CAPITAL BUDGETING - 1

Where should you put your money? In business you should put it in those assets 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? 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? Maybe, if you believe in Adjusted Present Value. This chapter walks you through these.

TIME VALUE OF MONEY

"Time Value of Money" (TVM) is the first and the most important of lessons that you would ever learn in finance. That's because anything connected with finance is based on the time value of money.

THE EIGHT PRINCIPLES OF TIME VALUE

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

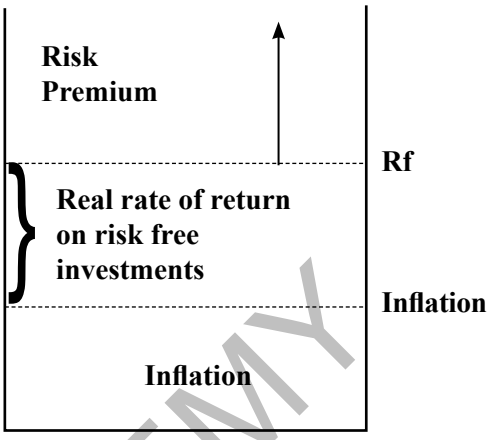
Principle 1: If you were given a choice between receiving Rs.1,000 today and receiving Rs.1,000 a year later, which one would you prefer? "Of-course Rs.1,000 today", you would say. If we were to ask you "Why?" you would probably say, "Hey, I would earn interest while I waited". This means that while money 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 than a rupee received tomorrow because money has a time value."***

1. Rs. 100 today is NOT equal to 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

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 consumption or 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 that 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? This depends on what is 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 that is 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 risk 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 9% for making an investment with us, you would expect a time value of 12% 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. Would both of you want to earn the same rate of return. The answer is "No". This is because your perception of risk can be different from your friend's perception of risk. While you might want a 4% risk premium, your friend might want a 6% risk premium. If the risk free rate is 9%, your TVM on this investment is 13% while that of your friend is 15%

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 person 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 on this deposit be the same as the rate of return that you expected on your fixed deposit in Global Steels Ltd? Again the answer is "No". That's because your perception of the risk involved in the first deposit can be different from your perception of the risk involved in the second deposit. 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: TVM helps value any asset including the valuing an 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 about time value of money, let's proceed to put it to practical use. To do that we must understand the following TEN issues.

Every project has a cash flow stream. This can be a single flow or multiple flows!

Single Flow

This means that there is only one cash flow. i.e., there is one inflow and one outflow

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 **compounded** at TVM. It is the same thing as the "amount" that you learnt in the compound interest formula at school.

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

Explanation 1: Suppose you invest Rs.10,000 in a fixed deposit that pays you 10% per annum as interest. At the end of the first year, you will have Rs.11,000. This consists of the original principal of Rs.10,000 and the interest earned of Rs.1,000. The Rs.11,000 is the future value of the Rs.10,000

invested for one year at 10%. Put differently, Rs.10,000 today is worth Rs.11,000 in one year's time if the interest rate is 10%.

Formula 2
FV = Today's investment x FVF
Where PVF is $(1 + r)_n$

Explanation 2: Now suppose you invested the Rs.10,000 for two years. How much would you have at the end of the second year? Well you had Rs.11,000 at the end of the first year. If you reinvest it, you end up having Rs.11,000 × 1.1 = Rs.12,100 at the end of the second year. Thus Rs.12,100 is the future value of the Rs.10,000 invested for two years at 10%.

This process of reinvesting the interest is called compounding. 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.

Concept Problem 1

You invest Rs.15,000 in a two-year investment that pays you 12% per annum. How much will you have at the end of two years?

Solution:

- Value at the end of 2nd year is to be computed. Hence FV formula is to be used.
- FV = PV × FVF = 15,000 × 1.254 = Rs. 18,810

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 150,000. How long will you have to wait from today?

Solution:

- PV = Rs. 10,000. FV = Rs. 150,000.
- FV = PV × FVF
- 150,000 = 10,000 × FVF. Hence FVF = 15.000
- From the FVF table for 10% we find that 15.000 correspond to approximately 28 years.
- You will have to wait for about 28 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.

Explanation 1: Let's go back to our fixed deposit example. You invested Rs.10,000 at 10% to get Rs.11,000 at the end of the year. If Rs.11,000 was tomorrow's value of today's Rs.1,000 at 10%, then Rs.10,000 is today's value (a k a present value) of tomorrow's Rs.11,000 at 10%. In other words, if we want Rs.11,000 a year later we need to invest Rs.10,00 today at 10%.

Explanation 2: Suppose you needed Rs.12,100 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. i.e. 12,100 = PV × 1.1 × 1.1. Hence the present value is Rs.10,000.

Formula 3
PV = FV / $(1+TVM)^n$.

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

- FV = Today's investment × FVF.
- We know that today's investment is called present value.
- Hence FV = Present Value × FVF.
- Or, FV × 1/FVF = Present Value.
- **1 / FVF** is called the present value factor.
- Hence PV = Tomorrow's Value × PVF.
- Or, PV = Single Sum × PVF

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

In compounding, we move from today's value to tomorrow's value. Tomorrow's value is called Future Value. In discounting, we move from tomorrow's value to today's value. Today's value is also called Present Value. This link between Future Value and Present Value is the discount rate

Why we need them?

Consider a situation where Rs.10,000 is received today, Rs. 11,000 is received a year later, 12,100 two years later, 13,310 three years later 14,640 four years later and 16,110 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 (i.e. Present value) or to the terminal year's value (i.e. 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 × PVF i.e. 10,000 × 0.935 = Rs. 9,350

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

Multiple Flows

Thus far we focussed on single cash flows. The world of investment is however not that simple. In all probability, we will be faced with multiple cash flows. These multiple cash flows can either be uneven cash flows or even cash flows or perpetual even cash flows.

Uneven cash flows mean that cash flows in the various years are not uniform. (Issues 3 and 4)

Annuity means cash flows in the various years are uniform or constant. 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. (Issues 5 to 7).

Perpetuity is a special kind of annuity where the cash flow is forever. (Issues 8 and 9)

We proceed to explain how future value and present value of each of these cash flows are computed.

Issue 3: Future value of uneven cash flows

In this case we simply have to compute the future value of each cash flow as at a specified date and then add them.

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

Step 2: Aggregate

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 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.

STEP 1				
Year	**Amount**	**Years to go**	**FVF**	**Future Value**
0	1,000	3	1.331	1,331
1	1,200	2	1.210	1,452
2	1,300	1	1.100	1,430
STEP 2			**SUM**	**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? Well, 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.

Step 2: Aggregate the present values.

STEP 1			
Year	**Amount**	**PVF**	**Future Value**
0	1,000	1.000	1,000
1	1,200	0.909	1,091
2	1,300	0.826	1,074
STEP 2		**SUM**	**3.165**