tax rate is 20%. If the after tax discount rate is 10%, decide.

Solution

Step 1: Initial Outflow

Capital expenditure 200 L

Step 2: In-between Cash flows (Rs. lacs)

Details	*Note*	*1*	*2-5*
Cash flow before depreciation and tax.		30	60
Less: Depreciation	1	(40)	(40)
Profit Before Tax		(10)	20
Less: Tax @ 20%	2	2	(4)
Profit After Tax		(8)	16
Add: Depreciation		40	40
Cash flow after tax		32	56

WN 1: With capital expenditure at 200 lacs and life 5 years, the annual depreciation is Rs 40 lacs.

WN 2: In year 1, the loss of Rs 10 lacs generates a tax saving of Rs 2 lacs.

Step 3: Terminal Flow

NIL

Step 4: Capital Budgeting Analysis Statement (Rs. lacs)

Yr	*CF*	*DF@10%*	*DCF*
0	(200)	1.000	(200)
1	32	0.909	29.1
2-5	56	2.882	161.4
		NPV	(9.5)

Conclusion: Since NPV of the project is negative, project should be rejected

Idea 2: Capital Gains and Capital Budgeting

When an asset is sold at a value that is higher than its written down value, to the extent of that difference, it reduces the depreciable value of other assets in the same block. Consequently, it increases the profit of the project to which these other assets belong. As a result of this, tax in other projects go up. This increase in tax represents a side effect caused by the sale of the asset and should hence be shown as an outflow in the present project.

Concept Problem 11

A machinery belonging to the block "Plant and Machinery" has a WDV of Rs 10 lacs. The WDV of the block is Rs 25 lacs. This means that the WDV of the other machines in the block is Rs 15 lacs. The machine can be sold for Rs 13 lacs. What is its Net sale value?

Solution

- If Machinery X is sold at Rs 13 lacs, the WDV of the block comes down to Rs 12 lacs [25-13]. This means that the WDV of the other assets falls from Rs 15 lacs to Rs 12 lacs.
- Hence the other machines lose out on depreciation to the extent of Rs 3 lacs (15-12). Consequently the profits from the activities carried out by the "other machines" will be higher by Rs 3 lacs.
- The project in which the other machines are used will pay a higher tax on Rs 3 lacs at 30% = Rs 0.9 lacs.
- The net sale value of the machine sold will be Rs 13 lacs less Rs 0.9 lacs = Rs 12.1 lacs.

Idea 3: Cost Reduction

A capital expenditure can be justified not merely because it earns revenue but also if it saves cost exclusively. The capital expenditure can be justified if there is adequate reduction in cost arising out of the capital expenditure. The reduction in cost represents a cash inflow.

Concept Problem 12

Swastik Ltd manufacturers of special purpose machine tools, have two divisions that are periodically assisted by visiting teams of consultants. The Management is worried about the steady increase of expenses in this regard over the years. An analysis of last year's expenses reveals: Consultants remuneration Rs.2,50,000; Travel & Conveyance Rs.1,50,000; Accommodation Expenses Rs.600,000; Boarding Charges Rs.2,00,000; Special Allowances Rs.50,000. The management estimates accommodation expenses to increase by Rs.2,00,000 annually. As part of a cost reduction drive, Swastik Ltd are proposing to construct a consultancy centre to take care of the accommodation requirements of the consultants. This center will additionally save the company Rs.50,000 in boarding charges and Rs.2,00,000 in the cost of Executive Training Programs hitherto conducted outside the Company's premises every year. The following details are available regarding the construction and maintenance of the new center. Land: At a cost of Rs. 8,00,000 already owned by the Company, will be used. Construction cost: Rs. 15,00,000 including special furnishings. Cost of annual maintenance Rs.1,50,000 Construction cost will be written off over 5 years being the useful life. Assuming that the write off of construction cost as aforesaid will be accepted for tax purposes, that the rate of tax will be 50% and that the desired rate of return is 15% you are required to analyse the feasibility of the proposal and make recommendation.

Solution

Step 1: Initial Outflow *(all amounts are Rs. lacs)*
Construction Cost 15.0. Assumed that the company has no intention of selling the land. Hence the market value of land is not relevant.
Step 2: In-between Cash flows

Details	*Note*	*1*	*2*	*3*	*4*	*5*
Savings in accommodation costs		8	10	12	14	16
Savings in boarding charges		0.5	0.5	0.5	0.5	0.5
Savings in training programs		2.0	2.0	2.0	2.0	2.0
Less: AMC		(1.5)	(1.5)	(1.5)	(1.5)	(1.5)
Less: Depreciation	1	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
Profit Before Tax		6.0	8.0	10.0	12.0	14.0
Tax		3.0	4.0	5.0	6.0	7.0
Profit After Tax		3.0	4.0	5.0	6.0	7.0
Cash flow after tax		6.0	7.0	8.0	9.0	10.0

WN 1: With capital expenditure at Rs 15 lacs and life 5 years, the annual depreciation is Rs 3 lacs.
Step 3: Terminal Flow : NIL
Step 4: Capital Budgeting Analysis Statement (Disc Fact 15%)

Yr	*CF*	*DF*	*DCF*
0	(15)	1.000	(15.0)
1	6.0	0.870	5.2
2	7.0	0.756	5.3
3	8.0	0.658	5.3
4	9.0	0.572	5.1
5	10.0	0.497	5.0
		NPV	10.9

Conclusion:

Since NPV of the project is positive, project to be accepted

Idea 4: Cash flow from various angles

In evaluating an investment, we must decide as to from whose perspective the evaluation is being done. The evaluation can be done either from the shareholders perspective or from the long-term lenders (including share holders) perspective.

If PAT has been computed by deducting the interest cost, the post tax cost of interest must be added back in arriving at the cash flow from long-term lenders perspective.

Depending upon the perspective, both the cash flow and the discount rate would undergo a change. The cash flow relevant for evaluation would exclude any payment, of whatever form, to be made to those for whom evaluation is being done. Thus when you evaluate from shareholders angle you don't deduct dividends. When you evaluate from long-term lenders angle you don't deduct principal repayment, interest payment and dividends. The idea is that what ever money is left for discounting should belong exclusively to those for whom the evaluation is done

Particulars	*Share Holders*	*Long Term lenders*
Investment in Capital expenditure	Yes	Yes
Investment in Working capital	Yes	Yes
PBDIT	Yes	Yes
Less: Interest on LT loans	Yes	**No**
Interest on ST Loans	Yes	Yes
Less: Depreciation	Yes	Yes
Less: Tax	Yes	Yes
Less: Repayment of LT	Yes	**No**
STL/CL	Yes	Yes
Recapture of Current assets	Yes	Yes
Recapture of Fixed Assets	Yes	Yes
Cash flow -- Money available for	Share holders	Long term lenders

The NPV of the Equity Shareholders cash flow is called Equity NPV whereas the IRR of the Equity shareholders cash flow is called Equity IRR. Similarly the NPV of the term lenders cash flow is called Project NPV whereas the IRR of the term lenders cash flow is called Project IRR.

Concept Problem 13 (November 2001)

XYZ Ltd., an infrastructure company, is evaluating a proposal to build, operate and transfer a section of 35 km of road at a project cost of Rs.200 crores to be financed as: Equity share capital Rs.50 crores and loans at the rate of interest of 15% p.a. from financial institution Rs.150 crores. The project after completion will be opened to traffic and a toll will be collected for a period of 15 years from the vehicles using the road. The company is also required to maintain the road during the above 15 years and after the completion of that period, it will be handed over to the Highway authorities at zero value. It is estimated that the toll revenue will be Rs.50 crores per annum and the annual toll collection expenses including maintenance of the roads will amount to 5% of the project cost. The company considers to write-off the total cost of the project in 15 years on a straight-line basis. For corporate income tax purposes the company is allowed to take depreciation @ 10% on WDV basis. The financial institutions are agreeable for the

repayment of the loan in 15 equal annual installments, consisting of principal and interest. Compute project IRR and equity IRR. If the company's WACC is 16% and the cost of equity is 24% should the project be accepted?

Solution

Equity Perspective

Step 1: Initial Outflow: Rs 50 crores

Step 2: In-between Cash flows

	(Rs. In crores)
Toll Revenue	50.00
Less: Collection costs	10.00
Less: Interest and Principal	25.65 (Refer WN 1)
CFAT	14.35

Since tax rate is nil, depreciation is irrelevant.

WN 1: Computation of equated annual instalment.

Let "X" be the EAI 150 crores = "X" × PVAF (15%, 15 years)

150 crores = "X" × 5.847 X = 25.65

The breakup between interest and principal is not required since the tax rate is zero.

Step 3: Terminal flow : NIL

Step 4: Capital Budgeting Analysis Statement:

Equity IRR:

Year	*CF (in Crores)*
0	(50.00)
1 to 15	14.35

a. PVAF = Outflow/Annuity = 50/14.35 = 3.484.

b. From the PVAF table for 15 years, we find that 3.484 corresponds to 28%. Hence the Equity IRR is 28%.

Project Perspective:

Step 1: Initial outflow (Rs crores)

Project cost = 200

Step 2: Operational flows (Rs crore)

Inflow = 50

Outflow (5% of project cost) = 10

Net flow = 40

Interest and principal are not deducted as the evaluation is being done from the long term fund angle.

Step 3: Terminal flow: NIL

Step 4: Capital Budgeting Analysis Statement

Year	*CF (in Crores)*
0	(200)
1 to 15	40

a. This falls under single outflow annuity inflow model. PVAF = 200/40 = 5.

b. From the PVAF table for 15 years, we find that 5 closely approximates to 18%. Actual Project IRR is 18.42%.

The NPV – IRR JUGGERNAUT

Cynthia, an engineer by profession, is toying with the idea of making a capital investment. She has a choice between 2 projects A and B. Each involve an initial outlay of Rs 110,000 and a life of 4 years but the after tax cash flows that they generate are different. She is a nuts and bolts techie and has no flair for numbers. You are the bright new chartered accountant fresh and ready to make a mark in the big bad world of consulting. She wants you to help her take a call on which project to select. How do you proceed?

While there are about six investment selection criteria that you can adopt we shall focus only on three of them – Net present value, Internal Rate of Return and Profitability Index. You should learn each of them in depth because each is capable of giving out a contradictory decision! You should know what they mean; how to compute; what are the merits and drawbacks, how to select and finally pass a judgment.

Net present value method: Suppose you were to give us Rs 1,000 today and we were to give you Rs 1,100 also today would you be game for it? Of-course you would because it would make you richer by Rs 100. Now, suppose you were to give us Rs 1,000 today and we were to give you "Rs 600 new plus Rs 500 one year from today", would you be game for it? That would depend on how much the Rs 600 plus the Rs 500 is worth today. For that you need to know the discount rate. If the discount rate were 10%, the present value of the two cash inflows would be Rs 1,050. You would naturally be willing to part with Rs 1,000 in lieu of Rs 1,050 because that would make you richer by Rs 55. This Rs 55 is in financial management jargon is the net present value.

We can now formalize the computation process in four easy to use steps:

Net present value

Step 1: Identify the appropriate discount rate

Step 2: Compute PV of inflow

Step 3: Compute the PV of outflow

Step 4: NPV = PVI - PVO

Decision Rules: We saw earlier that you would select a project if it had a positive NPV because it made you wealthier. By a logical extension, it would mean that between 2 projects, you would select the one with the higher NPV. This brings us to the two decision rules:

Rule 1: Accept Rule: A project which has a positive NPV should prima-facie be selected.

Rule 2: Choice Rules: Between projects which have positive NPV the one with the highest positive NPV should be selected

Internal Rate of Return Method: Not every one is sold on NPV. After all, NPV tells you by how much you are becoming wealthier. It does not tell you what is the rate of return you are earning. Some are happier knowing the rate of return than the amount of return. It's here that IRR steps in.

IRR is the discount rate at which NPV is equal to zero. The logic is simple. If at a discount rate, the NPV is positive, it means that the actual rate of return is greater than the discount rate. If the NPV is negative it means that actual rate of return is less than the discount rate. If the NPV is zero it means that the actual rate of return is neither greater than nor less than the discount rate! Hence IRR represents the actual rate of return earned on an investment.

How to compute?

Step 1: Compute NPV at an initial guess rate (L1)

Step 2: Compute NPV at a second-guess rate (L2)

Step 3: Compute IRR through Linear intrapolation

IRR = L1 + [(NPV of L1)/(NPV of L1- NPV of L2)] * (L2- L1)

Caveat: In computing the IRR the gap between L1 and L2 should be narrow, preferably only 1% point. Further, NPV at one discount rate should preferably be positive and at another discount rate should preferably be negative. This is necessary because the linear intrapolation formula assumes that PV factors fall uniformly with rise in discount rate whereas in reality they do not fall uniformly. By ensuring a small gap between L1 and L2 and by ensuring that NPV at one rate is positive and at the other is negative, the margin of error in the interpolation formula is reduced.

Decision Rules

Accept Rule: Accept if the IRR is greater than target rate of return.
Selection/choice: Between two acceptable projects select the one which has higher IRR

Profitability Index Method: At times it is good to know the productivity of money; meaning how much do we get for every rupee that we spend. This is crucial especially if money is in short supply. Profitability Index does just that.

PI is the ratio of present value of inflow to present value of outflow with cost of capital being used as the discount rate.

Steps in computation:

Step 1: Compute the PV of inflow by discounting the cash flow at the cost of capital.

Step 2: Compute the PV of outflow by discounting the cash flow at the cost of capital.

Decision Rules: The decision on whether a project should be accepted or rejected would depend on whether the index is greater or less than one. From this we can lay down our two rules.

Accept Rule: Project will be accepted if its profitability index is greater than 1.

Selection/Choice: Between acceptable projects the one with the higher profitability index will be selected.

CAPITAL BUDGETING - 3

REPLACEMENT ANALYSIS

If a company bought an asset a few years back, there is no need that it must stay stuck with the asset until the asset gives up its ghost. In business there are no sentiments. If at a point in time we find that the asset is no longer valuable, it should be discarded. Hence each year, without fail, the company should look at the asset afresh and decide whether it would be worthwhile to continue with the asset. How does it carry out this exercise? We explain in the following paragraphs.

Stage 1: Abandonment decision

Called the abandonment decision, this exercise is simple. Let us look at it this way. The value of any asset is the present value of future cash flows generated from the asset. Let us call this the fair value.

	Equation	Action
Rule 1	Sale Price < Fair value	Retain
Rule 2	Sale Price > Fair value	Abandon

If the current disposal value of the asset is less than the fair value of the asset, it means that the asset is undervalued in the market. Hence we must retain the asset. If the current disposal value of the asset is greater than the fair value it means that the asset is overvalued in the market. We should therefore sell the asset and replace it with a new one. We proceed to lay down the computation steps.

The following are the cash flows associated with retaining the asset.

Step 1: Find today's net sale value of the existing asset.

If the company continues with the asset, the cash inflow from the sale value of the asset will have to be foregone. Hence, this value is reckoned as opportunity outflow.

Step 2: Compute future cash flows

You should next find out the cash inflows and outflows across the balance life of the asset including in the terminal year.

Step 3: Compute NPV.

The new set of cash flows consolidated from Steps 1 and 2 should be discounted at the appropriate discount rate to arrive at the revised NPV. A positive NPV means you should continue with the asset. A negative NPV would mean that you should abandon the asset.

Stage 2: The Purchase Decision

Suppose when the company does the abandonment analysis it finds that it should continue with the existing machine because it has a positive NPV. Suppose further that the company

finds a comparable asset in the market with avowed superiority in terms of quality of output and possibilities of high cash flows. Should the company go for the new machine? Here again the answer is simple. You should do the usual capital budgeting exercise (four step analysis) on the new machine. Namely find its initial outflow, the CFAT across its useful life, the terminal value of the asset and then discount these cash flows at the after tax cost of capital to arrive at the Net Present Value. If the NPV is positive the asset can prima facie by bought.

Rule 3

A new asset with a positive NPV is a good asset

Yet at times, such a decision may not be as easy as it appears! Here's why.

Stage 3: The Replacement Decision

Abandonment was about giving up an existing asset. Purchase was about buying a new asset. Replacement is about abandoning an existing asset and replacing it with a new one. How do we decide whether to replace?

Method 1: Aggregate Cash flow Method: While the new asset may have a positive NPV, it will have to replace an existing asset, which too had a positive NPV. Hence you have has two choices, both with positive NPVs.

Applying the basic principles of capital budgeting, the alternative that offers the higher NPV should be selected. Thus, if the NPV of the purchase option is greater than the NPV of the continuing option (also called abandonment option or AO) the new asset (a k a "NA") should be purchased and the old discarded. If the NPV of the purchase option is less than the NPV of the abandonment option you must continue with the old asset and not buy the new asset.

Rule 4:

If NPV of AO > NA, retain the asset.

If NPV of AO < NA, abandon the asset.

Caveat 1: Equated Annual Benefit: An analysis of this kind would be okay only if the life of the new asset and the remaining useful life of the existing asset were equal. For example, the life of the new asset is 4 years and the remaining life of the old asset is also 4 years. Where the lives of two assets under evaluation are unequal, an evaluation based on NPV alone will not lead to a correct decision. That's because the project with the larger life has an inbuilt added advantage of ending up with a higher NPV. Hence, we need to ensure that the lives of the two projects are equated. While there are several ways of cracking this, by far the best-known method is the equated annual benefit method. Under this method we find what annual net cash flow across the project life will equal the computed NPV. This annual cash flow is called the Equated Annual Benefit (EAB). A project with the higher EAB is selected. If the evaluation is not based on NPV but on present value of costs, because the inflows are common to the projects, the asset with the lower equated annual cost (a k a EAC) should be selected.

Rule 5:

If lives are unequal, EAB should be the basis of deciding

The formula for EAB: NPV/PVAF.

The formula for EAC: PVO/PVAF

Incidentally EAB or EAC, as the case may be, can be applied only if the projects are repeatable. This means that once the project duration is over, we should be in a position to do the project a second time around. If the projects are not repeatable, the decision will

have to be based on NPV or PVO as the case may be and not on the basis of EAB/EAC. All this is captured in the following easy to use steps.

Step 1: Compute NPV of the Existing Machine

Step 2: Compute NPV of the New Machine

Step 3: Select the machine with the higher NPV.

Step 4: If the life of the two machines is unequal, compute EAB of existing machine, EAB of new machine and select the one with the higher EAB.

Method 2: Incremental cash flow method

There is a second way in which you can do the analysis. Called the incremental cash flow approach, it is an elegant method.

> **Rule 6:**
>
> If NPV of incremental cash flow is positive, the asset should be replaced

Under this method you must compute the additional cash flows that come in when you replace the old asset. This would be the difference between the cash flow from the new asset and that from the old asset. The incremental cash flow is then discounted at the after tax cost of capital to arrive at the NPV. If the NPV of the incremental cash flow is positive the asset should be replaced since these were cash flows of replacing the asset. If the NPV is negative the existing asset should be retained. All this is captured in the following easy to use steps.

Step 1: Compute incremental initial outflow.		
Purchase price of the new asset	xxx	
Less: net sale value of the old asset	xxx	xxx
Step 2: Compute incremental operational flows.		
Operational flows from the new asset	xxx	
Less: Operational flows from the old asset	xxx	xxx
Step 3: Compute incremental terminal flows.		
Net sale value of new asset	xxx	
Less: Net sale value of old asset	xxx	xxx

Step 4: Consolidate the cash flows in Steps 1 to 3. Discount them at the after tax cost of capital so as to arrive at NPV. If the NPV is positive the asset should be replaced.

Caveat 2: The results under two methods, ie, aggregate cash flow method, and incremental cash flow method, would be the same. However, the incremental cash flow method, its elegance notwithstanding, has some serious limitations.

> **Rule 7:**
>
> Know both the methods. Work under the second method only if both options have positive NPV

Limitation 1: It cannot be used if the life of the new machine and the balance life of the old machine are unequal and if the projects are repeatable.

Limitation 2: It would give a wrong answer if the NPV of the new machine and the NPV of the continuing option are both negative. This is best explained with the following example.

Suppose the new machine (purchase option) has a negative NPV of Rs. 3,00,000. Suppose the old machine (continuing option) has a negative NPV of Rs 4,00,000. The incremental NPV of selecting the new machine to the exclusion of the old machine is Rs 1,00,000. While the new machine is for sure better than continuing with the old machine, the company will do well to do away with both machines because both of them destroy wealth!

Concept Problem 14

An existing machine in Deep's company can be sold today for Rs 100,000 net. The CFAT for the balance life of 4 years is Rs 30,000 per annum. At the end of the 4th year the existing machine can be sold for Rs 20,000 net. A new asset can replace the existing asset at a net cash outflow of Rs 150,000 and will generate annual CFAT of Rs 46,000. The scrap value at the end of its useful life will be Rs. 25,000 net. If the appropriate discount rate is 10%, decide the issue. Would the position change if the life of the new machine is only 3 years and if it can be disposed off on that date at Rs.58,000 net?

Solution

Table 1: NPV of continuing option (Dis. Fac. 10%)

Year	*Cash flow (Rs)*	*Discount*	*PV (Rs)*
0	(1,00,000)	1.000	(1,00,000)
1	30,000	0.909	27,270
2	30,000	0.826	24,780
3	30,000	0.751	22,530
4	30,000	0.683	20,490
4	20,000	0.683	13,660
		NPV	8,730

Table 2: NPV of New machine (Dis. Fac. 10%)

Year	*Cash flow (Rs)*	*Discount*	*PV (Rs)*
0	(1,50,000)	1.000	(1,50,000)
1	46,000	0.909	41,814
2	46,000	0.826	37,996
3	46,000	0.751	34,546
4	46,000	0.683	31,418
4	25,000	0.683	17,075
	NPV		12,849

Both "continuing" and "Buying" have positive NPV. Since NPV of the new machine is greater, Replace the old machine and buy the new one.

Table 3A: New Machine with 3 years to go (Dis. Fac. 10%)

Year	*Cash flow (Rs.)*	*Discount*	*PV (Rs)*
0	(1,50,000)	1.000	(1,50,000)
1	46,000	0.909	41,814
2	46,000	0.826	37,996
3	46,000	0.751	34,546
3	58,000	0.751	43,558
	NPV		7,914

Table 3B: Equated Annual Benefit

Continuing option	8,730/3.170	2,754
New Machine	7,914/2.487	3,182

New machine has the higher EAB. Hence replace old machine.

Table 4: NPV based on incremental cash flow,

Year	*Cash flow Old (Rs)*	*Cash flow New (Rs)*	*Cash flow Incremental (Rs)*	*Discount factor (Rs)*	*PV Rs*
0	(100,000)	(150,000)	(50,000)	1.000	(50,000)
1	30,000	46,000	16,000	0.909	14,544
2	30,000	46,000	16,000	0.826	13,216
3	30,000	46,000	16,000	0.751	12,016
4	30,000	46,000	16,000	0.683	10,928
4	20,000	25,000	5,000	0.683	3,415
				NPV	4,119

Replace since incremental NPV is positive

CAPITAL BUDGETING - 4

INFLATION & CAPITAL BUDGETING

Inflation eats into the purchasing power of the rupee. While taking capital budgeting decisions we should take cognizance of inflation. We should carefully compute the future cash flows and the discount rate. To do that we must properly understand three capital budgeting ideas viz Cash flow, discount rate and present value.

CASH FLOWS

Principle 1: The future cash flows can be expressed either inclusive of inflation or exclusive of inflation. When cash flows include future inflation they are referred to as money cash flows. When they exclude future inflation they are referred to as real cash flows.

In simpler terms, money cash flow is the actual physical currency payable. Unless stated otherwise, all cash flows are expressed in money terms.

Concept Problem 15

Next year when you go to a shop to buy a television it would cost Rs 22,000/-. What is the money cash flow?

Solution

The money cash flow is Rs 22,000 since it is the actual physical currency payable at the materail time.

Concept Problem 16

You find that the next year's price of Rs 22,000 is on account of 10% inflation. How much is the money cash flow and how much is the real cash flow?

Solution

- The Rs 22,000 is the actual physical currency payable and is hence the money cash flow.
- Had there been no inflation the cash flow would have been 22,000/1.1 ie Rs 20,000. The Rs 20,000 is the real cash flow.

	Future Inflation
MCF	Includes
RCF	Excludes
MDR	Includes
RDR	Excludes

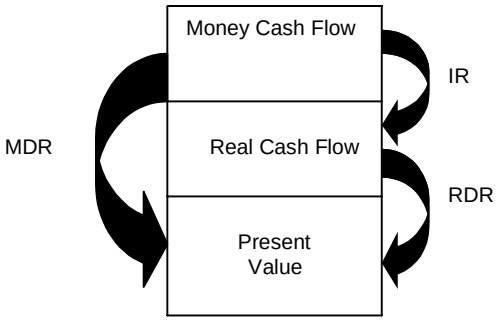
DISCOUNT RATES

Principle 2: Discount rates can be expressed either as inclusive of future inflation or exclusive of future inflation. When the discount rate includes future inflation it is referred to as money discount rate. When it excludes future inflation it is referred to as real discount rate.

Principle 3: The link between money discount rate and real discount rate is expressed by the following formula.

Formula 1: Money discount rate (MDR) is generally taken as the sum of real discount rate (RDR) and inflation rate (IR).

Formula 2: However, because of the interplay of RDR and IR, the more appropriate formula is (1+MDR) = (1+RDR) × (1+IR). The adjoining box explains why.



Why (1+MDR) = (1+RDR) × (1+IR)

You want to buy a cricket bat today. It costs Rs 1,000/-. You decide to postpone its purchase by a year. By then the quality of cricket bats being made will increase such that a similar bat if available today would have cost Rs 1,100. This means that the quality increase (a k a real flow) is 10%. Next let us assume that inflation is running at 5%. A year later, the new bat will not cost Rs 1,100 but would cost Rs 1,100 + 5% = 1,155. This is not a 15% increase over Rs 1,000 as laid in Formula 1. Instead it is a 15.5% increase over Rs 1,000 and not a 15% increase. This is validated by Formula 2 such that 1.1 × 1.05 = 1.155 or 15.5%.

The logic is simple. Inflation hits not just the base cash flow but the real flow as well.

Concept Problem 17

One year from now a fridge would cost Rs 25,000/-. Inflation is 10%. The model has undergone a modest change due to which price is increased by 6%. Identify money cash flow and real cash flow.

Solution

The money cash flow is Rs 25,000.

The inflation rate is 10%, and the the real discount rate is 6%.

Had there been no inflation the new model fridge would have cost Rs 25,000/1.10 viz Rs 22,727. This is the real cash flow.

PRESENT VALUE

Principle 4: Money cash flows should be discounted at the money discount rate to arrive at present value. Similarly real cash flows should be discounted at the real discount rate

to arrive at present value. Real cash flow is not the same as present value. Real cash flow merely excludes future inflation while present value factors both inflation and risk premium.

Principle 5: It is important to recognize that in computing NPV all cash flows should be expressed consistently either in money terms or in real terms. Thus if cash inflows are in money terms, cash outflows should also be expressed in money terms. If they are not expressed in money terms they must be converted into money terms. The conversion rules are fairly simple:

Rule 1: Money cash flow can be converted into real cash flow by discounting at the inflation rate.

Rule 2: Real cash flow can be converted into money cash flow by compounding at the inflation rate.

Concept Problem 18

Data as in Concept Problem 17. (i) What is the present value? (ii) Compute Money discount rate? (iii) Prove your answer by using the formula.

Solution

(i) Had there been no technology changes the television would have cost 22,727/1.06 = 21,441. That's the price of today's quality fridge, a k a, present value.

(ii) The increase from 21,441 to Rs 25,000 is a 16.6% increase. This is the money discount rate.

(iii) Computations using the formula:

The money cash flow is Rs 25,000. The inflation rate is 10%. The real discount rate is 6%

Real cash flow is money cash flow discounted at inflation rate i.e., Rs 25,000/1.10 viz Rs 22,727.

MDR is computed using the formula, (1+MDR) = (1+RDR) × (1+IR). Hence (1.06) × (1.1) = 1.166 or 16.6%

Present value is money cash flow discounted at money discount rate ie 25,000 /1.166 = 21,441

Present value is also real cash flow discounted at real discount rate ie Rs. 22,727/1.06 = Rs. 21,441

Two key issues

Our examples were that of products so that we could appreciate the terms better. In industry we talk not about products per se but about revenues and costs. Simple as the concept of present value is, we must be careful about 2 issues – multiple inflation rates and the treatment of depreciation.

Issue no 1: Inflation rates

Cash flows may be in "one term" (Money or Real) and the discount rate may be in the "other term" (Real or Money). Similarly inflation rates may be symmetrical (one rate)

To Arrive at NPV

- All cash flows should be converted into money terms or to real terms.
- Discount Money Cash flow at the money discount rate to arrive at present value.
- Discount Real Cash flow at the real discount rate to arrive at present value.

In either case, the result should be the same.

or asymmetrical (multiple rates). Symmetrical inflation means all items of revenue and cost have undergone the same level of inflation. Asymmetrical inflation means some items have suffered inflation at rates that are different from those of others. The intersection of the two types of cash flows and the two types of inflation throw up myriad combinations. We capture this in the matrix below!

Situation	*Cash flow*	*Discount factor*	*Inflation*	*Convert Cash Flow*
1	Money terms	Money terms	Uniform	Straight case
2	Money terms	Real terms	Differential	Real terms
3	Money terms	Money terms	Differential	No issue
4	Money terms	Real terms	Uniform	Real terms
5	Real terms	Money terms	Uniform	Money terms
6	Real terms	Real terms	Differential	No issue
7	Real terms	Money terms	Differential	Money terms
8	Real terms	Real terms	Uniform	Straight case

Next, we lay down some simple rules to crack the eight situations.

Rule 1: So long as symmetrical inflation exists, you have two options:

1. Converting cash flows into the terms in which the discount rates are
2. Converting the discount rate into the terms in which the cash flows are.

Rule 2: If Asymmetrical inflation exists, convert the cash flows into the terms in which the discount rates are.

Concept Probelm 19

The following are the sales and cost figures for the three years. The initial investment is Rs 5 lacs.

Details	*Year 1*	*Year 2*	*Year 3*
Sales	5	9	15
Costs	3	6	9

Compute NPV under each of the following situations. Each situation is to be considered separately.

(i) Inflation is zero. The discount rate is 5%
(ii) All cash flows are in money terms. Inflation is 10%. Money discount rate is 15%.
(iii) All cash inflows are in money terms. Inflation is 10%. RDR is 8%
(iv) All cash flows are in real terms. Inflation is 10%. Real discount rate is 6%.
(v) All cash inflows are in real terms. Sales inflation is 10%. Cost inflation is 5%. MDR is 15%
(vi) All cash flows are in real terms. Sales Inflation is 8%. Cost inflation is 5%. RDR is 4%.
vii) All cash inflows are in real terms. Sales Inflation is 10%. Cost inflation is 5%. MDR is 12%
(viii) All cash flows are in money terms. Sales Inflation is 10%. Cost inflation is 6%. Money discount rate is 15%.
(ix) All cash inflows are in money terms. Inflation is 10%. Cost inflation is 8%. RDR is 4%

Solution

Case (i)

WN 1: All cash flows are in money terms. Hence sales cash flow less cost cash flow becomes net cash flows. Discount rate is also in money terms.

WN 2: Computation of NPV.

Year	*Money Cash Flow (Rs)*	*D-Factor @ 5%*	*DCF (Rs)*
0	(5)	1.000	(5.000)
1	2	0.952	1.904
2	3	0.907	2.721
3	6	0.864	5.184
		NPV	4.809

Case (ii)

WN 1: As both cash flows and discount rate are in money terms, no conversion need to be made.

WN 2: NPV Computation

Year	*Money cash flow (Rs)*	*Money discount rate @ 15%*	*DCF (Rs)*
0	(5)	1.000	(5.000)
1	2	0.870	1.740
2	3	0.756	2.268
3	6	0.658	3.948
		NPV	2.956

Case (iii)

WN 1: Cash inflows have been given in money terms. They have to be converted into real terms. Cash outflows are already in real terms.

Year	*Money cash flow (Rs)*	*Inflation rate @ 10%*	*Real cash inflow (Rs)*
1	5	0.909	4.545
2	9	0.826	7.434
3	15	0.751	11.265

WN 2: Computation of NPV

Year	*Net Cash flow (real values) (Rs)*	*Real Discount rate @ 8%*	*DCF (Rs)*
0	(5.000)	1.000	(5.000)
1	1.545	0.926	1.431
2	1.434	0.857	1.229
3	2.265	0.794	1.798
		NPV	(0.542)

Case (iv)

WN 1: As cash flows and discount rate are both in real terms, there is no need for conversion.

WN 2: Computation of NPV

Year	*Real cash flow (Rs.)*	*Real discount rate @ 6%*	*DCF (Rs.)*
0	(5)	1.000	(5.000)
1	2	0.943	1.886
2	3	0.890	2.670
3	6	0.840	5.040
		NPV	4.596

Case (v)

WN 1: As cash inflows are in real terms and money discount rate has been given, the real cash inflows have to be converted into money cash inflows.

Year	*Real cash flow (Rs.)*	*Inflation rate @ 10%*	*Money cash flow (Rs.)*
1	(5.000)	1.100	5.500
2	9.000	1.210	10.890
3	15.000	1.331	19.965

WN 2: Computation of NPV

Year	*Net money cash flow (Rs.)*	*Money discount rate @ 15%*	*DCF (Rs.)*
0	(5.000)	1.000	(5)
1	2.500	0.870	2.175
2	4.890	0.756	3.697
3	10.965	0.658	7.215
		NPV	8.087

Case (vi)

WN 1: All cash flows are in real terms and real discount rate is given. Therefore, no conversion is necessary.

WN 2: Computation of NPV

Year	*Real cash flow (Rs.)*	*Real discount rate @ 4%*	*DCF (Rs.)*
0	(5)	1.000	(5.000)
1	2	0.962	1.924
2	3	0.925	2.775
3	6	0.889	5.334
		NPV	5.033

Case (vii)

WN 1: As cash inflows have been given in real terms they have to be converted into money terms.

Year	*Real cash inflow (Rs.)*	*Inflation rate @ 10%*	*Money cash in flow (Rs.)*
1	5	1.100	5.500
2	9	1.210	10.890
3	15	1.331	19.965

WN 2: Computation of NPV

Year	*Money cash flow (Rs.)*	*Money discount rate @ 12%*	*DCF (Rs.)*
0	(5.000)	1.000	(5.000)
1	2.500	0.893	2.233
2	4.890	0.797	3.897
3	10.965	0.712	7.807
		NPV	8.937

Case (viii)

WN 1: All cash flows are in money terms and money discount rate is given. Hence no adjustment is required.

WN 2: Computation of NPV

Year	*Money cash flow (Rs.)*	*Money discount rate @ 15%*	*DCF (Rs.)*
0	(5)	1.000	(5.000)
1	2	0.870	1.740
2	3	0.756	2.268
3	6	0.658	3.948
		NPV	2.956

Case (ix)

WN 1: As cash inflows have been given in money terms and real discount rate has been given, the money cash in flow has to be converted into real terms.

Year	*Money cash inflow (Rs.)*	*Inflation @ 10%*	*Real cash flow (Rs.)*
1	5	0.909	4.545
2	9	0.826	7.434
3	15	0.751	11.265

WN 2: The cash outflows are already in Real Terms. Hence the Real Net cash flow can be computed and thereafter discounted at real discount rate to arrive at NPV

Year	*Real cash flow (Rs.)*	*Real discount rate @ 4%*	*DCF (Rs.)*
0	(5)	1.000	(5.000)
1	1.545	0.962	1.486
2	1.434	0.925	1.326
3	2.265	0.889	2.014
		NPV	(0.174)

Issue no 2: Depreciation

Depreciation is a non-cash charge. But we know that it is relevant for capital budgeting because it affects tax. Depreciation is on original cost. Hence we could consider it as an item with zero inflation.

Concept Problem 20

Today is 1st Jan. A company's PBDT on 31st Dec would be Rs 10,000. Inflation is 10%. Annual depreciation is Rs 2,000 under straight-line method. The real discount rate is 4%. Assume tax rate as 40%. Compute money cash flows and real cash flows for three years. Compute present value. Use different methods to arrive at the answer.

Solution

Step 1: Compute Operating Cash flows. (Money Cash flow terms)

	Inflation	*1*	*2*	*3*
PBDT	10%	10,000	11,000	12,100
Depreciation	0%	(2,000)	(2,000)	(2,000)
PBT		8,000	9,000	10,100
Tax @ 40%		(3,200)	(3,600)	(4,040)
PAT		4,800	5,400	6,060
CFAT		6,800	7,400	8,060

Computation of Money Discount Rate

(1+MDR) = (1+RDR) (1+1R)

1+MDR = (1.04) (1.10)

1+MDR = 1.144

MDR = 0.144 ie 14.4%

Computation of Money Discount Rate

(1+MDR) = (1+RDR) (1+1R)

1+MDR = (1.04) (1.10)

1+MDR = 1.144

MDR = 0.144 ie 14.4%

Step 2: Computation of NPV

Method 1: Discounting money cash flows at money discount rate

Year	*CFAT (Money Terms)*	*Discount factor @ 14.4%*	*DCF (Rs.)*
1	6,800	0.874	5,943
2	7,400	0.764	5,654
3	8,060	0.668	5,384
		Present Value	16,981

Method 2: Discounting real cash flows at real discount rate.

Step 1: Conversion of money cash flows into real cash flows

Year	*MCF (Rs.)*	*Inflation rate @ 10%*	*Real Cash Flow (Rs.)*
1	6,800	0.909	6,181
2	7,400	0.826	6,112
3	8,060	0.751	6,053

Step 2: Computation of Net Present Value

Year	*Real cash flow (Rs.)*	*Real discount rate @ 4%*	*DCF (Rs.)*
1	6,181	0.962	5,946
2	6,112	0.925	5,654
3	6,053	0.889	5,381
		Present value	16,981

Note that the NPV remains the same, irrespective of the method adopted.

CAPITAL BUDGETING - 5

CAPITAL RATIONING

Early in capital budgeting we learnt that in order to maximize wealth We must select projects with positive NPV. Between two mutually exclusive projects, we must select the one with the higher NPV. These presupposed that we would have enough resources to undertake any and every project. However, when money is in short supply (capital rationing) we must lay out a mechanism by which we will be able to maximize wealth within the framework of the money available. To do this we must appreciate two issues.

MEANING

The term rationing means, "short supply". The term capital rationing means, "money is in short supply". Incidentally, money is said to be in short supply if the availability of money is less than the demand for money.

Issue No 1: Types of capital rationing

Money could be in short supply either in one year only or in more than one year. When it is in short supply in one year only it is called single period capital rationing. When it is in short supply in more than one year it is called multi period capital rationing.

Concept Problem 21

Total money available is Rs 100 lacs. Three projects with cumulative investment value of Rs 90 lacs have a positive NPV. One project with a negative NPV has an investment requirement of Rs 20 lacs. Identify whether money is in short supply.

Solution

- We are concerned only with projects that can be selected. Projects with positive NPV alone matter.
- Requirement: The aggregate investment of projects with positive NPV is Rs 90 lacs
- Availability: Rs 100 lacs
- Since requirement is less than availability, money is not in short supply

Concept Problem 22

Total money available is Rs 100 lacs. Five projects with cumulative investment value of Rs 120 lacs have positive NPVs while two others with an investment value of Rs 30 lacs have negative NPV. Identify whether money is in short supply.

Solution

- Projects with positive NPV alone matter.
- Requirement: The aggregate investment of projects with positive NPV is Rs 120 lacs
- Availability: Rs 100 lacs
- Since requirement is greater than availability money is in short supply

Concept Problem 23

The total requirement in respect of the five projects that can be accepted is Rs. 100 lacs in year 0. Three of the projects also require additional investment in year 1 to the extent of Rs 50 lacs. The moneys available in the two years are 90 lacs and Rs 40 lacs. Is there capital rationing?

Solution

- Requirement in Year 0 (Rs 100 lacs) is greater than the availability (Rs 90 lacs). Hence money is in short supply in year 0.
- Requirement in Year 1 (Rs 50 lacs) is greater than the availability (Rs 40 lacs). Hence money is in short supply in year 1 also.
- Hence multi-period capital rationing exists.

Concept Problem 24

The total requirement in respect of the four projects that can be accepted is Rs.50 lacs in year 0. Two of the projects also require additional investment in year 1 to the extent of Rs 30 lacs. The moneys available in the two years are 40 lacs and Rs 35 lacs. Is there capital rationing.

Solution

- Requirement in Year 0 (Rs 50 lacs) is greater than the availability (Rs 40 lacs). Hence money is in short supply in year 0.
- Requirement in Year 1 (Rs 30 lacs) is less than the availability (Rs 35 lacs). Hence money is not in short supply in year 1.
- Hence single -period capital rationing exists.

Issue No 2: Nature of projects

A project may be either a divisible project or an indivisible one. Divisible projects permit fractional investments ie they can be taken up in parts. Indivisible projects do not permit fractional investments ie they have to be taken up in full or dropped. For example: A project for constructing a 10-storeyed apartment complex is a divisible project. If you have money only for constructing 7-storeys you could do so; ie undertake 0.7 of the project. A project for buying a lorry is an indivisible project because if you don't have enough money you cannot buy 0.7 of a lorry!

The two issues throw up the following matrix

	Single period	*Multi period*
Divisible	Situation 1	Situation 3
Indivisible	Situation 2	Situation 4

We take each situation one after the other.

Situation 1: Single period, divisible projects

When money is in short supply, selecting projects on the basis of NPV would lead to an incorrect decision. This is because when resources are scarce we should look for projects that give us the biggest bang per rupee of money invested. Hence the correct tool in times of capital rationing is the ratio of NPV to initial investment.

Suppose the total money available for a project is Rs 50 lacs and the investment on the various projects amount to Rs 60 lacs. Suppose only 4 of the 6 projects can be selected and these four aggregate to Rs 40 lacs. What should the company do with the remaining Rs 10 lacs. Would it invest in the next project? Obviously it cannot. However if a part of the project can be undertaken (divisible projects, it can select a part of it). Otherwise it will have to let the balance money lie idle or invest in a bank or repay to the providers of money.

We now summarize our discussion into 5 easy to use steps.

Step 1: Identify projects with positive NPV.

Step 2: Identify that capital rationing exists.

Step 3: Rank projects in the order of NPV/Initial outlay

Step 4: Assign money to projects on the basis of rank. If money is not adequate to fully cover a project, part of the project would be undertaken.

Step 5: Aggregate the NPV of selected projects.

Concept Problem 25

A company with Rs 50 M on hand has to take a call on the following projects which it wishes to undertake. Given the money constraint which should it select?

Project	*Investment*	*NPV*
A	50	12
B	30	9
C	20	5

Solution

Step 1: Identify projects with positive NPV.
All the projects have positive NPV.

Step 2: Identify if capital rationing exists
Money required = Rs 100 M
Money available = Rs 50 M
Hence capital rationing exists

Step 3: Rank projects in the order of $\frac{\text{NPV}}{\text{Outlay}}$

Project	*Investment*	*NPV*	*Index*	*Rank*
A	50	12	0.24	3
B	30	9	0.30	1
C	20	5	0.25	2

Step 4: Allot money to projects in the order of rank

Project	*Initial outlay*	*Balance Money available*
–	–	50
B	30	20
C	20	0

Step 5: Compute aggregate NPV

Between Project B and C the aggregate NPV is Rs 14 lacs

Concept Problem 26

Data as in Concept Problem 25 except that the company had only Rs 40 M for investment. How would the position change if the projects were divisible?

Solution

Step 1 to 3: Same as in Concept Problem 25

Step 4: Allot moneys to projects in the order of rank

Project	*Initial Outlay*	*Balance Available Money*
		40
B	30	10
0.5 C	10	0

Only 50% of Project C can be undertaken. Consequently its NPV will be 50% of original NPV.

Step 5: Final NPV

Project B gives an NPV of Rs 9 lacs

50% of Project C means NPV of 50% of 5 lacs ie 2.50 lacs

Total NPV is hence 11.5 lacs

Limitations: (in resolving situation 1): *The method explained above does not work best if:*

- Projects are indivisible
- Money is in short supply in more than one year (irrespective of whether the project is divisible or not).
- Projects are mutually exclusive

Situation 2: Single period, indivisible projects

The Method adopted in Situation 1 is sometimes referred to as the profitability index. The method outlined above does not work best in the case of indivisible projects. We have to hence proceed on a "Trial and Error" basis or use the more sophisticated "Linear Programming" approach. Before we proceed to explain these, we must first take stock of a key principle called Surplus Cash.

Surplus Cash: When projects are indivisible, despite capital being originally in short supply, we could still end up with surplus cash! Consider this example. A company having access to Rs 10000 has five projects with capital investments as detailed below

	A	*B*	*C*	*D*	*E*
Outlay	1,000	2,000	3,000	2,500	3,500
NPV	500	1,500	600	1,500	1,400
PI	0.5	0.75	0.2	0.6	0.4
Rank	3	1	5	2	4

Suppose for some reason we select A, B, C and D then we are left with Rs 1,500 of surplus cash. We are not saying that's the optimal mix. How do we deal with this? It depends on how the surplus cash can be invested. Three rules follow:

Rule 1: If the surplus cash can be invested at a rate greater than cost of capital the NPV of surplus cash will be positive.

Rule 2: If the surplus cash can be invested at cost of capital it means that the NPV of surplus cash will be zero. Compounding at one rate and discounting it at the same rate will make the NPV nil.

Rule 3: If the surplus cash can be invested at a rate less than the cost of capital, the NPV of the surplus cash will be zero.

In short, we see it as just another project! The opinion on what period we should compound it for, is debatable.

While we will explain linear programming in Situation 3, we proceed to explain what we mean by trial and error here. "Trial and error" would mean that various project combinations would be tried out without bothering so much about ranks so that the project combination that results in the highest aggregate NPV would be selected. Incidentally, while ranking based on Index may not be useful, we would still do the ranking in order to help us in our trial and error process!

Rule	Investment Rate	NPV
1	Greater	Positive
2	Equal to	Zero
3	Less than	Negative

Here are 5 easy to use steps.

Step 1: Identify projects with positive NPV.

Step 2: Identify that capital rationing exists.

Step 3: Rank projects in the order of NPV/Initial outlay

Step 4: Identify various feasible combinations. If, money is available but cannot be allotted to any project, it will be dealt with as surplus cash.

Step 5: Compute NPV of the feasible combinations and select the one with the highest aggregate NPV.

Concept Problem 27

Consider the following five projects where the capital availability is restricted to Rs 100 lacs. Which projects to select assuming that money is in short supply

Project	*Outlay*	*NPV*
A	40	15
B	30	20
C	20	5
D	30	12
E	10	6

Solution

Step 1: Identify projects with positive NPV.
All the projects have positive NPV.

Step 2: Identify if capital rationing exists
Requirement: Rs 130 lacs. Availability: Rs 100 lacs
Hence money is in short supply

Step 3: Rank the projects in the order of NPV/outlay

Project	*Investment*	*NPV*	*Index*	*Rank*
A	40	15	0.375	4
B	30	20	0.667	1
C	20	5	0.250	5
D	30	12	0.400	3
E	10	6	0.600	2

Step 4: Draw basic feasible combinations

	B	*E*	*D*	*A*	*C*	*Surplus*	*NPV*
NPV	20	6	12	15	5		
Outlay	30	10	30	40	20		
1	Yes	Yes	Yes		Yes	10	43
2	Yes		Yes	Yes		0	47
3		Yes	Yes	Yes	Yes	0	38

We have assumed that NPV of surplus cash is zero.

Step 5: Alternative 2 has the highest aggregate NPV and should therefore be selected.

Concept Problem 28

Recompute Concept Problem 27 if NPV of every rupee of surplus cash would be 0.05

Solution

Step 1 to 3 Same as before

Step 4 Basic feasible combinations and NPV

	B	*E*	*D*	*A*	*C*	*Surplus*	*NPV*
NPV	20	6	12	15	5	5%	
Outlay	30	10	30	40	20		
1	Yes	Yes	Yes		Yes	10	43.5*
2	Yes		Yes	Yes		0	47
3		Yes	Yes	Yes	Yes	0	38

NPV for every rupee of surplus cash is 0.05. Hence for Rs 10 lacs of surplus cash it is Rs 50,000

Step 5: Combination 2 has the highest aggregate NPV and should hence be selected.

Situation 3: Multi period, divisible projects.

What do we do if money is in short supply in more than one year? Do we use the profitability index method suggested in situation 1 or the trial and error method suggested in situation 2? Actually we should do neither. For, the profitability index method is ill equipped to do multi period capital rationing and the trial and error approach would be too cumbersome. The solution lies in linear programming. We explain this in a logical sequence.

Our objective is to maximize NPV. We would be undertaking a proportion of each project, each of which has a NPV. If we undertake a part of the project we make a proportion of the NPV. Hence the equation would be:

Maximize Z = Chosen proportion of Project A * (NPV of project A) + Chosen proportion of Project B * (NPV of project B) + Chosen proportion of Project C * (NPV of project C) etc.

Now, the NPV of the project would be subject to a couple of constraints. Like

a. Total outflow in year 1 should not exceed say Rs X

b. Total outflow in year 2 should not exceed say Rs Y

c. We cannot invest in the project twice

d. We cannot invest a negative proportion of the project

If we pick all this mess and put it in one place it would read:

Constraint 1:

(Proportion of A * Investment value of A) +
(Proportion of B * Investment value of B) +
(Proportion of C * Investment value of C) $\leq$ X

Constraint 2:

(Proportion of A * Investment value of A) +
(Proportion of B * Investment value of B) +
(Proportion of C * Investment value of C) $\leq$ Y

Non-negativity

Proportion of A $\geq$ 0

Proportion of B $\geq$ 0

Proportion of C $\geq$ 0

Steps in Situation 3

Step 1: Establish the maximization function.

Step 2: Lay down the constraints.

Step 3: Solve the LP equation.

This is a Linear Programming equation which you then proceed to crack with a computer or through detailed iterations. For a detailed explanation of how to solve an LP equation take a look at any good textbook on Operations Research or into the ICAI's Study Material on Cost Management.

Concept Problem 29

The following are the outlay in present value terms

Project	*Period 1*	*Period 2*	*NPV*
1	500	300	5000
2	600	300	6000
3	300	600	6000
4	800	400	7000
Funds Available	1200	800	

Required: Present this as an LP problem, in order to determine the optimal project mix in order to maximize NPV assuming that the projects are divisible

Solution

Step 1: Establish the Maximization equation

Let A, B, C and D be the proportion of Investment in projects 1, 2,3 and 4 respectively

Maximize NPV = 5000A + 6000B + 6000C + 7000D

Step 2: Lay the constraints

500A + 600B + 300C + 800D $\leq$ 1200

300A + 300B + 600C + 400D $\leq$ 800

0 $\leq$ (A, B, C, D) $\leq$ 1.

Step 3: Solve the LP.

Situation 4: Multi period, indivisible projects.

The procedure for working out multi period capital rationing where projects are indivisible is similar to that of multi period capital rationing with divisible projects except that the proportion that we can take up of a project is either zero or one. In quantitative techniques, this is referred to as integer programming. The following would be the steps.

Step 1: Establish the maximization function

Maximize Z = Chosen proportion of Project A * (NPV of project A) + Chosen proportion of Project B * (NPV of project B) + Chosen proportion of Project C * (NPV of project C) Etc.

Step 2: Lay down the constraints:

Constraint 1:

(Proportion of A * Investment value of A) +
(Proportion of B * Investment value of B) + ≤ X
(Proportion of C * Investment value of C)

(Proportion of A * Investment value of A) +
(Proportion of B * Investment value of B) + ≤ Y
(Proportion of C * Investment value of C)

Constraint 2:

0 = Proportion of A or 1 = Proportion of A

0 = Proportion of B or 1 = Proportion of B

0 = Proportion of C or 1 = Proportion of C

Step 3: Solve the equation.

Steps in Situation 4

Step 1: Establish the maximization function.

Step 2: Lay down the constraints.

Step 3: Solve the LP equation.

Concept Problem 30

Data as in Concept Problem 29 except that the projects are indivisible. Decide.

Solution

Step 1: Establish the Maximization equation

Let A, B, C and D be the proportion of Investment in projects 1, 2,3 and 4 respectively

Maximize NPV = 5000A + 6000B + 6000C + 7000D

Step 2: Lay the constraints

500A + 600B + 300C + 800D ≤ 1200

300A + 800B + 600C + 400D ≤ 800

A = 0 or 1. B = 0 or 1. C = 0 or 1.

Step 3: Solve the LP.

CAPITAL BUDGETING - 6

ADJUSTED NPV

When we talked about the long-term fund principle we had said that projects must be evaluated on a stand-alone basis and that we should not concern ourselves with how it is funded. This may not always be so. We look at the when, why and how of it.

Meaning of Adjusted NPV

In our capital budgeting exercises by discounting the after tax cash flows at the WACC we intuitively assumed that every rupee of capital expenditure was funded both by debt and by equity in the company's debt equity ratio. But at times the investment decision is inexorably tied to a financing decision. For example a project may be eligible for concessional finance because it is being set up in a backward area or because the government is keen that funds should flow to this area. In this case we use Adjusted NPV.

Adjusted NPV (ANPV) is the project's NPV after considering the effect of financing. Two adjustments are relevant here: (a) Issue costs (b) Tax shield on interest on debt.

Method of computing APV

The following should be the step-by-step procedure.

Step 1: Compute NPV of the project on the assumption that it is fully financed by equity. This would mean that you would discount the cash flows at cost of equity. This is called base case NPV.

Step 2: Compute the issue costs. The firm has to incur costs to raise the money. This is already in today's value and represents an outflow.

Step 3: Compute the tax saved on interest payable. The interest paid is tax deductible. We must hence compute the tax saved on interest paid.

Step 4: Compute present value of the tax shield. The tax saving takes place at different points in time. They must therefore be brought down to today's value. This is achieved by discounting the tax saving at the pre tax cost of debt. The logic for pretax cost of debt lies in the assumption that the cash flow arising out of tax saving is as risky as the cash flow from debt

Step 5: ANPV = Base case NPV – Issue costs + PV of interest tax Shield.

This is a useful method because it tells the CFO to know where his net present value is coming from and thereby helps him take an apt decision. For example

A-NPV equals
Base case NPV
(–) Issue costs
(+) PV of tax shield on interest

if the base case NPV is positive but issue costs far outweigh the benefits, the CFO can decide to look for alternative sources of financing.

Concept Problem 31
A project involves an initial capital expenditure of Rs 10 lacs. The annual CFAT is Rs 2 lacs for the next 10 years. The opportunity cost of capital is 12% which reflects the project's business risk. Issue costs are 5% of the gross proceeds of the issue. The firm can borrow upto Rs 5 lacs. The cost of debt is 6% and is payable in 10 equal annual installments of principal.
(i) Compute base case NPV and (ii) Compute adjusted NPV

Solution

Step 1: Base case NPV

Year	*CF (Rs L)*	*Disc factor*	*DCF*
0	(1,000,000)	1.000	(1,000,000)
1-10	200,000	5.650	1,130,000
		Total	130,000

Step 2: Issue costs

(a) This is 5% of gross proceeds
(b) Hence if 100 is gross proceeds 95 is net proceeds and Rs 5 is issue costs
(c) Since net proceeds are 10 lacs issue cost is $5/95 \times 10$ lacs = 52,632

Step 3: PV of tax saved on interest paid (at 6%)

Year	*Opening*	*Interest*	*Principal*	*Closing*	*Tax saved*	*Disc factor*	*PV Rs.*
1	500,000	30,000	50,000	450,000	15,000	0.943	14,145
2	450,000	27,000	50,000	400,000	13,500	0.890	12,015
3	400,000	24,000	50,000	350,000	12,000	0.840	10,080
4	350,000	21,000	50,000	300,000	10,500	0.792	8,316
5	300,000	18,000	50,000	250,000	9,000	0.747	6,723
6	250,000	15,000	50,000	200,000	7,500	0.705	5,288
7	200,000	12,000	50,000	150,000	6,000	0.665	3,990
8	150,000	9,000	50,000	100,000	4,500	0.627	2,822
9	100,000	6,000	50,000	50,000	3,000	0.592	1,776
10	50,000	3,000	50,000	0	1,500	0.558	837
						Total	65,992

Step 4:	Step 1 NPV	130,000
	Less: Step 2 Issue costs	(52,632)
	Add: Step 3: Tax saved on interest paid	65,992
	Total NPV	143,360

The project has an adjusted positive NPV and should be selected.

APV and hurdle rates

APV can be used to compute a project's Adjusted IRR. The Adjusted IRR (A-IRR) is the rate at which the ANPV is zero. The A-IRR is useful in decision-making. When Project B is in competition with Project A, its IRR should be greater than the A-IRR of project

A for it to get selected! For Project B this A-IRR is the adjusted cost of capital. If Project B's cash flows are discounted at this adjusted cost of capital and if it gives a positive NPV it would mean that Project B should be accepted. This NPV can be called Adjusted NPV. The message: Accept projects with positive NPV at the adjusted cost of capital. While the regular cost of capital is the expected rate of return on similar assets, the adjusted cost of capital takes into account the effects of financing.

If you know the adjusted discount rate, you don't have to calculate APV. You just calculate NPV at the adjusted rate. The WACC formula is the most common way to calculate adjusted cost of capital

Concept Problem 32

A project involves an investment of Rs 90 lacs. The present value of the interest tax shield is Rs 10 lacs. There are no issue costs. The cost of capital is 10%. (i) Compute A-IRR. (ii) A project with a similar risk profile has an outlay of Rs 100 lacs what would be the appropriate discount rate for the second project?

Solution

Part (i)

- At A-IRR, ANPV should be zero
- 0 = (Cash flow / R) – Investment + PV of interest tax shield
- 0 = (X / 0.1) – 90 + 10
- Hence X = 8 lacs per annum
- Since the initial investment is 90 lacs the IRR is 8/90 lacs. i.e. 8.89%.

Part (ii)

- If there is another project with cost of capital of 10% and same debt financing the cash flows are to be discounted at 8.89% to arrive at ANPV. If at that rate the second project shows a positive NPV, the project can be accepted.