

Notion of Interest Rate

TIME VALUE OF MONEY

Introduction

Discounted Cash Flow analysis

One rupee (INR) in hand today is worth more than one INR in future (say after one year) if it is lent to somebody.

This is due to time value of money which is equivalent to the notion of “interest rate”

Future Value= Today's value (1+time value)

OR

Future Value= Today's value (1+interest rate)

Example

Evolution of 100 INR with 5% interest rate (per annum)



Numerical Example (find time period)

Finding time period-

$$\ln(FV) = \ln(PV) + n\ln(1 + r)$$

Example-

INR 50000 will grow to 100000INR with interest rate 4.5% per annum

$$\begin{aligned}\text{So, } n &= \{\ln(100000)/\ln(50000)\}/\ln(1.045) \\ &= 15.74 \text{ years}\end{aligned}$$

Notion of Annuities and Annuity due

Ordinary annuity (fixed amount of money at the end of the time period for certain number of years)
(Mortgages, car loan or student loan etc.)

However, if the payment is to be paid at the beginning of every time period (say a year) then is refereed as annuity due.
(Rental payment, insurance premium etc.)

Numerical Example

- Future value of Annuity
- $FVA = P(1 + r)^{n-1} + P(1 + r)^{n-2} + P(1 + r)^{n-3}$

If $n=3$ and $r=5\%$ then 100 INR will have the

- future value of the annuity $= 100(1 + 0.05)^{3-1} + 100(1 + 0.05)^{3-2} + 100(1 + 0.05)^{3-3}$
 $= 315.25 \text{ INR}$

MS Excel command

- Alternative formula for FVA-
 - $$FVA = P[(1 + r)^n / r - \frac{1}{r}]$$
 - Using this formula for previous example, we will get similar result for FAV value
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- MS EXCEL exercises: Command
 - =FV(r,n,P,PV)
 - Here PV=0 since we start paying at the end of first period and P is payment per period, n is number of years to be paid at r% interest rate.