ISEG - Quantitative Finance Formulae

Quantitative Finance Formulas

Interest accumulation: $Fv = Pv + I$

Simple interest: $Fv = Pv(1 + i \cdot t)$

Compound interest: $Fv = Pv(1 + i)^t$

Simple discount: $D = Fv \cdot d \cdot t$

I=Interest; P=Principal; i=interest rate

t=number of periods

Effective rates conversion:

$i_L = (1 + i_S)^{L/S} - 1;\ i_S = (1 + i_L)^{S/L} - 1$

Relation between nominal and effective rates:
$i_A(m) = m[(1 + i_A)^{1/m} - 1]$

Continuous compounding:

Nominal rate: $\delta = \ln(1 + i_A)$

Future Value: $S=Pe^{\delta t}$

Present Value: $P=Se^{-\delta t}$

Present value of a n payment annuity immediate of 1 per period: $a_{\bar{n}|i} = \frac{1-(1+i)^{-n}}{i}$

Accumulated value of a n payment annuity immediate of 1 per period:

$$s_{\bar{n}|i} = \frac{(1+i)^n - 1}{i} = a_{\bar{n}|i}(1 + i)^n$$

Present value of annuity due:

$$\ddot{a}_{\bar{n}|i} = 1 + a_{\overline{n-1}|i} = a_{\bar{n}|i}(1 + i)$$

Accumulated value of annuity due:

$$\ddot{s}_{\bar{n}|i} = s_{\bar{n}|i}(1 + i)$$

Present value of deferred annuity:

$${}_{k|}a_{\bar{n}|i} = a_{\bar{n}|i}(1 + i)^{-k}$$

Accumulated value of deferred annuity:

$${}_{k|}s_{\bar{n}|i} = s_{\bar{n}|i}$$

Forborne annuities

$FV=R.S_{n|i}(1+i)^p$

p- number of intervals between the last payment and FV.

Present value of perpetuity immediate: $a_{\infty|i} = \frac{1}{i}$

Increasing arithmetic progression:

$$(C - h)a_{\bar{n}|i} + h(Ia)_{\bar{n}|i};\qquad (Ia)_{\bar{n}|i} = \frac{\ddot{a}_{\bar{n}|i} - n(1+i)^{-n}}{i}$$

Decreasing arithmetic progression:

$$(D - h)a_{\bar{n}|i} + h(Da)_{\bar{n}|i};\quad (Da)_{\bar{n}|i} = \frac{n - a_{\bar{n}|i}}{i}$$

Geometric progression: $C\frac{1-r^n(1+i)^{-n}}{1+i-r}$

M^{thly} payable annuity:

$$a^{(m)}_{\bar{n}|i} = a_{\bar{n}|i}\frac{i}{i^{(m)}};\ \ s^{(m)}_{\bar{n}|i} = s_{\bar{n}|i}\frac{i}{i^{(m)}}$$

Leasing:

Lease payment=PMT + I

Pv=PMT $a_{\bar{n}|i}$, I=RV $\cdot\, i$

Leasing (for an annuity immediate):

$Vc = E + Ra_{\bar{n}|i} + RV(1 + i)^{-n}$, where

Vc: value of the contract; E: entry value

RV = residual value; PMT = periodic payment

Linear Interpolation:

Rn=R1+[(R2-R1)/(t2-t1)].(tn-t1)

Rn - unknown rate
R1 and R2 - two known