Security Analysis & Security Valuation

(1) $$\mu_r = \frac{2n_1n_2}{n_1+n_2} + 1$$

$$\hat{\sigma}_r = \sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$$

lower limit $= \mu - t \times \hat{\sigma}_r$

Upper limit $= \mu + t \times \hat{\sigma}_r$

(2) Expected Return

$$E(R_t) = r_t + \frac{V_0 - P_0}{P_0}$$

where $E(R_t)$ = Expected Return

r_t = required return, V_0 = intrinsic value

P_0 = day's Market price

(3) Equity Risk premium

$$R_x = R_f + \beta(R_m - R_f)$$

R_x = Expected return on investment

R_f = Risk free rate of Return

β = Beta

R_m = expected return of Market

$R_m - R_f$ = Market Risk premium

(4) Valuation of Equity Shares

(1) Dividend Based Models

(i) Valuation Based holding period of one year

$$P_0 = \frac{D_1}{(1+K_e)^1} + \frac{P_1}{(1+K_e)^1}$$

(ii) Valuation Based on Multi Holding period

(a) zero growth → No Growth Model

$$P_0 = \frac{D}{K_e}$$

b) Constant growth → quite unrealistic assumption

$$P_0 = \frac{D_1}{K_e - g} \quad (\text{or}) \quad \frac{D_0(1+g)}{K_e - g}$$

(c) Variable growth in Dividend

(1) Two stage Dividend Discount Model

$$P_0 = \left[\frac{D_0(1+g_1)}{(1+K_e)^1} + \frac{D_0(1+g_1)^2}{(1+K_e)^2} + \cdots + \frac{D_0(1+g_1)^n}{(1+K_e)^n}\right] + \frac{P_n}{[1+K_e]^n}$$

$$P_n = \frac{D(1+g_1)(1+g_2)}{K_e - g_2}$$

D_0 = Dividend just paid

g_1 = Finite or super growth rate

g_2 = Normal growth Rate

K_e = Required rate of return on Equity

P_n = Price of share at the end of super growth i.e., beginning of Normal growth Period

(2) Three stage Dividend Discount Model :-

$$P_0 = \frac{D_0(1+g_n)}{r-g_n} + \frac{D_0 H_1 (g_c-g_n)}{r-g_n}$$

g_n = Normal growth rate long run.

g_c = Current growth rate i.e., initial short term growth rate.

H_1 = Half-life of high growth period.

Earning Based Models

(a) Gordon's Model :-

$$\frac{EPS_1(1-b)}{K_e - br}$$

r = Return on retained Earnings

b = Retention ratio.

(b) Walter's Approach :-

$$\frac{D + (E-D) \times r/K_e}{K_e}$$

(c) Price Earning ratio (or) Multiplier Approach :-

Value = EPS × PE ratio

$$EPS = \frac{PAT - PD}{\text{No. of Eq. shares}}$$

Calculation of Free cash flow to Firm (FCFF) :-

(a) Based on its Net Income :

FCFF = Net Income +
Int Exp (1-tax) +
Depreciation +/-
Capital Expenditure +/-
change in Non-cash Working Capital

(b) Based on Operating Income or Earnings Before Interest and Tax (EBIT)

FCFF = EBIT (1 - taxrate) +
Depreciation +/-
Capital expenditure +/-
change in Non-cash working Capital.

(c) Based on Earnings before Interest, Tax, Depreciation and Amortisation (EBITDA)

FCFF = EBITDA * (1-tax) +
Depreciation * (Tax rate) +/-
Capital Expenditure +/-
change in Non-cash working Capital.

(d) Based on free Cash flow to Equity (FCFE) :-

FCFF = FCFE +
Interest (1 - taxrate) +
Principal prepaid -
New Debt Issued +
Preferred Dividend

(e) Based on cash flows :-

FCFF = Cash flow from operations (CFO) + Interest (1 - tax) +/- Capital Expenditure.

* CAPEX (or) Capital Expenditure
  = purchase of Fixed Asset
  (-)
  Sale of fixed Asset

* Working Capital = Current Asset
  (-)
  current liability.

* Non cash working capital
  = working capital (-) Cash & Bank Balance.

* change in Non-Cash working capital
  = Non Cash working cap for cur yr
  (-)
  Non cash working cap for prev. yr

If Δ is positive → ↑ in Working Capital.

Value of firm

(a) One stage Model :-

Intrinsic Value = Present Value of stable period free cash flows to firm.

(b) Two stage Model :-

Intrisic Value = present value of Explicit period free cash flows to Firm
(+)
Present Value of stable period free cash flows to a firm.

(C) For three stage Model :

= PV of Explicit period FCFF (+)
PV of Transition period FCFF (+)
PV of stable period FCFF

Free Cash flow to Equity (FCFE) :-

FCFE = Net Income
(−) Capital Expenditure
(+) Depreciation
(−) Change in Non cash working Capital
(+) New Debt Issued.
(−) Debt Repayments

Value of preference shares :-

$$\frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + --- + \frac{(D_n + MV)}{(1+r)^n}$$

Value of Non Redeemable preference shares :-

$$= \frac{\text{Dividend}}{\text{Required return on pref. share}}$$

* Modified duration = $\left[\dfrac{\text{Macaulay Duration}}{\left[1 + \frac{YTM}{n}\right]}\right]$

* n = no. of compounding periods per year

YTM = yield to Maturity.

* Interest and fixed Dividend coverage

$$= \frac{\text{PAT} + \text{Debenture Interest}}{\text{Debenture Interest} + \text{preference Dividend}}$$

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* Capital Gearing ratio :

$$= \frac{\text{Fixed Interest Bearing funds}}{\text{Equity shareholder's funds}}$$

$$= \frac{\text{Pref. s. capital + Debentures}}{\text{Eq. s. Capital + Reserves}}$$

* yield on Equity shares

$$= \frac{\text{yield on shares}}{\text{Equity share Capital}} \times 100.$$

Value of Equity share

$$= \frac{\text{Actual yield}}{\text{Expected yield}} \times \text{paid up value of share.}$$

* Firm's Expected or Required return on Equity

$$P_0 = \sum_{t=1}^{n} \frac{Div_0 (1+g_s)^t}{(1+K_e)^t} + \frac{Div_{n+1}}{K_e - g_n} \times \frac{1}{(1+K_e)^n}$$

$$K_e = LR + \frac{\text{NPV at LR}}{\text{NPV at LR} - \text{NPV at HR}} \times \Delta V$$

LR = lower rate

NPV at LR = PV of share at LR

NPV at HR = PV of share at HR.

Value of share :-

$$P_0 = \frac{FCFE\,(1+g)}{K_e - g}$$

* Conversion Value :-

$$= \text{Conversion Ratio} \times \text{Market price}.$$

* Assets Turnover Ratio $= \dfrac{\text{Turnover}}{\text{Total Assets}}$

* Effective Interest rate $= \dfrac{\text{Interest}}{\text{Liabilities}}$

* Sustainable growth rate $= ROE (1 - b)$

where $ROE = \dfrac{PAT}{\text{Networth}}$

b = Dividend payout ratio.

* Ratio of Conversion premium

$$= \frac{\text{Market price} (-) \text{conversion Value}}{\text{Conversion Value}} \times 100.$$

* Conversion parity price

$$= \frac{\text{Bond price}}{\text{No. of shares on Conversion}}$$

* $$YTM = \frac{C + \frac{(F-P)}{n}}{\frac{F+P}{2}}$$

C = Coupon rate F = Face Value (Issue price

P = Market price of Bond.

* Current yield $= \dfrac{\text{Coupon Interest}}{\text{Market price}} \times 100.$

PORTFOLIO MANAGEMENT

* Return of a security

$$= \frac{[\text{Price @ yr end} - \text{Price @ yr. beg}] + \text{Dividend}}{\text{Price @ yr beginning}}$$

$$= \frac{[P_1 - P_0] + D}{P_0}$$

* Standard deviation $= \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$

$x - \bar{x}$ = Mean deviation.

with probability :—

$$\sigma_x = \sqrt{\Sigma p(x-\bar{x})^2}$$

* standard deviation of a portfolio

$$= \sqrt{w_1^2\sigma_x^2 + w_2^2\sigma_y^2 + 2w_1w_2\sigma_x\sigma_y r_{xy}}$$

* when correlation is +1

$$\sigma_p = w_1\sigma_x + w_2\sigma_y$$

* when correlation is −1

$$\sigma_p = w_1\sigma_x - w_2\sigma_y.$$

* Minimum Variance Portfolio :—

Proportion of $x = \frac{\sigma_y}{\sigma_x + \sigma_y}$

Proportion of $y = \frac{\sigma_x}{\sigma_x + \sigma_y}$

* Correlation $r_{xy} = \frac{\text{Covariance of } xy}{\sigma_x \times \sigma_y}$

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* Covariance of XY

Without probability

$$\frac{\Sigma (x-\bar{x})(y-\bar{y})}{n}$$

With probability

$$\Sigma p (x-\bar{x})(y-\bar{y})$$

* Alternative formula for portfolio standard deviation :-

$$\sqrt{w_1^2 \sigma_x^2 + w_2^2 \sigma_y^2 + 2 w_1 w_2 \, cov \, xy}$$

* Standard deviation of a three security portfolio

$$\sqrt{w_1^2 \sigma_x^2 + w_2^2 \sigma_y^2 + w_3^2 \sigma_z^2 + 2 w_1 w_2 \sigma_x \sigma_y r_{xy} + 2 w_1 w_3 \sigma_x \sigma_z r_{xz} + 2 w_2 w_3 \sigma_y \sigma_z r_{yz}}$$

* $U = ER - \frac{1}{2} \times A \times \sigma^2$

* portfolio risk $\sigma_p = W_m \times \sigma_m$

$$\Rightarrow W_m = \frac{\sigma_p}{\sigma_m}$$

* CML allocation

$$R_p = R_F + \frac{\sigma_p}{\sigma_m} [R_m - R_F]$$

* SML Equation :-

$$K_e = R_F + \beta [R_m - R_F]$$

$$\beta = \frac{\Delta \text{ in Security Return}}{\Delta \text{ in Market Return}}$$

$$= \frac{\sigma_s}{\sigma_m} \times r_{sm}$$

[Covariance of SM]

* If $\beta = 1 \Rightarrow$ Normal stock

If $\beta > 1 \Rightarrow$ Aggressive stock

If $\beta < 1 \Rightarrow$ Defensive stock.

* $\beta_L = \beta_{UL} \times \frac{D+E}{E}$ (without tax).

$= \beta_{UL} \times \frac{D(1-t)+E}{E}$ (with tax)

* $\beta_{UL} = \beta_L \times \frac{E}{D+E}$

* $\beta = \frac{\Sigma XY - N\bar{X}\bar{Y}}{\Sigma X^2 - N(\bar{X})^2}$

$= \frac{N\Sigma XY - \Sigma X \Sigma Y}{N\Sigma X^2 - (\Sigma X)^2}$

Regression Method/ least Squares method :—

$\Sigma Y = N\alpha + \beta \Sigma X$

$\Sigma XY = \alpha \Sigma x + \beta \Sigma x^2$

* Expected Return $\bar{R_i} = \alpha + \beta \bar{R_m}$

Actual Return $R_i = \alpha + \beta R_m + e_i$

* Sharpe Single Index

$V = \beta^2 \sigma_m^2 + \sigma e_i^2 \longrightarrow$ Unsystematic Risk

V ↓ Variance of Security Return

$\beta^2 \sigma_m^2$ ↓ systematic risk

* Coefficient of Determination

$$= \frac{\text{Systematic Risk}}{\text{Total Risk}}$$

Reward to Volatility ratio :-

* Sharpe Ratio $= \dfrac{R_p - R_F}{\sigma_P}$

* Treynor Ratio $= \dfrac{R_p - R_F}{\beta_P}$

R_p = Return R_F = Risk

σ_P = Standard deviation of fund.

β_P = Beta of fund.

Characteristic line :-

$$\alpha + \beta R_m$$

where $\beta = \dfrac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n(\bar{x})^2}$

$$\alpha_i = \bar{y} - \beta\bar{x}.$$

* Sensitivity of returns of each stock with respect to the market is given by its Beta.

* Covariance between any two stocks is

$$\boxed{\beta_1\beta_2\,\sigma_m^2}$$

* Expected Return = Risk free Rate of Return (+) Risk premium

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Jensen's Alpha :-

$$\boxed{\alpha = R_p - [R_f + \beta(R_m - R_f)].}$$

* Risk free Rate $= \dfrac{\text{Coupon payment}}{\text{Current Market price}}$

Mutual funds

* $NAV = \dfrac{\text{Net Assets of the Scheme}}{\text{No. of units outstanding}}$

* Net Assets of the scheme

= MV of Investments (+) Receivables (+) other Accrued Income (+) other Assets

(−)

Accrued Expenses (+) other payables (+) other Liabilities

* The rate of return the mutual fund should Earn

$$\boxed{r_2 = \frac{1}{1 - \text{initial Exp}} \times r_1 + \text{Recurring Expenses}}$$

* Monthly return on Mutual funds :—

$$\frac{NAV_t - NAV_{t-1} + I_t + G_t}{NAV_{t-1}}$$

* Front end load = $\dfrac{\text{Public offer price} - NAV}{NAV}$

* Back end load = $\dfrac{NAV - \text{Redemption price}}{NAV}$

* public offer price = $\dfrac{NAV}{(1 - \text{Front end load})}$

* Redemption price = $\dfrac{NAV}{(1 - \text{Back end load})}$

Interest Rate Risk Management

* Final settlement Amount

$$\frac{(N)\ (RR-FR)\left[\frac{dtm}{DY}\right]}{\left[1+RR\left(\frac{dtm}{DY}\right)\right]}$$

N - Notional principal Amount of the agreement.

RR - Reference Rate for the maturity.

FR - Agreed upon forward rate.

dtm - Maturity of the forward rate

DY - Day count Basis

CORPORATE VALUATION

* Total Assets = Fixed Assets + Intangible Assets + Current Assets (–) Current Liabilities

* From the total Assets, the value of debt should be subtracted.

Book value = Total Assets – long term debt

(or)

Share Capital (+) Reserves

* EVA = NOPAT – Invested Capital * WACC

(or)

NOPAT – capital charge

NOPAT = EBIT + Tax Expense

* Invested Capital = Total Assets

(−) Non Interest Bearing CL

(+) Non Cash Elements

* Market Value added (MVA) = Market Value of firm (−) Invested Capital

* Value of firm $V_0 = \frac{FCFF_1}{k_e - g_n}$

Security Analysis.

* The formula for Duration of a Coupon Bond

$$= \frac{1+YTM}{YTM} - \frac{(1+YTM) + t(c - YTM)}{c[(1+YTM)^t - 1] + YTM}$$

YTM = yield to Maturity

c = Coupon rate

t = Years to Maturity

* $YTM = \frac{\text{coupon + prorated discount}}{(\text{Redemption purchase + purchase price})/2}$

* Intrinsic Value of Bond

= PV of Interest + PV of Maturity of Bond

* Expected price of Bond in the market

= Intrinsic Value × Beta (β).

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* $\text{Volatility} = \dfrac{\text{Duration}}{1 + \text{YTM}}$

* $\text{Market conversion price} = \dfrac{\text{Market price}}{\text{Conversion ratio}}$

* Conversion premium per share

= Market conversion Price (–) Market price of Eq. share.

* Premium over straight Value of Debenture

$= \dfrac{\text{Market price}}{\text{Straight Value of Bond}} - 1$

* Favourable Income differential per share

$= \dfrac{\text{Coupon Interest} - \text{conversion ratio} \times \text{Div per share}}{\text{Conversion ratio}}$

* Premium pay Back period

$= \dfrac{\text{Conversion premium Per share}}{\text{Favourable Income differential per share}}$

* If the yield of the bond falls the Price will always Increase.

* If YTM Increases, duration of Bond will Decrease.

* $\text{P/E ratio} = \dfrac{\text{MPS}}{\text{EPS}}$ (or) $\dfrac{1}{\text{RoE}}$

* Walter's Model :—

$$V_c = \frac{D + \frac{R_a}{R_c}(E-D)}{R_c}$$

V_c = Market Value of the Share

R_a = Return on Retained Earnings

R_c = Capitalisation rate

E = Earnings per share.

D = Dividend per Share ;

* According to walter's Model, when the Return on Investment is more than the cost of Equity capital, the price per share increases as the dividend pay-out ratio decreases. Hence the optimum pay-out ratio in this case is Nil.

Derivatives Analysis and Valuation

* $\boxed{\text{Basis} = \text{Spot price} - \text{Futures price}}$

* The cost - of - carry model in for futures / forwa... is

$$\boxed{\text{Futures price} = \text{Spot price} + \text{Carrying cost} - \text{Returns (Dividends etc)}}$$

Computation of Forward price

ⓐ **Annual compounding :-**

$$\boxed{A = P\left(1 + r/100\right)^{t}}$$

A = Terminal Value

P = Amount

r = rate of Interest

t = no. of years

ⓑ **Multiple Compounding :-**

$$\boxed{A = P\left(1 + r/n\right)^{nt}}$$

A = forward price

P = Spot price

r = rate of Interest

n = no. of compounding

t = time

ⓒ **Continuos Compounding :-**

$$\boxed{A = P\,e^{rn}}$$

Value of e = 2.72

In case there is cash Income accruing to the security like dividends then

$$\boxed{A = (P - I)\, e^{nr}}$$

where I = present value of the Income flow during the tenure of the contract.

In case the Income accretion to the Securities is in the form of percentage yield

$$\boxed{A = P \cdot e^{n(r-y)}}$$

where y = percentage yield.

The value of epsilon can be calculated by using the following formula

$$e^x = 1 + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

Two period Binomial Model

$$u = \frac{\text{upward FSP}}{\text{spot price}} \qquad d = \frac{\text{Downward FSP}}{\text{spot price}}$$

$$p = \frac{e^{trf} - d}{u - d}$$

Assumptions of Black Scholes Model

1) European options are considered
2) No Transaction Costs
3) Short term Interest rates are known and are constant
4) Stocks do not pay dividend
5) Stock price movement is similar to a random walk.
6) Stock returns are normally distributed over a period of time
7) The variance of the return is constant over the life of an Option.

Steps in Black Scholes Model :-

1. $\ln\left(\frac{S}{x}\right)$

2. $$d_1 = \frac{\ln\left(\frac{S}{x}\right) + \left[\frac{\sigma^2}{2} + r_f\right] \times t}{\sigma \times \sqrt{t}}$$

3. $d_2 = d_1 - \sigma\sqrt{t}$

4. $NT(d_1)$
5. $NT(d_2)$

6. $N(d_1) = 0.5 \pm NT(d_1)$

7. $N(d_2) = 0.5 \pm NT(d_2)$

8. e^{-trf}

9. $V_c = S \times N(d_1) - X \times e^{-trf} \times N(d_2)$.

10. $N(-d_1) = 1 - N(d_1)$

11. $N(-d_2) = 1 - N(d_2)$

12. $V_p = \left[X \times e^{-trf} \times N(-d_2)\right] - \left[S \times N(-d_1)\right]$.

* The Variability of return can be calculated in terms of standard Deviation.

* Beta for cash = 0

* Beta for portfolio of shares

$$= \frac{\text{Change in Value of portfolio of Share}}{\text{Change in Value of Market portfolio (Index)}}$$

* Hedge Ratio $\Delta = \dfrac{C_1 - C_2}{S_1 - S_2}$

* Initial Margin = $\mu + 3\sigma$

where μ = Daily Absolute change

σ = Standard Deviation.

- **Semi Annual fixed payment :-**

$$(N) \times (A/C) \times \text{period}$$

(N) → Notional Amount

(A/C) → All in cost

- **Floating Rate payment :-**

$$(N)\,(LIBOR)\left[\frac{dt}{360}\right].$$