Time Value of Money

"Money has a time value" means that the value of money changes over a period of time. The value of a rupee, today is different from what it will be, say after one year.

Factors contributing to the time value of money

1. Individuals generally prefer current consumption to future consumption.
2. An investor can profitably employ a rupee received today, to give him a higher value to be received tomorrow or after a certain period of time.
3. In an inflationary economy, the money received today, has more purchasing power than money to be received in future.
4. "A bird hold in hand is worth to in the bush". This statement implies that, people consider a rupee today, worth more than a rupee in the future, say after a year. This is because of the uncertainty connected with the future.

Valuation concept or Techniques

The time value of money implies:

1. That a person will have to pay in future more, for a rupee received today and
2. A person may accept less today, for a rupee to be received in the future.

The above statements relate to two different concepts.

i) Compound Value Concept or Technique

ii) Discounting or present value concept or Techniques

i) Compound Value Concept (or) Techniques

The time preference for money encourages a person to receive the money at present instead of waiting for future. But he may like to wait if he is duly compensation for waiting time by way of ensuring more money n future. The future value at the end of period 1 can be calculated by a simple formula given below

$$V_1 = V_0 (1+i)^1$$

Where, V_1 = Future value at the period 1

V_0 = Value of money at time 0, i.e. Original sum of money

I = Interest rate

Future Value at sum of the Periods

$$V_n = V_0(1+i)^n$$

Multiple Compounding Periods

Interest can be compounded, even more than once a year. For example banks may allow interest on quarterly basis or a company may allow compounding in interest twice a year

$$V_n = V_0(1+i/m)^{m \times n}$$

Where,

V_n= Future value of money after n years

V_0 = Value of money at time 0. i.e. original sum of money.

i = Interest rate

M = Number of times of compounding per year

Effective Rate of Interest incase of Multi – Period Compounding:

We have noticed above that amount grows faster incase of multi-period compounding i.e. when frequency on interest compounding is more than once a year. It is so because the actual rate of interest realized, called effective rate incase of multi-period compounding is more than the apparent annual rate is interest called nominal rate.

$$EIR = (1 + i / m)^m - 1$$

Where,

EIR = Effective rate of interest

i = Nominal Rate or interest

M = Frequency of compounding per year

Future Vale of a series of payments:

So far we have considered only the future value of single payment made at time zero. But in many instances, we may be interested to know the future value of a series of payments made at different time periods.

$$V_n = R_1(1+i)^{n-1} + R_2(1+i)^{n-2} + \ldots\ldots..(R_{n-1})(1+i) + R_n$$

Where,

V_n= Future value at period n

R_1 = Payment after period 1

R_2 = Payment made after period 2

R_n = Payment made after period 2

i = Rate of interest

Compound Value of Annuity

An annuity is a series of equal payments lasting for some specified duration. The premium payments of life insurance company for example are an annuity.

When the cash flows occur at the end of each period the annuity is called a regular or a deferred annuity.

If the cash flows occur at the beginning of each period the annuity is called an annuity due

$$V_n = R\,[(1+i)^{n-1} + (1+i)^{n-2} + \ldots\ldots\ldots\ldots(1+i)^1+1]$$

Annuity Compound Factor Tables:

Compound value of an annuity can also be calculated with the help of annuity compound factor table.

$V_n = (R)\,(ACF_{i,n})$

Compound Value of an Annuity Due:

When the cash flows occur at the beginning of each period the annuity due

$$V_n = R\,[(1+i)^{n-1}/i]\,(1+i)$$

Making use of annuity compound factor tables we can calculate the future value of an annuity due.

$$V_n = (R)\,(ACF_{i,n})\,(1+i)$$

ii) Discounting or Present Value Technique

Present value is the exact opposite of compound or future value. While future value shows what the value is today of some future sum of money. In compound or future value approach the money invested today appreciates because the compound interest is added to the principal. The present value of money to be received on future date will be less because we have lost the opportunity of investing it at some interest.

V_n

$$V0 = \frac{}{(1+i)^n}$$

Where: Vn = Future value 'n'period

V0 = Present Value

Present value or Discount Factor Tables:

$$DF_{i,n} = \frac{V_n}{(1+i)^n}$$

V_0 = Present Value = Future Value x $DF_{i,n}$

$DF_{i,n}$ = The discount factor for (i) percent interest and 'n' periods

Present Value of a series payments

So far we have considered only present value of a single payment to be received or paid after a certain period. But in many instances we have to calculate preset value of several sums of money, each occurring at different point of time. If series of payments is represented by R1, R2, R3 etc. The present value of such a series of payment will be:

$$V_0 = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t}$$

Where: $R_t$is the payment at period t

Using the annuity Discount Factor tables: The present value of annuity can be calculated by multiplying the annuity payment with the annuity discount factor

$V_0 = R\ (ADF_{i,n})$

Present Value of an annuity Due:

The present value of an annuity due i.e. if the cash flows occur at the beginning of each year can be calculated by using the present value table as below:

$V_0 = (R)\ (ADF_{i,n})\ (1+i)$