Quantitative Finance Formulas

Interest accumulation: Fv = Pv + I

Simple interest: Fv = Pv (1 + i·t)

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

Simple discount: D = Fv·d·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: $a_{\bar{\infty}|i} = \frac{1}{i}$

Increasing arithmetic progression:

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

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:

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

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