Time Value of Money

Time Value of Money

- 1 crore rupee's today is more than 1 crorerupee's 5 years from now.

Why????

- Since it could be invested on someinterest or return generating instrumentfor the 5 year period.

- Also due toinflation in most caseswhat one could buy today from the same amount would be more as compared to 5 years form now.

Common Terminologies related to Time Value of Money

- Present Value (PV) – i.e. Today's Value
- Future Value (FV) – i.e. Value in the future
- No of years or Number of time frames (n)
- Rate of Return or Discounting rate (r)
- Annuity (A)– i.e. Constant Cash flow year after year for number of years

Relation between PV & FV

FV = PV *(1+r)^n

- *Above equation assumes annual compounding & one time cash flow.*
- In case of Semiannual compounding the equation would change to

FV = PV *(1+r/2)^2n

- In general, if year is divided in small parts of by dividing it say 't' times then n should be multiplied by 't' times.

FV= PV *(1+r/t)^t*n

- In case of continuous compounding above equation will change to,

FV = PV* e^(rn), where e=2.71828

Example

Q. What is the future value ofRs.10000 invested today atthe end of7years, given the investment is to earn 9% rate ofreturn, in the following cases ?

1. **Annual Compounding**
2. **Semi Annual Compounding**
3. **Quarterly Compounding**
4. **Continuous compounding**

Given

PV=10000

t1=7

r=9%

FV=???

Solution

FV1= 10000*(1+9%)^7= 18280.39

FV2=10000*(1+9%/2)^(7*2)= 10000*(1.045)^14=18519.45

FV3=10000*(1+9%/4)^(7*4)=10000*(1.0225)^28=18645.45

FV1= 10000*(2.71828)^(7*9%)= 18776.11

Relation between FV & PV

PV = FV /((1+r)^n)

- *Above equation assumes annual compounding & one time cash flow.*
- In case of Semiannual compounding the equation would change to

PV=FV /((1+r/2)^2n)

- In general, if year is divided in small parts of by dividing it in say 't' times then n should be multiplied by 't' times.

PV=FV /((1+r/t)^t*n)

- In case of continuous compounding above equation will change to,

PV=FV /(e^(rn)), where e=2.71828

Example

Q. What is thepresentvalue ofRs.1000000 which you would get atthe end of10years, given theaverage inflation in the interim is say 8% per annum, in the following cases ?

1. **Annual Compounding**
2. **Semi Annual Compounding**
3. **Quarterly Compounding**
4. **Continuous compounding**

Given

FV=1000000

t1=10

r=8%

PV=???

Solution

PV1= 1000000/((1+8%)^10)= 463193.5

PV2=1000000/((1+8%/2)^(10*2))= 1000000/((1.04)^20)=456386.9

FV3=1000000/((1+8%/4)^(10*4))= 10000/((1.02)^40)=452890.4

FV1=1000000/(2.71828)^(10*8%))=449329

FV of the annuity

$$FVA = A * \frac{(1+r)^n - 1}{r}$$

Annual cash flows of fixed amount A.

Example

What is the future value of an annuity which paysRs.25000per year at the end of the each next15years, given the investment is to earn11%rate of return ?

Given

A=25000

t=15

r=11%

FVA=???

Solution

FVA= 25000*(1+11%)^15 -1

11%

=860133.97

PV of the annuity or perpetuity

PVA= A *(1-(1/1+r)^n)/r

Annual cash flows of fixed amount Afor n number of years.

PVP=A

r

Annual cash flows of fixed amount A forinfinite number of years.

Example

What is thepresentvalue of an annuity which paysRs.25000per year at the end of the each next15years, given the investment is to earn11%rate of return? What if this investment is done till infinity?

Given

A=25000

t=15

r=11%

PVA1=???

PVA2=???

Solution

PVA1=25000*(1-(1/1+11%)^15)/11%

= 179771.74

PVA2=$\underline{25000}$

11%

=227272.73