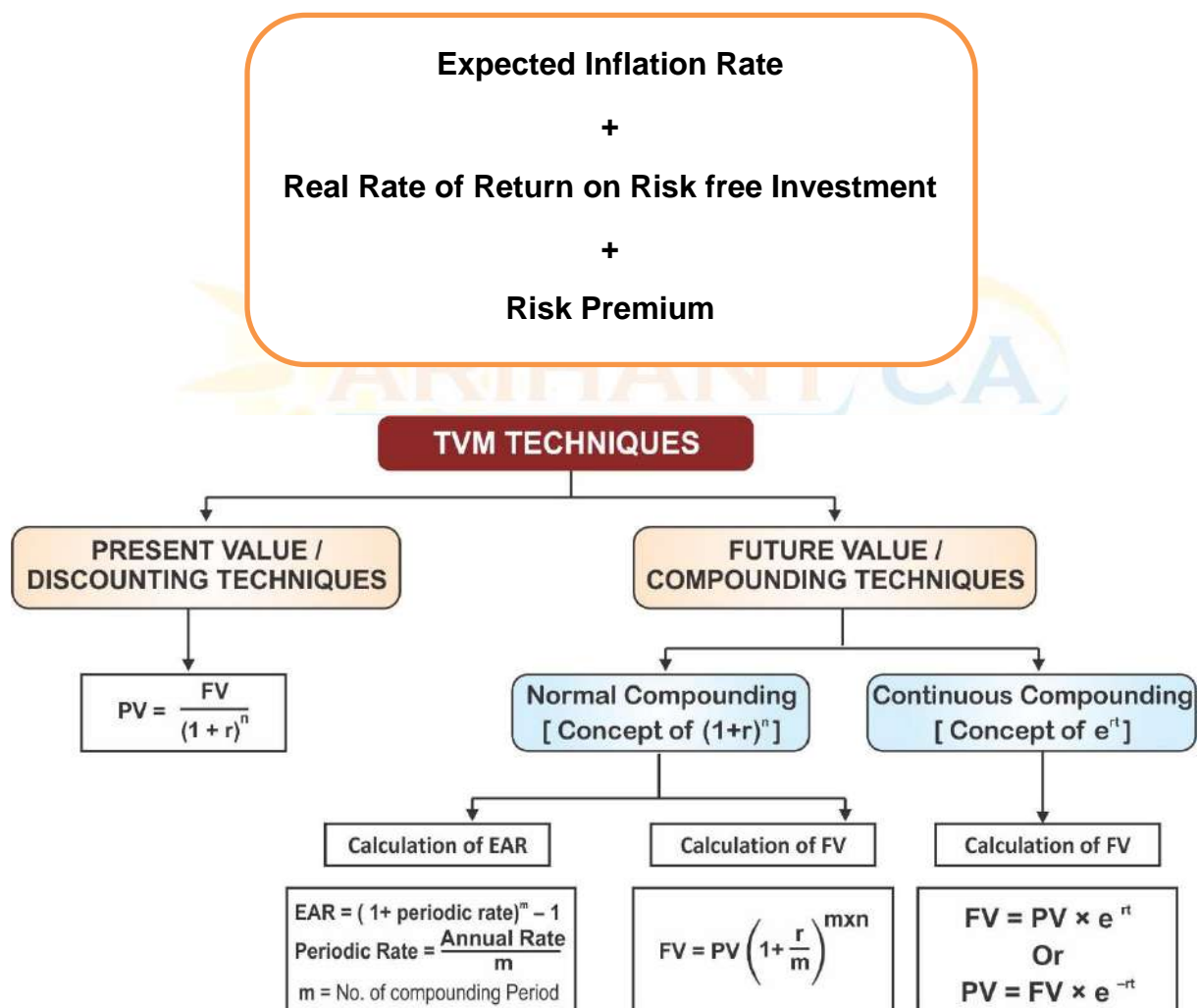


Time Value of Money

Study Session 1

LOS 1 : Introduction

- ❖ Time value of Money is the first and the most important chapter of Finance.
- ❖ Anything connected with Finance is based on the “TIME VALUE OF MONEY”
- ❖ ₹ 100 today is Not Equal to ₹ 100 a year later.
- ❖ Three Factors determines the Time Value of Money:



LOS 2 : Future Value of a Single Cash Flow

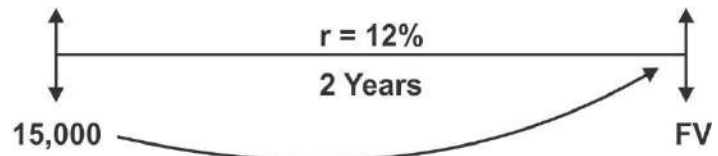
$$FV = PV \times (1 + r)^n$$

Example:

You invest ₹ 15,000 for two years that pays you 12% p.a. how much will you have at the end of two years?

Solution:

$$\begin{aligned} FV &= PV \times (1 + r)^n \\ &= 15,000 \times (1 + 0.12)^2 \\ &= 18,816 \end{aligned}$$

**LOS 3 : Present Value of a Single Cash Flow**

$$FV = PV \times (1 + r)^n \text{ or } PV = \frac{FV}{(1+r)^n}$$

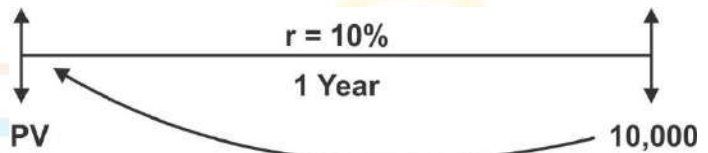
Example:

You need ₹ 10,000 for buying a mobile next year. You can earn 10% on your money. How much do you need to invest today?

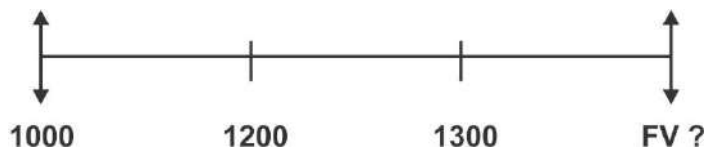
Solution:

$$\begin{aligned} FV &= 10,000 \\ r &= 10\% \\ n &= 1 \text{ year} \end{aligned}$$

$$PV = \frac{FV}{(1+r)^n} \Rightarrow \frac{10,000}{(1+0.10)^1} \Rightarrow 9090.91$$

**LOS 4 : Future Value of a Multiple Unequal Cash Flow****Example:**

Suppose you receive ₹ 1000 today, another ₹ 1200 a year later and ₹ 1300 two year later. How much will you have three years from today? Interest Rate @ 10%

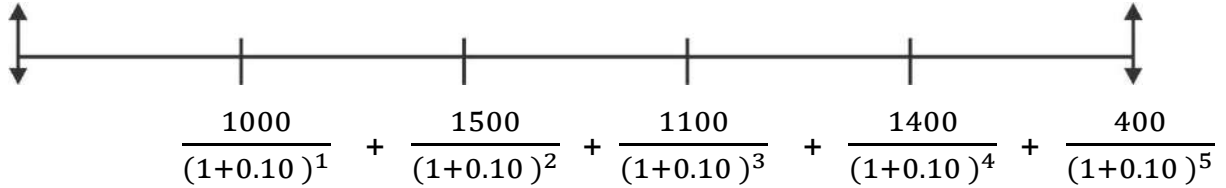
Solution:

$$\begin{aligned} 1000 \times (1 + 0.10)^3 &= 1331 \\ 1200 \times (1 + 0.10)^2 &= 1452 \\ 1300 \times (1 + 0.10)^1 &= 1430 \\ &\underline{\underline{4213}} \end{aligned}$$

LOS 5 : Present Value of a Multiple Unequal Cash Flow

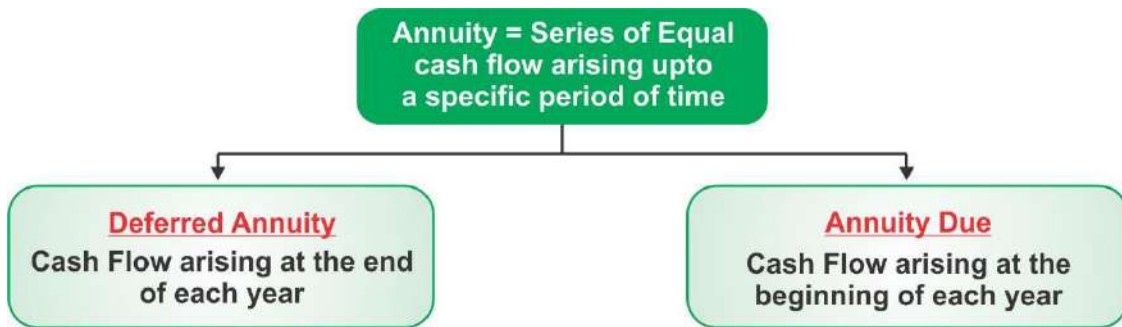
Example:

Mr. X receives ₹ 1000, 1500, 1100, 1400 & 400 at the end of year 1, 2, 3, 4 & 5. Rate = 10%, Calculate PV.



PV = 4179.30

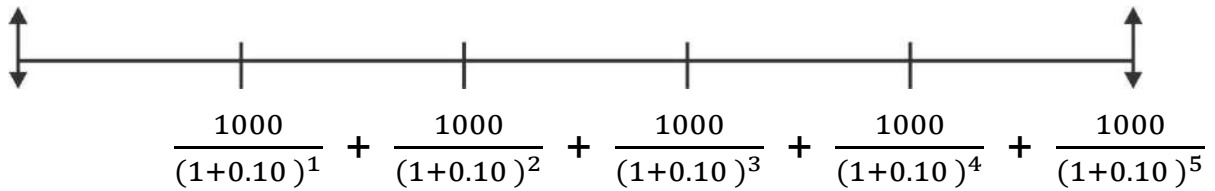
LOS 6 : Present Value of a Multiple Equal Cash Flow (Period Defined)



a) Present Value of Multiple Equal Cash Flow (Period Defined) :- (at the end of each year)

Example:

Mr. X will receive ₹ 1000 at the end of each year upto 5 years, Rate = 10%. Find Present Value.



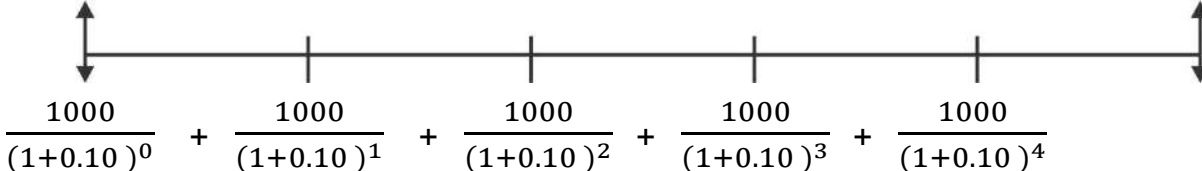
Or

$$PV = 1000 [PVAF @ 10\% \text{ for } 5 \text{ years}] \Rightarrow 1000 \times 3.791 \Rightarrow 3791$$

b) Present Value of Multiple Equal Cash Flow (Period Defined) :- (at the Beginning of each year)

Example:

Mr. X will receive ₹ 1000 starts from today upto 5 years. Rate = 10%. Find Present Value.



Or

$$PV = 1000 [1 + PVAF @ 10\%, (5 - 1) \text{ years}]$$

$$= 1000 \times [1 + 3.17] \Rightarrow 4170$$

Note: If question is silent always assume Deferred Annuity.

LOS 7 : Present Value of Equal Cash Flow upto infinity (Perpetuity/ Indefinite): (Series of equal Cash Flow arising upto infinite or forever)

$$PV = \frac{\text{Annual Cash Flow}}{\text{Discount Rate}}$$

Example:

Mr. X will receive ₹ 1000 at the end of each year upto infinity, Rate = 10%. Find Present Value.

Solution:

$$PV = \frac{1000}{0.10} \Rightarrow 10,000$$

LOS 8: Present Value of Growing Cash Flow upto Infinity (Growing Perpetuity)

$$PV = \frac{CF_1}{\text{Discount Rate} - \text{Growth Rate}}$$

Where CF_1 = Cash Flow at the end of year 1.

Example:

Mr. X will receive ₹ 1000 at the end of year 1, thereafter cash flow will grow by 8% every year upto infinity, Rate = 10%. Find Present Value.

Solution:

$$PV = \frac{1000}{0.10 - 0.08} \Rightarrow 50,000$$

Security Valuation

Study Session 2

LOS 1 : Introduction



Note: Total Earnings mean Earnings available to equity share holders

Income Statement

Sales
Less: Variable cost
Contribution
Less: Fixed cost excluding Dep.
EBITDA
Less: Depreciation and Amortization
EBIT
Less: Interest
EBT
Less: Tax
EAT
Less: Preference Dividend
Earnings Available to Equity Share holders
Less: Equity Dividend
T/F to R&S

LOS 2 : SOME BASIC RATIOS

- ❖ EPS = $\frac{\text{Total earning available to equity shareholders}}{\text{Total number of equity shares}}$
 - ❖ DPS = $\frac{\text{Total dividend paid to equity shareholders}}{\text{Total number of equity shares}}$
 - ❖ MPS = $\frac{\text{Total Market Value/ Market Capitalization/ Market Cap}}{\text{Total number of equity shares}}$
 - ❖ REPS = $\frac{\text{Total Retained earnings}}{\text{Total number of equity shares}}$
- OR
- ❖ REPS = EPS - DPS

- ❖ Dividend Yield = $\frac{\text{Dividend per share}}{\text{Market price per share}} \times 100$
- ❖ Dividend pay-out Ratio = $\frac{\text{Dividend per share}}{\text{Earning per share}} \times 100$
- ❖ Dividend Rate = $\frac{\text{Dividend per share}}{\text{Face value per share}} \times 100$
- ❖ Earning Yield = $\frac{\text{Earning per share}}{\text{Market Price per share}} \times 100$
- ❖ P/E Ratio = $\frac{\text{MPS}}{\text{EPS}}$
- ❖ Retention Ratio = $\frac{\text{Retained Earning per share}}{\text{Earning per share}} \times 100$
 $= \frac{\text{EPS} - \text{DPS}}{\text{EPS}} \times 100$

OR

- ❖ Retention Ratio = 1 – Dividend Payout Ratio

Note :❖ **Relationship Between DPR & RR:**

RR + DPR = 100% or 1

- ❖ Dividend yield and Earning Yield is always calculated on annual basis.
- ❖ Dividend is 1st paid to preference share holder before any declaration of dividend to equity share holders.
- ❖ Dividend is always paid upon FV(Face Value) not on Market Value.

LOS 3 : Define Cash Dividends, Stock Dividend ,Stock Split

Cash Dividends: As the name implies, are payments made to shareholders in cash. They come in 3 forms:

- (i) **Regular Dividends:** Occurs when a company pays out a portion of profits on a consistent basis. E.g. Quarterly, Yearly, etc.
- (ii) **Special Dividends:** They are used when favourable circumstances allow the firm to make a one-time cash payment to shareholders, in addition to any regular dividends. E.g. Cyclical Firms
- (iii) **Liquidating Dividends:** Occurs when company goes out of business and distributes the proceeds to shareholders.

Stock Dividends (Bonus Shares) :

- ❖ Stock Dividend are dividends paid out in new shares of stock rather than cash. In this case, there will be more shares outstanding, but each one will be worth less.
- ❖ Stock dividends are commonly expressed as a percentage. A 20% stock dividend means every shareholder gets 20% more stock.

Stock Splits :

- ❖ Stock Splits divide each existing share into multiple shares, thus creating more shares. There are now more shares, but the price of each share will drop correspondingly to the number of shares created, so there is no change in the owner's wealth.
- ❖ Splits are expressed as a ratio. In a 3-for-1 stock split, each old share is split into three new shares.
- ❖ Stock splits are more common today than stock dividends.

Effects on Financial ratios:

- ❖ Paying a cash dividend decreases assets (cash) and shareholders' equity (retained earnings). Other things equal, the decrease in cash will decrease a company's liquidity ratios and increase its debt-to-assets ratio, while the decrease in shareholders' equity will increase its debt-to-equity ratio.
- ❖ Stock dividends, stock splits, and reverse stock splits have no effect on a company's leverage ratio or liquidity ratios or company's assets or shareholders' equity.

LOS 4 : RETURN CONCEPTS

- ❖ A sound investment decision depends on the correct use and evaluation of the rate of return. Some of the different concepts of return are given as below:

Required Rate of Return:

An asset's required return is the minimum return an investor requires given the asset's risk. A more risky asset will have a higher required return. Required return is also called the opportunity cost for investing in the asset. If expected return is greater (less) than required return, the asset is undervalued (overvalued).

The Future of Finance starts with you

Price Convergence

If the expected return is not equal to required return, there can be a "return from convergence of price to intrinsic value."

Letting V_0 denote the true intrinsic value, and given that price does not equal that value (i.e., $V_0 \neq P_0$), then the return from convergence of price to intrinsic value is $\frac{V_0 - P_0}{P_0}$.

If an analyst expects the price of the asset to converge to its intrinsic value by the end of the horizon, then $\frac{V_0 - P_0}{P_0}$ is also the difference between the expected return on an asset and its required return:

$$\text{Expected Return} = \text{Required Return} + \frac{V_0 - P_0}{P_0}$$

Example:

Suppose that the current price of the shares of ABC Ltd. is ₹30 per share. The investor estimated the intrinsic value of ABC Ltd.'s share to be ₹35 per share with required return of 8% per annum. Estimate the expected return on ABC Ltd.

Solution :

Intel's expected convergence return is $(35 - 30)/30 * 100 = 16.67\%$, and let's suppose that the convergence happens over one year. Thus, adding this return with the 8% required return, we obtain an expected return of 24.67%.

Discount Rate

Discount Rate is the rate at which present value of future cash flows is determined. Discount rate depends on the risk free rate and risk premium of an investment.

Internal Rate of Return

Internal Rate of Return is defined as the discount rate which equates the present value of future cash flows to its market price. The IRR is viewed as the average annual rate of return that investors earn over their investment time period assuming that the cash flows are reinvested at the IRR.

LOS 5 : EQUITY RISK PREMIUM

Equity risk premium is the excess return that investment in equity shares provides over a risk free rate, such as return from tax free government bonds. This excess return compensates investors for taking on the relatively higher risk of investing in equity shares of a company.

Calculating the Equity Risk Premium

To calculate the equity risk premium, we can begin with the capital asset pricing model (CAPM), which is usually written:

$R_x = R_f + \beta_1 (R_m - R_f)$ Where:

R_x = required return on investment in "x"(company x)

R_f = risk-free rate of return

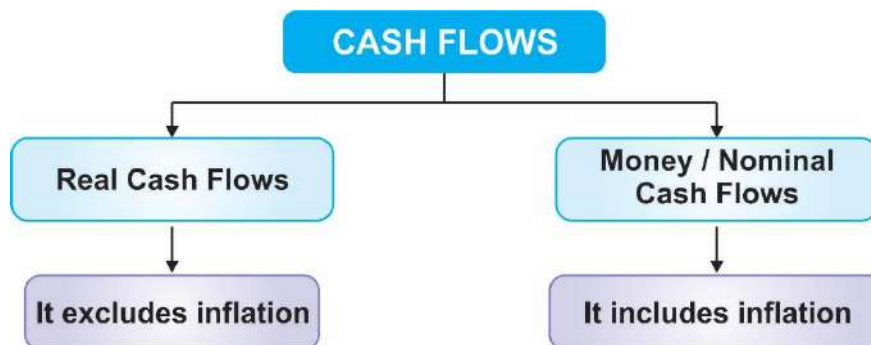
β_x = beta of "x"

R_m = required return of market

$$\text{Equity Risk Premium} = R_x - R_f = \beta_x (R_m - R_f)$$

LOS 6 : Concept of Nominal Cash Flow and Real Cash Flow

Cash Flow:



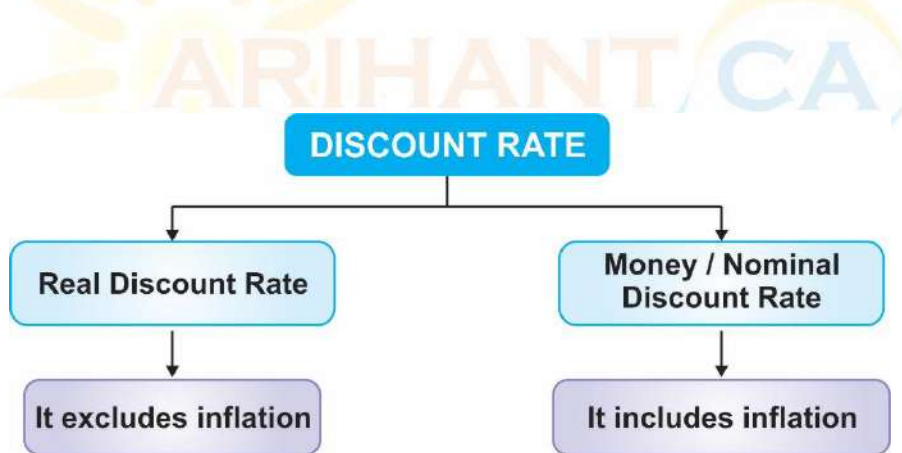
Conversion of Real Cash Flow into Money Cash Flow & Vice-versa

$$\text{Money Cash Flow} = \text{Real Cash Flow} (1 + \text{Inflation Rate})^n$$

Or

$$\text{Real Cash Flow} = \frac{\text{Money Cash Flow}}{(1 + \text{Inflation Rate})^n}$$

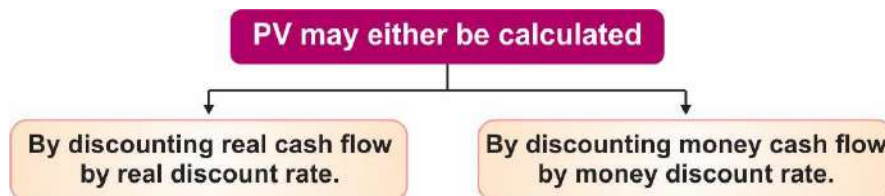
Discount Rate:



Conversion of Real Discount Rate into Money Discount Rate & Vice-versa

$$(1 + \text{Money Discount Rate}) = (1 + \text{Real Discount Rate}) (1 + \text{Inflation Rate})$$

PV:



Discount rate selection in Equity Valuation

- ❖ While valuing equity shares, only nominal cash flows are considered. Therefore, only nominal discount rate is considered. The reason is that the tax applying to corporate earnings is generally stated in nominal terms. Therefore, using nominal cash flow in equity valuation is the right approach because it reflects taxes accurately.
- ❖ Moreover, when the cash flows are available to Equity Share Holders only, nominal cost of Equity is used. And when cash flows are available to all the companies capital providers, nominal after tax weighted average cost of capital is used.

LOS 7 : Ex – Dividend and Cum – Dividend Price of a share

- ❖ If Question is Silent, always Assume Ex- Dividend price of share.
- ❖ If cum-dividend price is given, we must deduct dividend from it.
- ❖ It may be noted that in all the formula, we consider Ex-Dividend & not Cum-Dividend.

LOS 8 : Valuation Models based on Earnings & Dividends**Walter's Model :**

Walter's supports the view that the dividend policy plays an important role in determining the market price of the share.

He emphasis two factors which influence the market price of a share:-

- (i) Dividend Payout Ratio.
- (ii) The relationship between Internal return on Retained earnings (r) and cost of equity capital (K_e)

Walter classified all the firms into three categories:-**a) Growth Firm:**

- ❖ If ($r > K_e$). In this case, the shareholder's would like the company to retain maximum amount i.e. to keep payout ratio quite low.
- ❖ In this case, there is negative correlation between dividend and market price of share.
- ❖ If $r > K_e$, Lower the Dividend Pay-out Ratio Higher the Market Price per Share & vice-versa.

b) Declining Firm:

- ❖ If ($r < K_e$). In this case, the shareholder's won't like the firm to retain the profits so that they can get higher return by investing the dividend received by them.
- ❖ In this case, there is positive correlation between dividend and market price of share.
- ❖ If $r < K_e$, Higher the Dividend Pay-out Ratio, Higher the Market Price per Share & vice-versa.

c) Constant Firm:

- ❖ If rate of return on Retained earnings (r) is equal to the cost of equity capital (K_e) i.e. ($r = K_e$). In this case, the shareholder's would be indifferent about splitting off the earnings between dividend & Retained earnings.
- ❖ If $r = K_e$, Any Retention Ratio or Any Dividend Payout Ratio will not affect Market Price of share. MPS will remain same under any Dividend Payout or Retention Ratio.

Note: Walter concludes:-

- ❖ The optimum payout ratio is NIL in case of growth firm.
- ❖ The optimum payout ratio for declining firm is 100%
- ❖ The payout ratio of constant firm is irrelevant.

Summary: Optimum Dividend as per Walter's

Category of the Firm	r Vs. K_e	Correlation between DPS & MPS	Optimum Payout Ratio	Optimum Retention Ratio
Growth	$r > K_e$	Negative	0 %	100 %
Constant	$r = K_e$	No Correlation	Every payout is Optimum	Every retention is Optimum
Decline	$r < K_e$	Positive	100%	0 %

Valuation of Equity as per Walter's

Current market price of a share is the present value of two cash flow streams:-

- a) Present Value of all dividend.
- b) Present value of all return on retained earnings.

In order to testify the above, Walter has suggested a mathematical valuation model i.e.,

$$P_0 = \frac{DPS}{K_e} + \frac{\frac{r}{K_e} (EPS - DPS)}{K_e}$$

When

- P_0 = Current price of equity share (Ex-dividend price)/ Fair or Theoretical or Intrinsic or Equilibrium or present Value Price per Share
- DPS = Dividend per share paid by the firm
- r = Rate of return on investment of the firm / IRR / Return on equity
- K_e = Cost of equity share capital / Discount rate / expected rate of return/opportunity cost / Capitalization rate
- EPS = Earnings per share of the firm
- EPS – DPS = Retained Earning Per Share

Assumptions :

- ❖ DPS & EPS are constant.
- ❖ K_e & r are constant.
- ❖ Going concern assumption, company has infinite life.
- ❖ No external Finance

LOS 9 : Gordon's Model/Growth Model/ Dividend discount Model

- ❖ Gordon's Model suggest that the dividend policy is relevant and can effect the value of the share.
- ❖ Dividend Policy is relevant as the investor's prefer current dividend as against the future uncertain Capital Gain
- ❖ Current Market price of share = PV of future Dividend, growing at a constant rate

$$P_0 = \frac{D_0 (1+g)}{K_e - g_c} \quad \text{OR} \quad P_0 = \frac{D_1 \text{ (next expected dividend)}}{K_e - g_c} \quad \text{OR} \quad P_0 = \frac{EPS_1 (1-b)}{K_e - br}$$

P_0 = Current market price of share.

K_e = Cost of equity capital/ Discount rate/ expected rate of return/ Opportunity cost/ Capitalization rate.

g = Growth rate

D_1 = DPS at the end of year / Next expected dividend / Dividend to be paid

D_0 = Current year dividend / dividend as on today / last paid dividend

EPS_1 = EPS at the end of the year

b = Retention Ratio

$1-b$ = Dividend payout Ratio

Note:

Watch for words like 'Just paid' or 'recently paid', these refers to the last dividend D_0 and words like 'will pay' or 'is expected to pay' refers to D_1 .

Assumptions:

- (i) No external finance is available.
- (ii) K_e & r are constant.
- (iii) 'g' is the product of its Retention Ratio 'b' and its rate of return 'r'

$$g = b \times r \quad \text{OR} \quad g = RR \times ROE.$$

(iv) $K_e > g$

(v) g & RR are constant.

(vi) Firm has an infinite life

Applications

1. $EPS_1 (1-b) = DPS_1$

Proof :

$$EPS_1 (1-b) = EPS_1 \times \text{Dividend payout Rate}$$

$$= EPS_1 \times \frac{DPS_1}{EPS_1}$$

$$= DPS_1$$

We know that $DPR + RR = 1$ or 100%

2. If $EPS = DPS$, $RR = 0$ then $g = 0$

$$P_0 = \frac{D_0 (1+g)}{K_e - g}$$

$$P_0 = \frac{D_0}{K_e} \text{ as } g = 0$$

$$P_0 = \frac{\text{EPS}}{K_e} \quad (\because \text{EPS} = \text{DPS})$$

3. Calculation of P_1 (Price at the end of year 1)

Price at the beginning = PV of Dividend at end + PV of market price at end

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

4. $K_e = \frac{1}{\text{P.E Ratio}}$

Note:

The above equation for calculating K_e should only be used when no other method of calculation is available.

LOS 10 : Determination of Growth rate

The sustainable growth rate is the rate at which equity, earnings and dividends can continue to grow indefinitely assuming that ROE is constant, the dividend payout ratio is constant, and no new equity is sold.

Method 1: Sustainable growth (g) = (1 - Dividend payout Ratio) \times ROE

$$\text{Or } g = \text{RR} \times \text{ROE}$$

Method 2: $D_n = D_0 (1 + g)^{n-1}$

D_0 = Base year dividend

D_n = Latest (Current year dividend)

$n-1$ = No. Of times D_0 increases to D_n

LOS 11: Calculation of K_e in case of Floating cost is given

Floating Cost are costs associated with the issue of new equity. E.g. Brokerage, Commission, underwriting expenses etc.

❖ If issue cost is given in question, we will take P_0 net of issue cost (Net Proceeds).

❖ If floating Cost is expressed in % i.e. $P_0 (1 - f) = \frac{D_1}{K_e - g_c}$

❖ If floating Cost is expressed in Absolute Amount i.e. $P_0 - f = \frac{D_1}{K_e - g_c}$

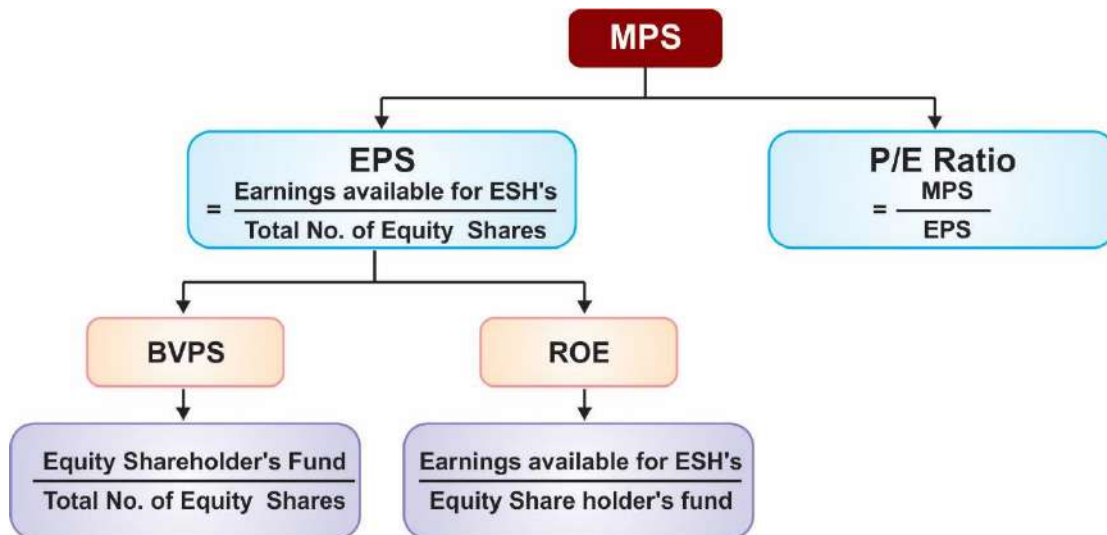
Note:

❖ K_e of new equity will always be greater than K_e of existing equity.

❖ Floatation Cost is only applicable in case of new equity and not on existing equity (or retained earnings).

LOS 12 : Return on Equity (ROE) and Book Value Per Share (BVPS)

$$\text{EPS} = \text{BVPS} \times \text{ROE}$$



Note : Calculate P / E Ratio at which Dividend payout will have no effect on the value of the share.

When $r = K_e$, dividend payout ratio will not affect value of share.

Example:

If $r = 10\%$ then $K_e = 10\%$ and $K_e = \frac{1}{\text{P/ERatio}} \Rightarrow 0.10 = \frac{1}{\text{P/ERatio}}$
 $\Rightarrow \text{P/E Ratio} = 10 \text{ times}$

LOS 13 : Over – Valued & Under – Valued Shares

Cases	Value	Decision
PV Market Price < Actual Market Price	Over – Valued	Sell
PV Market Price > Actual Market Price	Under – Valued	Buy
PV Market Price = Actual Market Price	Correctly Valued	Buy / Sell

LOS 14 : Holding Period Return (HPR)

$$\text{HPR} = \frac{(P_1 - P_0) + D_1}{P_0}$$

$$\text{HPR} = \frac{P_1 - P_0}{P_0}$$

↓

(Capital gain Yield / Return)

$$+$$

$$\frac{D_1}{P_0}$$

↓

(Dividend Yield / Return)

LOS 15 : Multi-stage Dividend discount Model [If $g > K_e$]/ Variable Growth Rate Model

- ❖ Growth model is used under the assumption of $g = \text{constant}$.
- ❖ When more than one growth rate is given, then we will use this concept.

or
If $g > K_e$

- ❖ A firm may temporarily experience a growth rate that exceeds the required rate of return on firm's equity but no firm can maintain this relationship indefinitely.

**Value of a dividend- paying firm that is experiencing temporarily high growth =
PV of dividends expected during high growth period.**

+

PV of the constant growth value of the firm at the end of the high growth period.

$$\text{Value} = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \dots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

$$\text{When } P_n = \frac{D_n(1+g_c)}{K_e - g_c}$$

LOS 16 : IRR Technique & Growth Model

IRR is the discount rate that makes the present values of a project's estimated cash inflows equal to the Present value of the project's estimated cash outflows.

- ❖ At IRR Discount Rate \Rightarrow PV (inflows) = PV (outflows)
- ❖ The IRR is also the discount rate for which NPV of a project is equal to Zero.
- ❖ IRR technique is used when, K_e is missing in the Question.
- ❖ $\text{IRR} = \text{Lower Rate} + \frac{\text{Lower Rate}_{\text{NPV}}}{\text{Lower Rate}_{\text{NPV}} - \text{Higher Rate}_{\text{NPV}}} \times \text{Difference in Rate}$

LOS 17 : Price at the end of each year

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

$$P_1 = \frac{P_2 + D_2}{(1 + K_e)^1}$$

$$P_2 = \frac{P_3 + D_3}{(1 + K_e)^1}$$

$$P_3 = \frac{P_4 + D_4}{(1 + K_e)^1}$$

.

So on

Los 18 : Negative Growth

If Positive Growth, then
$$P_0 = \frac{D_0(1+g)}{K_e - g}$$

If Negative Growth, then
$$P_0 = \frac{D_0(1-g)}{K_e + g}$$

Note: We Know $g = RR \times ROE$

Case I	EPS > DPS	Retention is Positive	$g = \text{Positive}$
Case II	EPS < DPS	Retention is Negative	$g = \text{Negative}$
Case III	EPS = DPS	No Retention	$g = 0$

LOS 19 : Valuation Using the H-Model

The earnings growth of most firms does not abruptly change from a high rate to a low rate as in the two-stage model but tends to decline over time as competitive forces come into play. The H-model approximates the value of a firm assuming that an initially high rate of growth declines linearly over a specified period. The formula for this approximation is:

$$P_0 = \frac{D_0 \times (1 + g_L)}{K_e - g_L} + \frac{D_0 \times H \times (g_S - g_L)}{K_e - g_L}$$

where:

$H = \frac{t}{2}$ = half-life (in years) of high-growth period

t = length of high growth period

g_S = short-term growth rate

g_L = long-term growth rate

r = required return

LOS 20 : Preference Dividend Coverage Ratio & Equity Dividend Coverage Ratio

$$\text{Interest Coverage Ratio} = \frac{\text{Earning Before Interest and Tax}}{\text{Interest}}$$

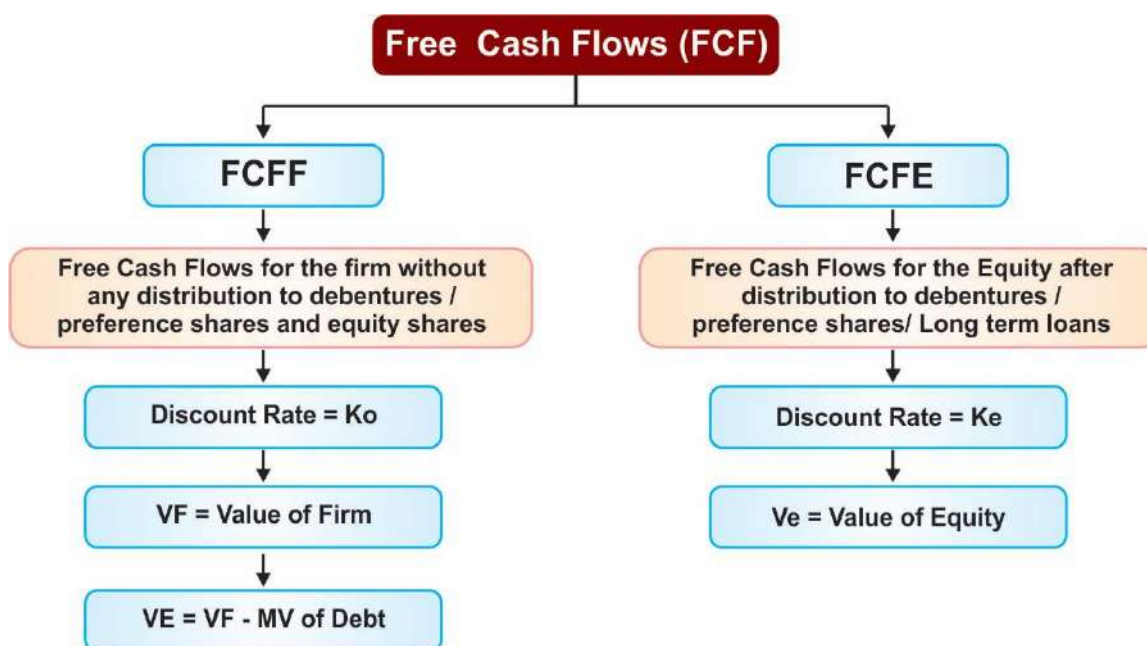
$$\text{Preference Dividend Coverage Ratio} = \frac{\text{Profit After Tax}}{\text{Preference Dividend}}$$

$$\text{Equity Dividend Coverage Ratio} = \frac{\text{Profit After Tax} - \text{Preference Dividend}}{\text{Dividend payable to equity share holders}}$$

Note:

The Higher the Better. These Ratios indicates the surplus profit left after meeting all the fixed obligation.

LOS 21 : Cash Flow Base Models



Calculation of FCFF

EBITDA	XXX
Less : Depreciation & Amortisation (NCC)	XXX
EBIT	XXX
Less : Tax	XXX
NOPAT	XXX
Add : Depreciation (NCC)	XXX
Less : Increase in Working Capital (WCInv)	XXX
Less : Capital Expenditure (FCInv)	XXX
Free Cash Flow For Firm (FCFF)	XXX

a) Based on its Net Income:

$FCFF = \text{Net Income} + \text{Interest expense} \times (1 - \text{tax}) + \text{Depreciation} -/+ \text{Capital Expenditure} -/+ \text{Change in Non-Cash Working Capital}$

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

$FCFF = \text{EBIT} \times (1 - \text{tax rate}) + \text{Depreciation} -/+ \text{Capital Expenditure} -/+ \text{Change in Non-Cash Working Capital}$

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

$FCFF = \text{EBITDA} \times (1 - \text{Tax}) + \text{Depreciation} \times (\text{Tax Rate}) -/+ \text{Capital Expenditure} -/+ \text{Change in Non-Cash Working Capital}$

d) Based on Free Cash Flow to Equity (FCFE):

$FCFF = \text{FCFE} + \text{Interest} \times (1 - t) + \text{Principal Prepaid} - \text{New Debt Issued} + \text{Preferred Dividend}$

e) Based on Cash Flows:

$FCFF = \text{Cash Flow from Operations (CFO)} + \text{Interest} \times (1 - t) -/+ \text{Capital Expenditure}$

Calculation of FCFE**Method 1 : If Debt financing ratio is given:**

EBITDA	XXX
Less : Depreciation & Amortisation	XXX
EBIT	XXX
Less : Interest	XXX
EBT	XXX
Less : Tax	XXX
PAT	XXX
Add : Depreciation × % Equity Invested	XXX
Less: Increase in Working Capital × % Equity Invested	XXX
Less: Capital Expenditure × % Equity Invested	XXX
Free Cash Flow for Equity (FCFE)	XXX

Method 2 : If Debt financing ratio is not given:

EBITDA	XXX
Less : Depreciation & Amortisation	XXX
EBIT	XXX
Less : Interest	XXX
EBT	XXX
Less : Tax	XXX
PAT	XXX
Add : Depreciation (NCC)	XXX
Less: Increase in Working Capital (WCInv)	XXX
Less: Capital Expenditure (FCInv)	XXX
Add : Net Borrowings	XXX
Free Cash Flow for Equity (FCFE)	XXX

a) Calculating FCFE from FCFF

$$FCFE = FCFF - [\text{Interest} (1 - \text{tax rate})] + \text{Net borrowing}$$

b) Calculating FCFE from net income

$$FCFE = NI + NCC - FCInv - WCInv + \text{net borrowing}$$

c) Calculating FCFE from CFO

$$FCFE = CFO - FCInv + \text{net borrowing}$$

LOS 22 : Valuation Based on Multiples**1. P/E Multiple Approach** **MPS = EPS × P/E Ratio**

$$2. \text{ Enterprise Value to Sales} = \frac{EV}{Sales}$$

$$3. \text{ Enterprise Value to EBITDA} = \frac{EV}{EBITDA}$$

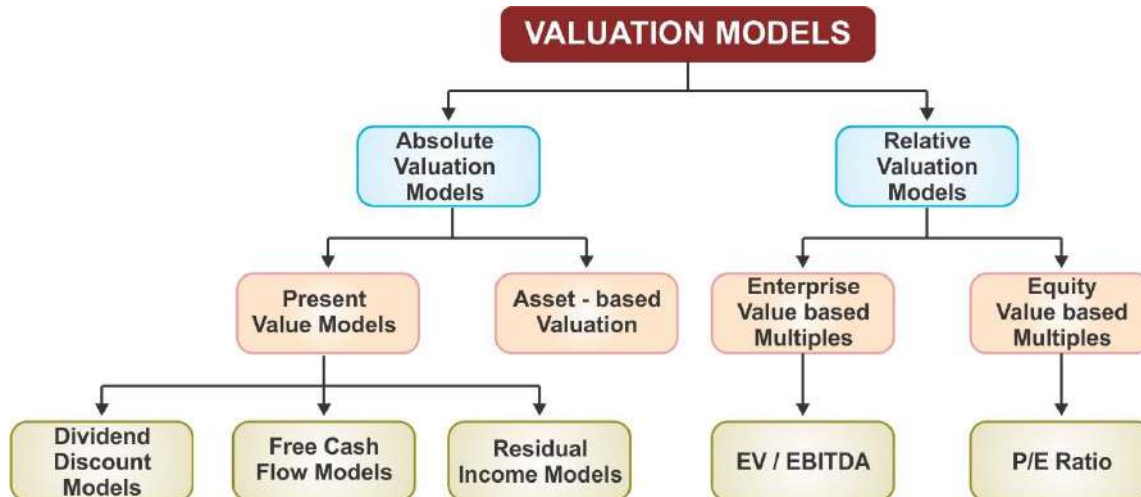
EV = market value of common stock + market value of preferred equity + market value of debt + minority interest – cash & cash equivalents and Equity investments, investment in any co. & also Long term investments.

EBITDA = EBIT + depreciation + amortization

Corporate Valuation

Study Session 3

LOS 1 : Introduction



LOS 2 : Dividend Yield Valuation Method

$$\text{Dividend Yield} = \frac{\text{DPS}}{\text{MPS}}$$

$$\text{MPS} = \frac{\text{DPS}}{\text{Dividend Yield}}$$

Note:

$$\text{DPS} = \frac{\text{Total dividend paid}}{\text{Total number of equity shares}}$$

$$\text{Total Market Value} = \text{MPS} \times \text{Total Number of Equity share}$$

LOS 3 : Earning Yield Valuation Method

$$\text{Earning Yield} = \frac{\text{EPS}}{\text{MPS}}$$

$$\text{MPS} = \frac{\text{EPS}}{\text{Earning Yield}}$$

$$\text{Therefore, EPS} = \frac{\text{Earning available to Equity Share holders}}{\text{Total number of equity shares}}$$

LOS 4 : P/E Ratio Valuation Model

$$P / E \text{ Ratio} = \frac{MPS}{EPS}$$

$$MPS = EPS \times P/E \text{ Ratio}$$

LOS 5 : Value Based on Future Maintainable Profits (FMP's)

$$\text{Value of Business} = \frac{\text{Future Maintainable Profit}}{\text{Relevant Capitalisation Rate}}$$

$$\text{Value of Business} - \text{Market Value of Debt} = \text{Value of Equity}$$

Calculation of Future Maintainable Profits:

Average Past Year Profits before tax	XXX
Add : All Profit likely to arise in Future	XXX
All Actual Expenses & Losses not likely to occur in future	XXX
Less : All Profit not likely to occur in Future	XXX
All Actual Expenses & Losses likely to occur in future	XXX
Future Maintainable Profits (FMP's) before tax	XXX
Less : Tax	XXX
FMP's after tax	XXX

Note:**Treatment of Sunk Cost**

Sunk Cost are those cost which are not relevant for decision making. These cost must be totally ignored. Example: Allocated Fixed Cost, R & D cost already incurred.

LOS 6 : Net Asset Valuation Method (For Equity)

$$\text{NAV per Share} = \frac{\text{Total Assets} - \text{Total External Liability}}{\text{Total number of equity shares}}$$

Note:**1. The following external liabilities should be deducted**

- ❖ All short term (Current Liabilities) and Long Term Liabilities (Debenture, Loans, etc) including outstanding and accrued interest.
- ❖ Provision for Taxation
- ❖ Liabilities not provided for in the accounts i.e. Contingent Liabilities which have crystallized now.
- ❖ Liabilities arising out of prior period adjustment
- ❖ Preference Share Capital including Arrears of dividend and proposed preferred Dividend
- ❖ Proposed Equity Dividend (If the objective is to determine ex-dividend value of equity share).

2. Total assets doesn't include Miscellaneous Expenditure to the extend not yet written-off, fictitious assets, accumulated losses, profit & Loss (Dr.) Balance.
3. **NAV may be calculated by using**
 - a) **Book Value (BV):** The BV of an asset is an accounting concept based on the historical data given in the balance sheet of the firm.
 - b) **Market Value (MV):** The MV of an asset is defined as the price which is prevailing on the market.
 - c) **Liquidating Value (LV):** The LV refers to the net difference between the realizable value of all assets and the sum total of external liabilities. This net difference belongs to the owners/ shareholders and is known as LV.
4. **If question is silent always prefer Market Value weights.**

LOS 7 : Economic Value Added (EVA)

It is excess return over minimum return which is expected by the company on its Capital employed.

$$\text{EVA} = \text{NOPAT} - K_0 \times \text{Average Capital Invested}$$

Calculation of NOPAT:

- ❖ NOPAT means, **Net Operating Profit After Tax** but before any distribution of Interest, Preference Dividend and Equity Dividend.

i.e. $\text{NOPAT} = \text{EBIT} (1 - \text{Tax Rate})$

Note: It excludes non-operating income & expenses/losses like

- ❖ Profit/Loss on Sale of Fixed Assets
- ❖ Interest on non-trade investment
- ❖ Profit/Loss on trading in shares & bonds
- ❖ Interest income from Loans & Advances

Calculation of Cost of Overall Capital:

$K_0 = \text{Cost of Overall Capital} = \text{WACC} = \text{Weighted Average Cost of Capital}$

$$K_e W_e + K_r W_r + K_D W_D + K_P W_P$$

Note:

1. $K_d = \text{Interest} (1 - \text{Tax Rate})$
2. $K_e = R_f + \beta (R_m - R_f)$ Or $K_e = \frac{D_1}{P_0} + g$
3. $K_p = \text{Preference Dividend} (1 + \text{CDT})$
4. Calculation of Average Capital Invested:

$$\frac{\text{Capital at the beginning} + \text{Capital at the End of Year}}{2}$$

5. Calculation of Capital Invested:

	Equity share capital
Add	Preference share capital
	Reserve & Surplus
	Debenture/Bonds
	Long-Term Loan
Less	P/L (Dr. Balance)
	Preliminary Expenses
	Miscellaneous Expenditure

Note: It excludes:

- ❖ Investment in Equity shares & Bonds
- ❖ Loans & Advances
- ❖ Non-Trade Investment

$$6. \text{ Financial Leverage} = \frac{\text{EBIT}}{\text{EBT}} \quad \text{Or} \quad = \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}}$$

$$7. \text{ EBIT} = \text{EBT} + \text{Interest}$$

$$\text{EBIT} = \frac{\text{PAT}}{(1 - \text{tax rate})} + \text{Interest}$$

$$\text{EBIT} = \frac{\text{Earning for equity} + \text{Pref Div}}{(1 - \text{tax rate})} + \text{Interest}$$

8. Note :

- ❖ Operating profits may have to be adjusted using matching concept.
- ❖ There might be some intangible assets such as patents, trademark etc. which is not shown in balance sheet, we need to include that in invested capital.
- ❖ The balance sheet figures of assets & liabilities are at book value. If replacement cost is provided, take invested capital at replacement cost instead of Book Value.

LOS 8 : Value of Business using EVA Method

Valuation of Business using EVA Method (Assume Constant growth after 2 years):

$$\text{MVA} = \frac{\text{EVA}_1}{(1 + K_0)^1} + \frac{\text{EVA}_2}{(1 + K_0)^2} + \frac{\text{EVA}_2 (1+g)}{K_0 - g} \cdot \frac{1}{(1 + K_0)^2}$$

MVA = Value of Business – Total Capital Employed

Value of Business = Total Capital Employed + MVA

LOS 9 : Discounted Cash Flow approach or Free Cash Flow Approach or Value of Business using FCFE & FCFF

Under this approach, we will calculate value of business by discounting the future cash flows.

Steps Involved:

- Step 1:** Calculation of Free Cash Flow of each Year.
- Step 2:** Calculate Terminal Value at the end of forecast period.
- Step 3:** Compute Discount Rate
- Step 4:** Calculate Present Value of Business/ Equity by discounting the Cash Flows & Terminal Value.

Calculation of Terminal Value / Continuing Value / Salvage Value

Terminal Value is calculated at the end of the Project Life or at the end of the forecasted period.

Note:

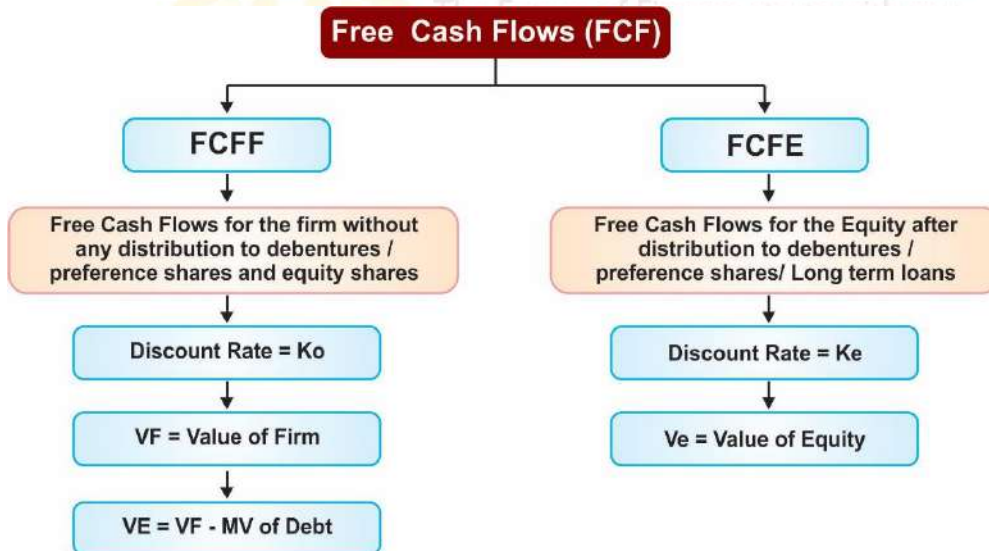
- ❖ **Given in the Question.**
- ❖ **Assumption of Growth Model (Let's assume Growing Cash Flow after 3 Years)**

$$P_0 = \frac{CF_1}{(1+K_0)^1} + \frac{CF_2}{(1+K_0)^2} + \frac{CF_3}{(1+K_0)^3} + \frac{\left[\frac{CF_3 (1+g)}{K_0 - g} \right]}{(1+K_0)^3}$$

- ❖ **Assumption of Constant Model/ Perpetuity Approach (Let's assume Constant Cash Flow after 3 Years)**

$$P_0 = \frac{CF_1}{(1+K_0)^1} + \frac{CF_2}{(1+K_0)^2} + \frac{CF_3}{(1+K_0)^3} + \frac{\left[\frac{CF_3}{K_0} \right]}{(1+K_0)^3}$$

- ❖ Continuing value/ Terminal Value is calculated because it is not easy to estimate realistic cash flows, so we take uniform assumption of Constant Model or Growth Model.



Calculation of FCFF

EBITDA	XXX
Less : Depreciation(NCC)	XXX
EBT	XXX
Less : Tax	XXX
NOPAT	XXX

Add : Depreciation (NCC)	xxx
Less : Increase in Working Capital (WCInv)	xxx
Less : Capital Expenditure (FCInv)	xxx
Free Cash Flow For Firm (FCFF)	xxx

Calculation of FCFE

Method 1 : When Debt-financing ratio is given:

EBITDA	xxx
Less : Depreciation & Amortisation	xxx
EBIT	xxx
Less : Interest	xxx
EBT	xxx
Less : Tax	xxx
PAT	xxx
Add : Depreciation × % Equity Invested	xxx
Less: Increase in Working Capital × % Equity Invested	xxx
Less: Capital Expenditure × % Equity Invested	xxx
Free Cash Flow for Equity (FCFE)	xxx

Calculation of FCFE

Method 2 : When Debt-financing ratio is not given:

EBITDA	xxx
Less : Depreciation & Amortisation	xxx
EBIT	xxx
Less : Interest	xxx
EBT	xxx
Less : Tax	xxx
PAT	xxx
Add : Depreciation (NCC)	xxx
Less: Increase in Working Capital (WCInv)	xxx
Less: Capital Expenditure (FCInv)	xxx
Add : Net Borrowings	xxx
Free Cash Flow for Equity (FCFE)	xxx

LOS 10 : Calculation of Range of Valuation

The range of valuation means we have to calculate minimum & maximum value of business by using more than one method as indicated in question.

LOS 11 : Valuation with NPV decision

$$\text{Revised MPS} = \text{Existing MPS} \pm \frac{\text{Total NPV}}{\text{Total number of Equity Shares}}$$

LOS 12 : Market Value Added (MVA)**From Equity Point of View**

$$\text{MVA} = \left[\begin{array}{l} \text{Value of Equity} - \text{Value of the Equity} \\ \text{as per market} \quad \text{as per Books of A/c's} \end{array} \right] \text{ for equity shareholders}$$

$$= \text{MPS} \times \text{No. of Equity share} - \text{Equity Shareholder's Fund.}$$

Note:

	Equity share capital
Add	Reserve & Surplus
Less	P/L (Dr. Balance)
	Preliminary Expenses
	Miscellaneous Expenditure

From Overall company's Point of View

$$\text{MVA} = \text{Value of the company based on Free Cash Flows} - \text{Total Capital Employed}$$

Note: Total Capital Employed

	Equity share capital
Add	Preference share capital
	Reserve & Surplus
	Debenture/Bonds
	Long-Term Loan
Less	P/L (Dr. Balance)
	Preliminary Expenses
	Miscellaneous Expenditure

Mergers, Acquisition & Corporate Restructuring

LOS 1 : Introduction

Merger & Acquisition

MERGER (A + B = A)
ACQUISITION (Stake Buyout)
AMALGAMATION (A + B = C)

Reasons for Merger & Acquisition

- ❖ Economies of Scale
- ❖ Efficiency Improvement
- ❖ Power of Market Share – Reduced Competition
- ❖ Tax Consideration
- ❖ Combining resources that are complementary.

LOS 2 : Share Exchange Ratio/ Swap Ratio

Swap Ratio may be defined as No. of equity shares issued by Acquiring Company to Target Company for every one share held by Target Company.

Methods of Calculating the Swap Ratio:

1. **On the basis of MPS** $\text{Swap Ratio} = \frac{\text{MPS of Target Company}}{\text{MPS of Acquiring Company}}$
2. **On the basis of EPS** $\text{Swap Ratio} = \frac{\text{EPS of Target Company}}{\text{EPS of Acquiring Company}}$
3. **On the basis of NAV per Share** $\text{Swap Ratio} = \frac{\text{NAV of Target Company}}{\text{NAV of Acquiring Company}}$
4. **On the basis of Book Value per share** $\text{Swap Ratio} = \frac{\text{BVPS of Target Company}}{\text{BVPS of Acquiring Company}}$
5. **On the basis of P/E Ratio** $\text{Swap Ratio} = \frac{\text{P/E Ratio of Target Company}}{\text{P/E Ratio of Acquiring Company}}$

Note:

$$\text{EPS} = \frac{\text{Earning available to Equity Shareholder}}{\text{Total number of equity shares}}$$

$$\text{NAV} = \frac{\text{Total Assets} - \text{Total External Liability}}{\text{Total number of equity shares}}$$

$$\text{P / E Ratio} = \frac{\text{Market Price per Share}}{\text{Earning Price per Share}}$$

Negative SWAP Ratio

$$\text{Swap Ratio} = \frac{\text{Acquiring Co.}}{\text{Target Co.}}$$

$$\text{e.g. Swap Ratio} = \frac{\text{NPA of Acquiring Co.}}{\text{NPA of Target Co.}}$$

LOS 3 : Some Basic Concepts**1. Total Number of Equity Shares after Merger**

$$\text{Number of Shares}_{A+B} = N_A + N_B \times ER$$

2. EPS after Merger or EPS_{A+B} or EPS of a Merged Firm/ Combined Firm

$$\text{EPS}_{A+B} = \left[\frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times ER} \right]$$

3. MPS after Merger or MPS_{A+B} or MPS of a Merged Firm**Alternative 1: If P/E Ratio is given**

$$\text{MPS}_{A+B} = \text{EPS}_{A+B} \times \text{P/E}_{A+B}$$

Alternative 2: If P/E Ratio is not given

$$\text{MPS}_{A+B} = \left[\frac{\text{Total MV after Merger}}{\text{Total No. of Equity Shares after Merger}} \right]$$

Or

$$\text{MPS}_{A+B} = \left[\frac{\text{MV}_A + \text{MV}_B + \text{Synergy Gain}}{N_A + N_B \times ER} \right]$$

Note:

- ❖ Answer by both alternative will be different.
- ❖ Alternative 1 should be preferred whenever any hint regarding P/E after merger is given in question.

4. Market Value of Merged Firm or MV_{A+B}**Alternative 1:**

$$\text{MV}_{A+B} = \text{MPS}_{A+B} \times [N_A + N_B \times ER]$$

Alternative 2:

$$\text{MV}_{A+B} = \text{MV}_A + \text{MV}_B + \text{Synergy}$$

Note:

- ❖ Answer by both alternative will be different.
- ❖ Alternative 1 should be preferred

5. Equivalent EPS of Target Co. in Merged Firm

$$\text{Equivalent EPS of Target Co. in Merged Firm} = \text{EPS}_{A+B} \times \text{ER}$$

6. Equivalent MPS of Target Co. in Merged Firm

$$\text{Equivalent MPS of Target Co. in Merged Firm} = \text{MPS}_{A+B} \times \text{ER}$$

LOS 4 : Gain or Loss

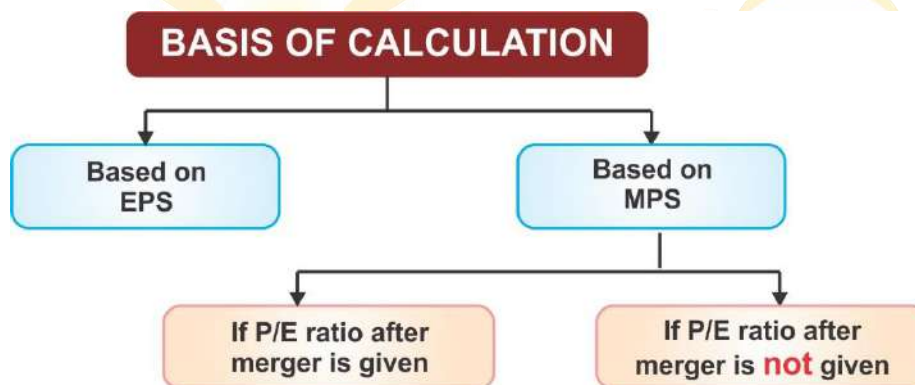
- ❖ Merger may result into Gain/Loss for acquiring company & target Company.
- ❖ On the basis of EPS/MPS/Market Value (MV)

	A Ltd.	B Ltd.
MPS / EPS / MV after Merger	XXX	XXX
MPS / EPS / MV before Merger	XXX	XXX
Gain/ Loss	XXX	XXX

LOS 5 : Maximum Exchange Ratio and Minimum Exchange Ratio

A= Acquiring Company → will try to keep exchange ratio as low as possible. Hence, we calculate maximum ER for acquiring company.

B= Target Company → will try to keep exchange ratio as high as possible. Hence, we calculate minimum ER for Target Company.



Case 1: On the basis of EPS:

a) **Maximum Exchange ratio for A Ltd.**

$$\text{EPS before Merger} = \text{EPS after Merger}$$

$$\text{EPS}_A = \text{EPS}_{A+B}$$

$$\text{EPS}_A = \frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio (ER)}}$$

↓
Solve for ER

b) Minimum Exchange ratio for B Ltd.

EPS before Merger = Equivalent EPS after Merger

$$EPS_B = EPS_{A+B} \times ER$$

$$ESP_B = \left[\frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio}} \right] \times ER$$

Solve for ER

Case 2: On the basis of MPS (If P/E Ratio after merge is given i.e. P/E_(A+B) is given)

a) Maximum Exchange ratio for A Ltd.

MPS before Merger = MPS after Merger

$$MPS_A = MPS_{A+B}$$

$$MPS_A = EPS_{A+B} \times P/E_{(A+B)}$$

$$MPS_A = \left[\frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio}} \right] \times P/E_{(A+B)}$$

Solve for ER

b) Minimum Exchange ratio for B Ltd.

MPS before Merger = Equivalent MPS after Merger

$$MPS_B = MPS_{A+B} \times ER$$

$$MPS_B = [EPS_{A+B} \times P/E_{(A+B)}] \times ER$$

$$MPS_B = \left[\frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio}} \right] \times P/E_{(A+B)} \times ER$$

Solve for ER

Case 3: On the basis of MPS (If P/E Ratio after merge is not given):

a) **Maximum Exchange ratio for A Ltd.**

MPS before merger = MPS after merger

$$MPS_A = MPS_{A+B}$$

$$MPS_A = \frac{MV_A + MV_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio (ER)}}$$

Solve for ER

b) **Minimum Exchange ratio for B Ltd.**

MPS before merger = Equivalent MPS after merger

$$MPS_B = MPS_{A+B} \times ER$$

$$MPS_B = \left[\frac{MV_A + MV_B + \text{Synergy Gain}}{N_A + N_B \times \text{Exchange Ratio (ER)}} \right] \times ER$$

Solve for ER

The Future of Finance starts with you

LOS 6 : Calculation of % of Holding in New Company

$$\text{For A Ltd.} = \frac{\text{Total Number of shares of A Ltd.}}{\text{Total Number of share of A Ltd.} + \text{Total Number of Shares issued to B Ltd.}}$$

$$\text{For B Ltd.} = \frac{\text{Total Number of Shares issued to B Ltd}}{\text{Total Number of share of A Ltd.} + \text{Total Number of Shares issued to B Ltd.}}$$

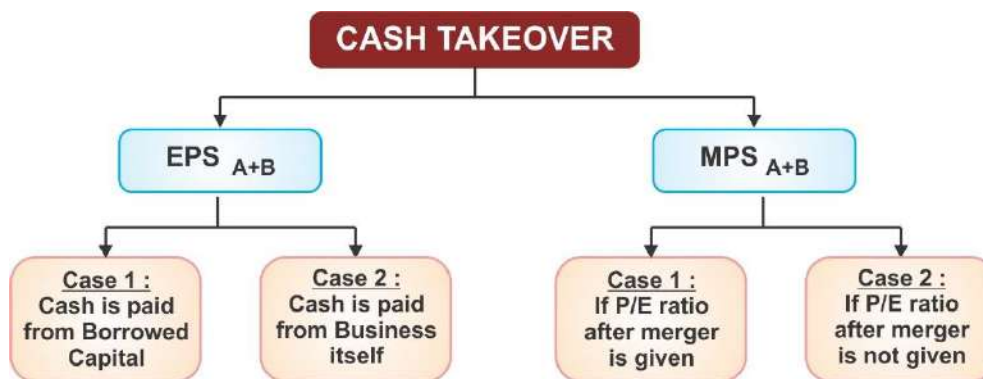
LOS 7 : Free Float Market Capitalization (Value)

- ❖ “Free Float” means shares which are freely available or freely tradable in the market. Shares held by promoters are not freely tradable in the market. These shares are subject to certain restrictions as placed by SEBI.
- ❖ A Firm’s market float is the total value of the shares that are actually available to the investing public and excludes the value of shares held by controlling shareholders because they are unlikely to sell their shares.
- ❖ Sensex and Nifty is based on Free-Float market Capitalization.

Free Float Mkt Capitalization = Free float No. of equity shares x MPS

$$\left(\begin{array}{c} \text{Total No. of Equity Shares} \\ (-) \\ \text{Promoters Holding / Management Holding / Govt.} \\ \text{Holding / Strategic Holding} \end{array} \right) \times \text{MPS}$$

LOS 8 : Calculatio of EPS_{A+B} and MPS_{A+B} in case of CASH TAKEOVER



1. EPS_{A+B} in case of cash take-over & cash is paid out of borrowed money

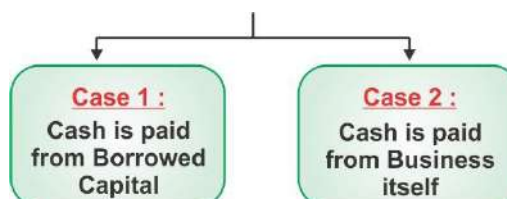
$$\text{EPS}_{A+B} = \left[\frac{E_A + E_B + \text{Synergy Gain} - \text{Interest} (1 - \text{tax})}{N_A} \right]$$

2. EPS_{A+B} in case of cash take-over & money is arranged from Business itself

$$\text{EPS}_{A+B} = \left[\frac{E_A + E_B + \text{Synergy Gain} - \text{Cash Paid} \times \text{Opportunity cost of interest}}{N_A} \right]$$

3. MPS_{A+B} (If P/E ratio after merger is given)

$$= \text{EPS}_{A+B} \times \text{P/E}_{A+B}$$



4. MPS_{A+B} (If P/E ratio after merger is NOT given)

$$\text{MPS}_{A+B} = \left[\frac{MV_A + MV_B + \text{Synergy Gain} - \text{Cash Paid}}{N_A} \right]$$

LOS 9 : Purchase Price Premium

$$\text{Purchase Price Premium} = \frac{\text{Offer Price to target Co.} - \text{MPS of target Co. before Merger}}{\text{MPS of target Co. before Merger}}$$

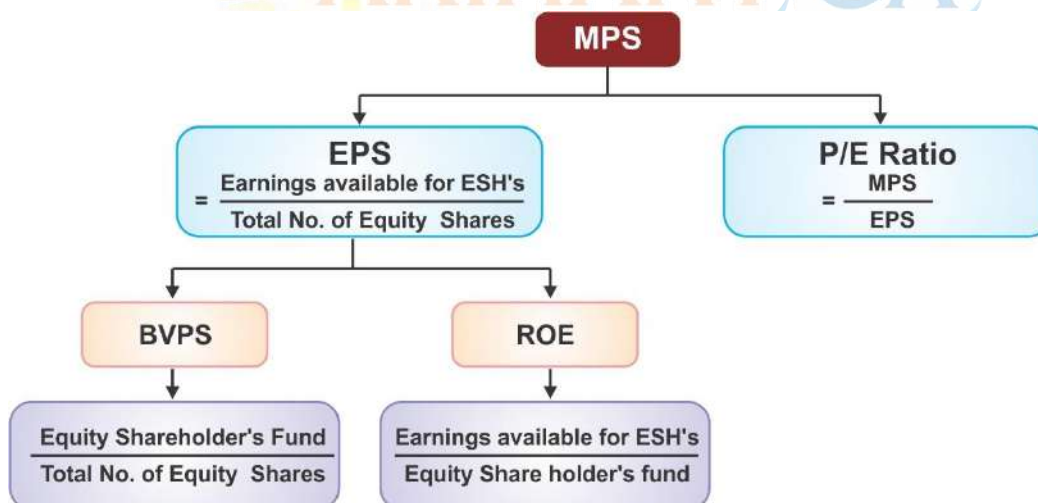
LOS 10 : Purchase Consideration / Cost of Acquisition

❖ PC = Net Payment made by Acquiring Co. to Target Co.

Calculation of PC/ COA	
Market Value of Equity Shares Issued by A Ltd. to B Ltd.	XXX
(+) Debentures, Preference shares Capital Issued by A Ltd. to B Ltd.	XXX
(+) Current Liability paid or Taken over	XXX
(+) Any other expenses incurred	XXX
(-) Cash in hand or Bank	XXX
(-) Sale of any other asset not required in business	XXX
Cost of Acquisition / Purchase Consideration	XXX

Note:

- ❖ Cash and current Liabilities must be taken, even if question is Silent.
- ❖ Sale of any other asset not required should be taken only if clear indication in the Question.

LOS 11 : Components of MPS**LOS 12 : Maximum MPS & Minimum MPS**

$$\text{Minimum MPS offered by A Ltd. To B Ltd.} = \frac{\text{Value of Equity of B Ltd.}}{\text{No. of Equity Shares of B Ltd.}}$$

$$\text{Maximum MPS offered by A Ltd. To B Ltd.} = \frac{\text{Value of Equity of B Ltd.} + \text{Value of Synergy}}{\text{No. of Equity Shares of B Ltd.}}$$

LOS 13 : Calculation of EPS A+B when Synergy Gain is Given in Question**1. EPS_{A+B} when Synergy Gain is Expressed in %**

$$ESP_{A+B} = \left[\frac{(E_A + E_B) (1 + \text{Synergy Gain})}{N_A + N_B \times ER} \right]$$

2. EPS_{A+B} when Synergy Gain is Expressed in Absolute Amount

$$ESP_{A+B} = \left[\frac{E_A + E_B + \text{Synergy Gain}}{N_A + N_B \times ER} \right]$$

Note:

If question is silent regarding Synergy Gain, assume it to be NIL.

Synergy Gain – In terms of Earnings & Market Value

Synergy means extra – benefit/ advantage.

1. Synergy In terms of Earnings

$$\text{Synergy} = E_{A+B} - (E_A + E_B)$$

2. Synergy In terms of Market Value

$$\text{Synergy} = MV_{A+B} - (MV_A + MV_B)$$

LOS 14 : True Cost & True Benefit of Merger

Case 1: When Merger is Financed by Cash	Case 2: When Merger is Financed by Stock
For Acquiring company (A Ltd.)	For Acquiring company (A Ltd.)
Cost to A Ltd. = Cash paid to B Ltd. – $MV_{B \text{ Ltd.}}$ received	Cost to A Ltd. = $MV_{A+B} \times \% \text{ Holding of B Ltd.}$ – $MV_{B \text{ Ltd.}}$ received
Benefit of Merger (Synergy Gain) = $MV_{A+B} - (MV_{A \text{ Ltd.}} + MV_{B \text{ Ltd.}})$	Benefit of Merger (Synergy Gain) = $MV_{A+B} - (MV_{A \text{ Ltd.}} + MV_{B \text{ Ltd.}})$
Net Benefit (NPV) = Benefit – Cost	Net Benefit (NPV) = Benefit – Cost
For Target Company (B Ltd.)	For Target Company (B Ltd.)
Benefit (Net Benefit) = Cash Received – $MV_{B \text{ Ltd.}}$ sacrificed	Benefit (Net Benefit) = $MV_{A+B} \times \% \text{ Holding of B Ltd.}$ – $MV_{B \text{ Ltd.}}$ sacrificed

Note:

Cost of A Ltd. = Benefit for B Ltd.



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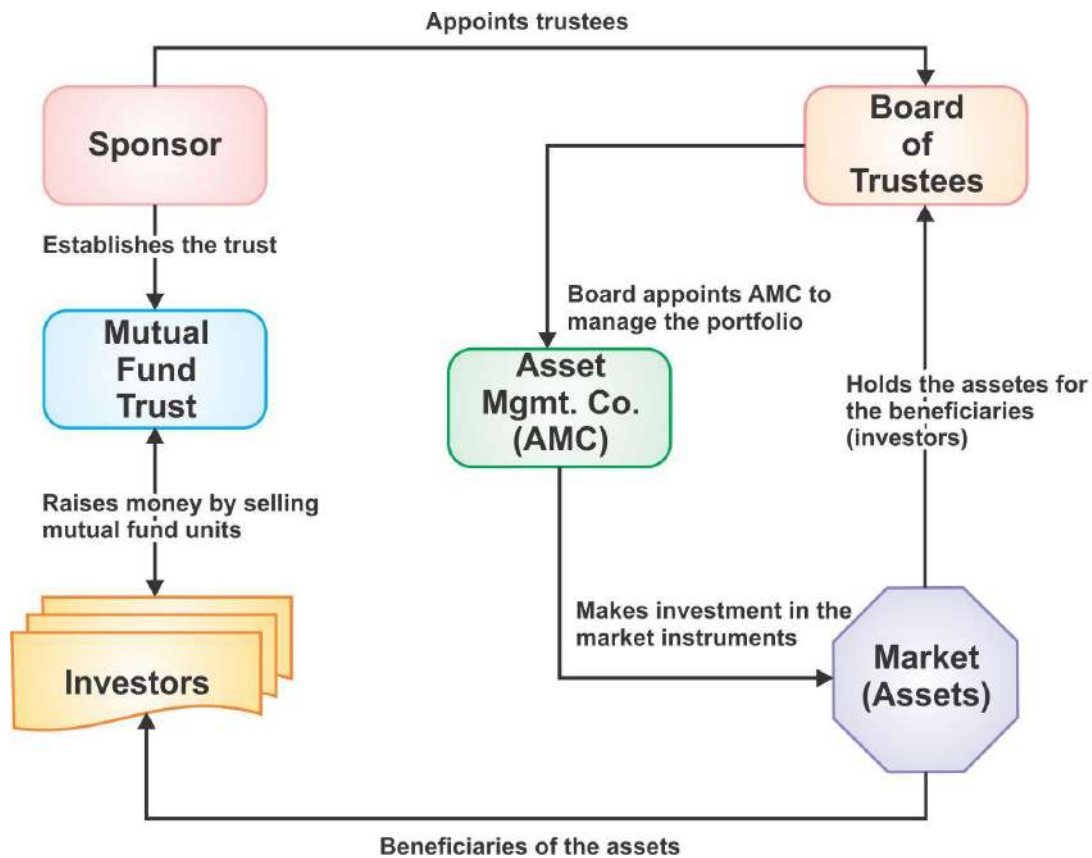
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Mutual Funds

Study Session 5

LOS 1 : Introduction

A mutual fund is a common pool of money into which investors place their contributions that are to be invested in accordance with a stated objective.



A Mutual Fund is the most suitable investment for the cautious investors as it offers an opportunity to invest in a diversified professionally managed basket of securities at a relatively low cost.

Mutual fund is a type of passive investment. If investors directly investment in market is known as **active investment**.

LOS 2 : NAV (Net Asset Value) per unit

As per SEBI Regulation, every mutual fund company should calculate its NAV on a daily basis (excluding holidays)

$$\text{NAV} = \frac{\text{Net Assets of the Scheme}}{\text{No.Of units Outstanding}}$$

$$\begin{aligned} & \text{Net Assets i.e. Total Assets – Total External Liabilities} \\ & = [\text{Market Value of Investments + Receivables + Accrued Income + Other Assets}] \\ & \quad - \\ & \quad [\text{Accrued Expenses + Payables + Other liabilities}] \end{aligned}$$

Note:

- ❖ NAV signifies the realizable value that the investor will get for each unit that one is holding, if the scheme is liquidated on that date.
- ❖ NAV is calculated for each Scheme & not for whole Company.
- ❖ While using NAV, we should always give preference to market value, If market value is not given then use book value.

LOS 3 : Calculation of Return (HPR)**Investors derive three type of Return :-**

- (i) Cash Dividend
- (ii) Capital Gain Disbursements
- (iii) Change in the Fund's NAV per unit (Unrealized Capital Gain) [**Closing NAV – Opening NAV**]

$$\text{Return} = \frac{[\text{Closing NAV} - \text{Opening NAV}] + \text{Dividend received} + \text{Capital Gain Received}}{\text{Opening NAV}} \times 100$$

LOS 4 : Different Plans Under Mutual Fund

1. **Dividend Payout Plan** : Under this plan, Mutual Fund Co. declares & distributes dividend to its unitholders on regular basis.

Impact : NAV will fall & no. of units will remain same.

2. **Bonus Plan** : Free units are distributed to the unitholders like bonus shares.

Impact : NAV will fall & no. of units will increase.

3. **Growth Plan** : Neither dividend is distributed nor are bonus units given. NAV will be increase to the extent of growth.

Impact : NAV will change according to the mkt only & no. of units will remain same.

4. **Dividend Re-investment Plan** : Although dividend is declared but it is not paid. Amount of dividend is again re-invested at the ex-Dividend NAV price prevailing at the time of declaration.

Impact : NAV will fall & no. of units will increase.

LOS 5 : Expense Ratio

$$\text{Expense ratio} = \frac{\text{Expense Incurred per unit}}{\text{Average NAV}}$$

Note:

$$\text{Average NAV} = \frac{\text{Opening NAV} + \text{Closing NAV}}{2}$$

LOS 6: Relationship between Return of Mutual fund, Recurring Expenses, Issue Expenses & Return Desire by Investors (Indifference Point)

$$\begin{aligned} & \text{Required return by investors} \\ & = (\text{Return of Mutual fund} - \text{Recurring Expenses}) (1 - \text{Issue Expenses}) \end{aligned}$$

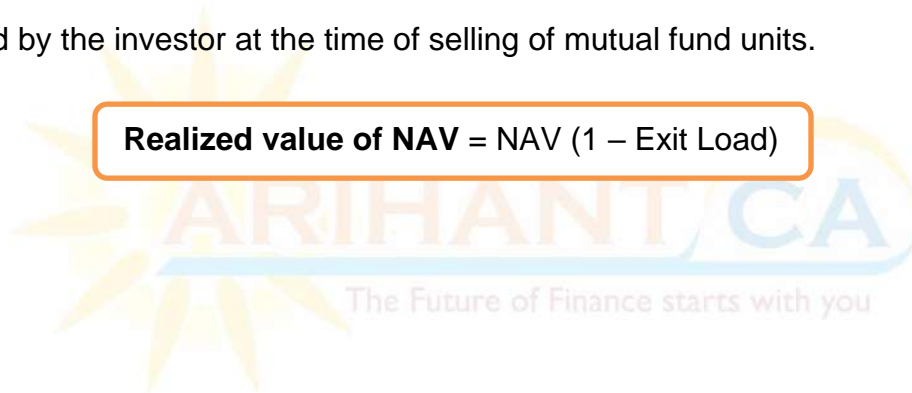
LOS 7: Entry Load & Exit Load

Entry Load is paid by the investor at the time of purchase of Mutual Fund unit.

$$\text{Sale Price of NAV} = \text{NAV} (1 + \text{Entry Load})$$

Exit Load is paid by the investor at the time of selling of mutual fund units.

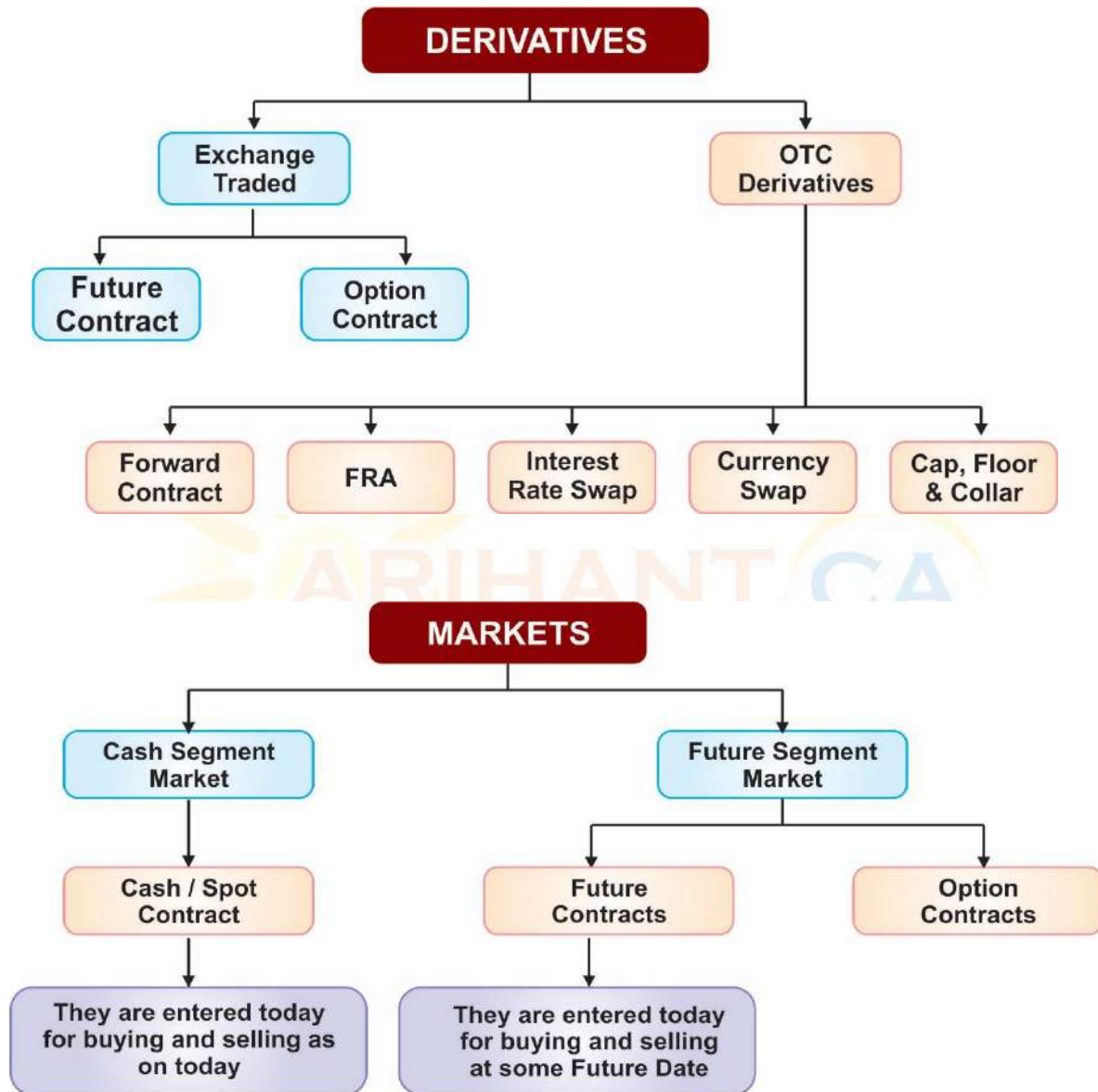
$$\text{Realized value of NAV} = \text{NAV} (1 - \text{Exit Load})$$



Derivatives Analysis & Valuation (Futures)

Study Session 6

LOS 1 : Introduction

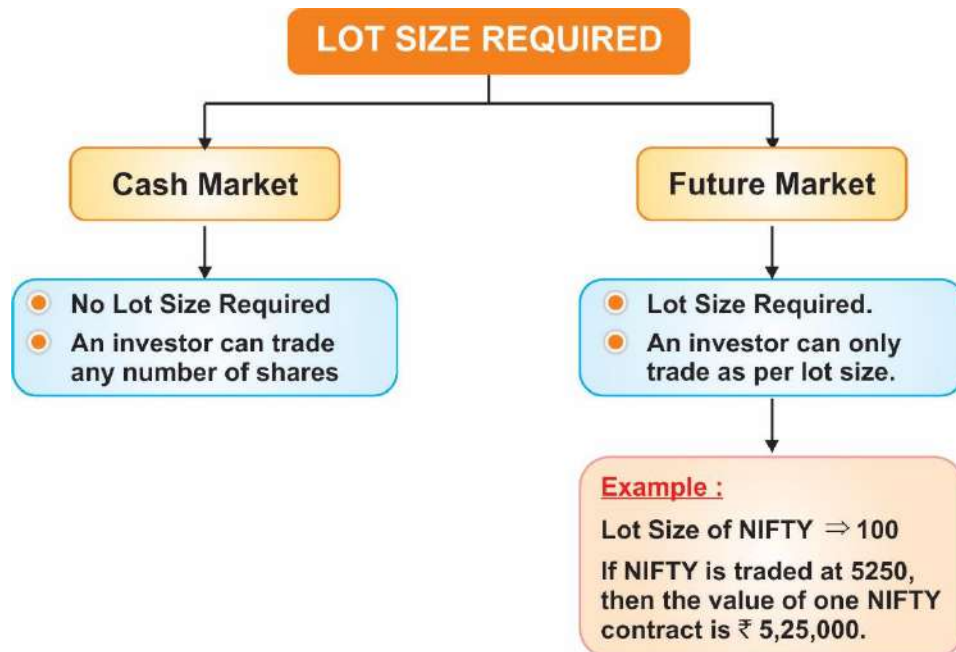
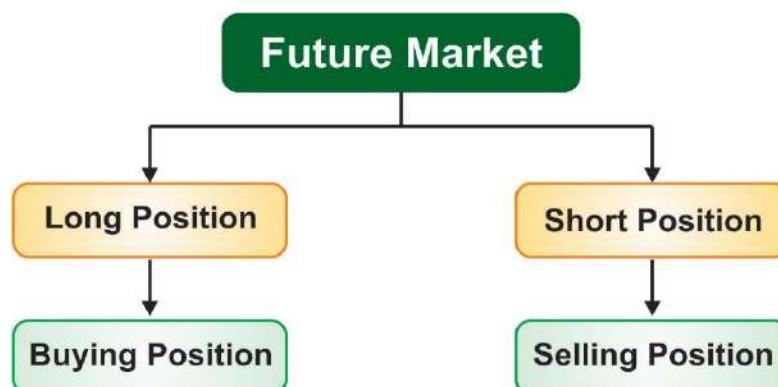
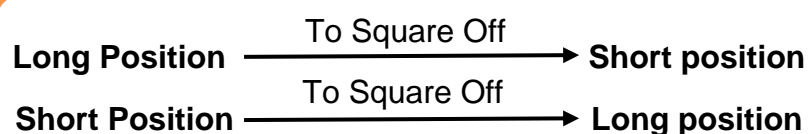


Define Forward Contract, Future Contract.

- ❖ **Forward Contract**, In Forward Contract one party agrees to buy, and the counterparty to sell, a physical asset or a security at a specific price on a specific date in the future. If the future price of the assets increases, the buyer(at the older, lower price) has a gain, and the seller a loss.
- ❖ **Futures Contract** is a standardized and exchange-traded. The main difference with forwards are that futures are traded in an active secondary market, are regulated, backed by the clearing house and require a daily settlement of gains and losses.

Future Contracts differ from Forward Contracts in the following ways:

Future Contracts	Forward Contracts
Organized Exchange	Private Contracts
Highly Standardized ❖ Lot size requirement ❖ Expiry Date ❖ MTM	Customized Contracts
No Counterparty default risk	Counterparty default risk exists
Government Regulated	Usually not Regulated

**LOS 2 : Position to be taken under Future Market**How to settle / square-off / covering / closing out a position to calculate Profit/ Loss

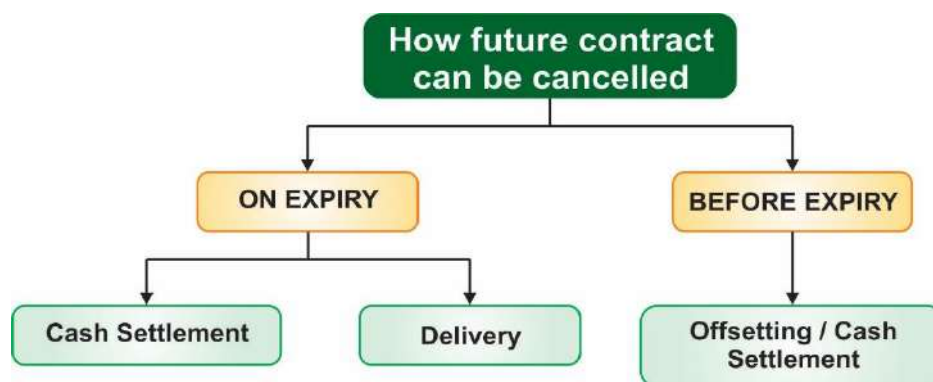
LOS 3 : Gain or Loss under Future Market

Position	If Price on Maturity/ Settlement Price	Gain/ Loss
Long Position	Increase	Gain
	Decrease	Loss
Short Position	Increase	Loss
	Decrease	Gain

Note:

- ❖ Gain/Loss is net of brokerage charge. Brokerage is paid on both buying & selling.
- ❖ Security Deposit is not considered while calculating Profit & Loss A/c.
- ❖ Interest paid on borrowed amount must be deducted while calculating Profit & Loss.
- ❖ A Future contract is ZERO-SUM Game. Profit of one party is the loss of other party.

LOS 4 : How Future Contract can be terminated at or prior to expiration?



- ❖ A short can terminate the contract by delivering the goods, and a long can terminate the Contract by accepting delivery and paying the contract price to the short. This is called **Delivery**. The location for delivery (for physical assets), terms of delivery, and details of exactly what is to be delivered are all specified in the contract.
- ❖ In a **cash-settlement contract**, delivery is not an option. The futures account is marked-to-market based on the settlement price on the last day of trading.
- ❖ You may make a **reverse**, or **offsetting**, trade in the future market. With futures, however, the other side of your position is held by the clearinghouse- if you make an exact opposite trade(maturity, quantity, and good) to your current position, the clearinghouse will net your positions out, leaving you with a zero balance. This is how most futures positions are settled.

LOS 5 : Difference between Margin in the cash market and Margin in the future markets and Explain the role of initial margin, maintenance margin

In **Cash Market**, margin on a stock or bond purchase is 100% of the market value of the asset.

- ❖ Initially, 50% of the stock purchase amount may be borrowed and the remaining amount must be paid in cash (Initial margin).
- ❖ There is interest charged on the borrowed amount.

In **Future Markets**, margin is a performance guarantee i.e. security provided by the client to the exchange. It is money deposited by both the long and the short. There is no loan involved and consequently, no interest charges.

- ❖ The exchange requires traders to post margin and settle their account on a daily basis.

Initial Margin

Money deposited in a futures account before any trading takes place and paid by both Long & Short position

Maintenance Margin

Amount of margin that must be maintained. If the margin balance falls below the MM due to the change in the Contract Price, ***additional fund must be deposited to bring the margin balance back-up to the initial margin requirement.***

Variation Margin

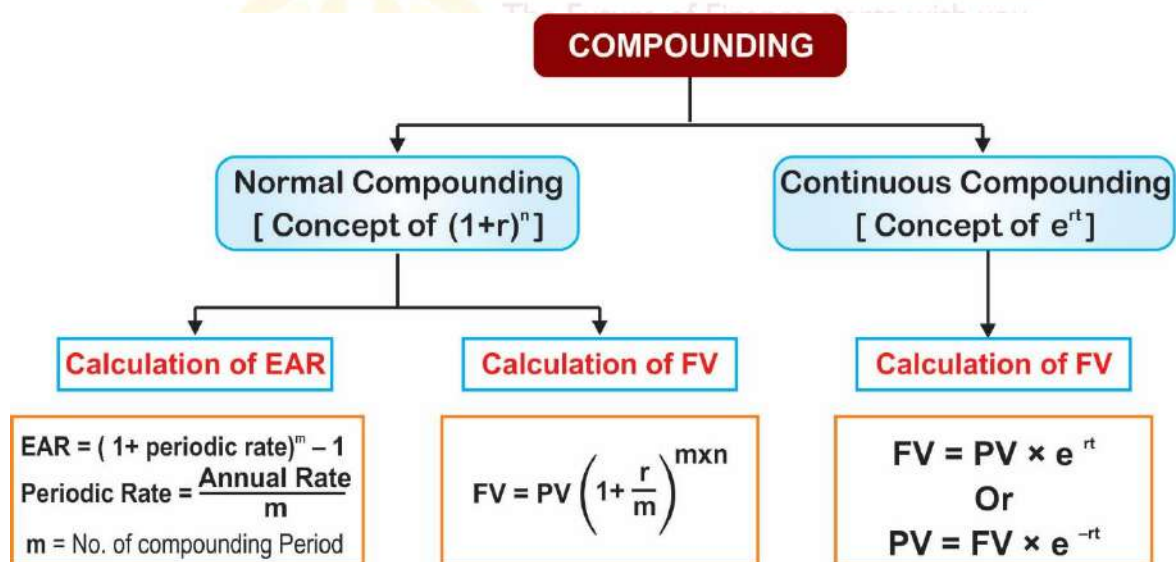
Amount which the trader has to bring when maintenance margin is breached.

Note:

- ❖ Any amount, over & above initial margin amount can be withdrawn.
- ❖ If Initial Margin is not given in the question, then use:

$$\text{Initial Margin} = \text{Daily Absolute Change} + 3 \text{ Standard Deviation}$$

LOS 6 : Concept of Compounding



Concept of e^{rt} & e^{-rt} (Continuous Compounding)

Most of the financial variable such as Stock price, Interest rate, Exchange rate, Commodity price change on a real time basis. Hence, the concept of Continuous compounding comes in picture.

Continuous Compounding means compounding every moment. Instead of $(1 + r)$ we will use e^{rt}

Calculation of a^b

1. \sqrt{a} 12 Times
2. - 1
3. $\times b$
4. + 1
5. $\times =$ 12 Times

Calculation of e^b

1. \sqrt{e} 12 Times
 2. - 1
 3. $\times b$
 4. + 1
 5. $\times =$ 12 Times
- Hint : $e^1 = 2.71828$

Valuation Rules



LOS 7 : Fair future price of security with no income

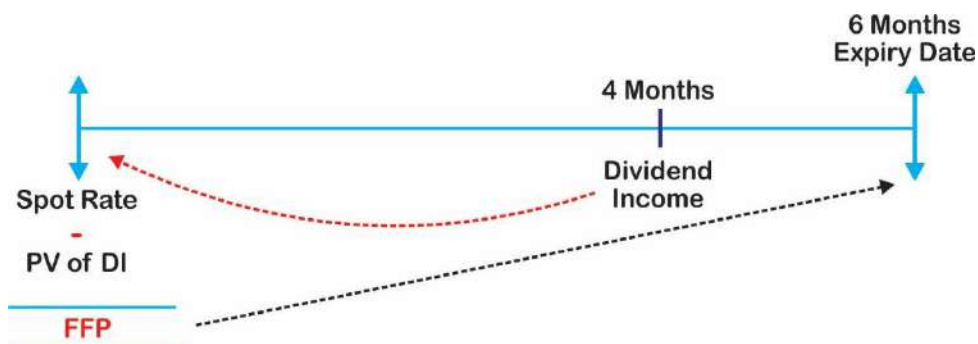
In case of Normal Compounding

Fair future price = Spot Price $(1+r)^n$

In case of Continuous Compounding

Fair future price = Spot Price $\times e^{rt}$

LOS 8 : Fair Future Price of Security with Dividend Income



In case of Normal Compounding

$$\text{Fair Future Price} = [\text{Spot Price} - \text{PV of Expected Dividend}] (1+r)^n$$

In case of Continuous Compounding

$$\text{Fair Future Price} = [\text{Spot Price} - \text{PV of Expected Dividend}] \times e^{rt}$$

LOS 9 : Fair Future Price of security when income is expressed in percentage or when dividend yield is givenIn case of Normal Compounding

$$\text{Fair Future Price} = \text{Spot Price} [1+(r-y)]^n$$

In case of Continuous Compounding

$$\text{Fair Future Price} = \text{Spot Price} \times e^{(r-y) \times t}$$

LOS 10 : Fair Future Price of Commodity with storage costIn case of Normal Compounding

$$\text{Fair Future Price} = [\text{Spot Price} + \text{PV of S.C}] (1+r)^n$$

In case of Continuous Compounding

$$\text{Fair Future Price} = [\text{Spot Price} + \text{PV of S.C}] \times e^{rt}$$

Where PV of S.C = Present Value of Storage Cost

Note: Fair Future Price when Storage Cost is given in percentage(%).

$$\text{FFP} = \text{Spot Price} \times e^{(r+s) \times t}$$

LOS 11 : Fair Future Price of commodities with Convenience yield expressed in % (Similar to Dividend Yield)

The benefit or premium associated with holding an underlying product or physical good rather than contract or derivative product i.e. extra benefit that an investor receives for holding a commodity.

In case of Continuous Compounding

$$\text{Fair Future Price} = \text{Spot Price} \times e^{(r-c) \times t}$$

Note: Fair Future Price when convenience income is expressed in Absolute Amount.

$$\text{Fair Future Price} = [\text{Spot Price} - \text{PV of Convenience Income}] \times e^{rt}$$

LOS 12 : Arbitrage Opportunity between Cash and Future Market

- ❖ Arbitrage is an important concept in valuing (Pricing) derivative securities. In its Purest sense, arbitrage is riskless.
- ❖ Arbitrage opportunities arise when assets are mispriced. Trading by Arbitrageurs will continue until they effect supply and demand enough to bring asset prices to efficient(no arbitrage) levels.
- ❖ Arbitrage is based on “Law of one price”. Two securities or portfolios that have identical cash flows in future, should have the same price. If A and B have the identical future pay offs and A is priced lower than B, buy A and sell B. You have an immediate profit.

Difference between Actual Future Price and Fair Future Price?

Fair Future Price is calculated by using the concept of Present Value & Future Value.
Actual Future Price is actually prevailing in the market.

Case	Value	Future Market	Cash Market	Borrow/ Invest
FFP < AFP	Over-Valued	Sell or Short Position	Buy	Borrow
FFP > AFP	Under-Valued	Buy or Long Position	Sell #	Investment

Here we assume that Arbitrager already hold shares

LOS 13: Complete Hedging by using Index Futures & Beta

Hedging is the process of taking an opposite position in order to reduce loss caused by Price fluctuation.

- ❖ The objective of Hedging is to reduce Loss.
- ❖ Complete Hedging means profit/ Loss will be Zero.

Position to be taken:

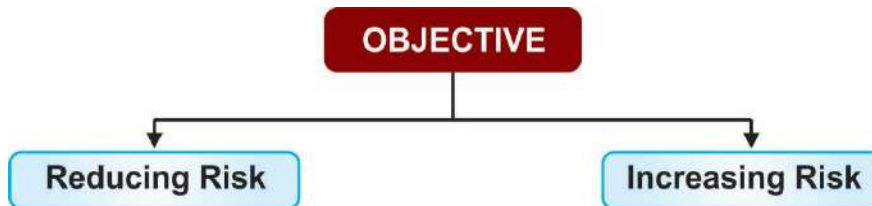
- a) Long Position should be hedged by Short Position.
- b) Short Position should be hedged by Long Position.

Value of Position to be taken:

Value of Position for Complete hedge should be taken on the basis of **Beta** through index futures.

Value of Position for Complete Hedge = Current Value of Portfolio × Existing Stock Beta

LOS 14: Value of Position for Increasing & Reducing Beta to a Target Level



Alternative 1 (Hedging Using Index Future)

Step 1 : Decide Position

Case 1 : To Reduce Risk

Long Position → Short Index Future

Short Position → Long Index Future

Case 2 : To Increase Risk

Long Position → Long Index Future

Short Position → Short Index Future

Step 2 : Value of Position

Case I: When Existing Beta > Target Beta

Objective: Reducing Risk

Value of Index Position = Value of Existing Portfolio × [Existing Beta – Desired Beta]

Action: Take Short Position in Index & keep your current position unchanged.

Case II: When Existing Beta < Target Beta

Objective: Increase Risk

Value of Index Position = Value of Existing Portfolio × [Desired Beta – Existing Beta]

Action: Take Long Position in Index & keep your current position unchanged

Step 3 : No. of future contracts to be sold or purchased for increasing or reducing Beta to a Desired Level using Index Futures.

$$\text{No. of Future Contract to be taken} = \frac{\text{Value of Index Position}}{\text{Value of one Future Contract}}$$

Alternative 2 (Hedging Using Risk free Investment or Borrowing)

Case 1: Reducing Risk

SELL SOME SECURITIES AND REPLACE WITH RISK-FREE INVESTMENT

Step1: Equate the weighted Average Beta formulae to the new desired Beta

$$\text{Target Beta} = \text{Beta}_1 \times W_1 + \text{Beta}_2 \times W_2 \quad (\text{Beta of Risk free investment is Zero})$$

Step2: Use the weights and decide

Case 2: Increasing Risk

BUY SOME SECURITIES AND BORROW AT RISK-FREE RATE

Step1: Equate the weighted Average Beta formulae to the new desired Beta

$$\text{Target Beta} = \text{Beta}_1 \times W_1 + \text{Beta}_2 \times W_2 \quad (\text{Beta of Risk free investment is Zero})$$

Step2: Use the weights and decide

LOS 15 : Partial Hedge

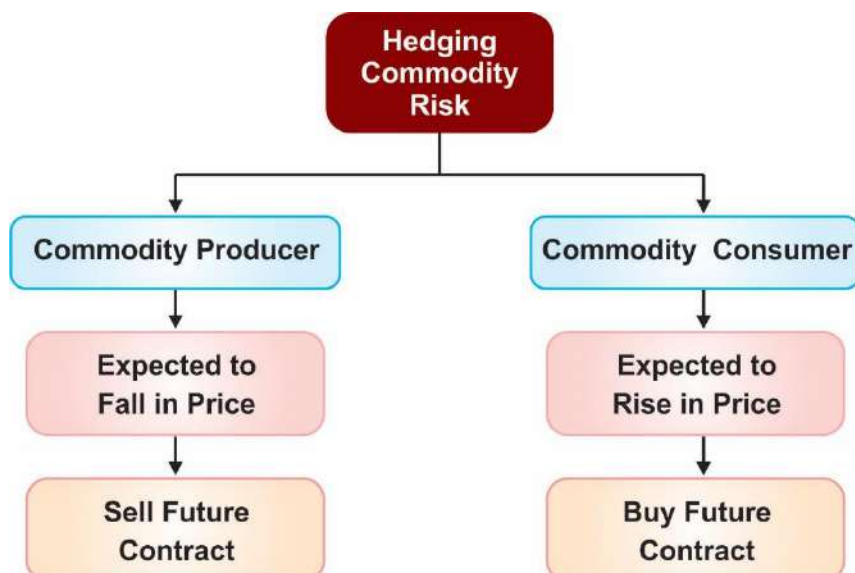
$$\text{Value of position in Index Future} = \text{Value of existing Portfolio} \times \text{Existing beta} \times \text{percentage (\%)} \text{ to be Hedge}$$

- ❖ It result into Over-Hedged or Under-Hedged Position
- ❖ There may be profit or loss depending upon the situation.

LOS 16 : Beta of a Cash and Cash Equivalent

Beta of a cash and Risk free security is Zero.

LOS 17 : Hedging Commodity Risk Through Futures



LOS 18 : Calculation of Rate of Return

	Increase or Decrease in Stock Price ($P_1 - P_0$)
(+)	Dividend Received
(-)	Transaction Cost
(-)	Interest Paid on Borrowed Amount
	Net Amount Received

$$\text{Rate of return} = \frac{\text{Net Amount Received}}{\text{Total Initial Equity Investment}} \times 100$$

LOS 19 : Hedge Ratio

The Optional Hedge Ratio to minimize the variance of Hedger's position is given by:-

$$\text{Hedge Ratio} = \text{Corr. (r)} \frac{\sigma_S}{\sigma_F}$$

σ_S = S.D of ΔS

σ_F = S.D of ΔF

r = Correlation between ΔS and ΔF

ΔS = Change in Spot Price

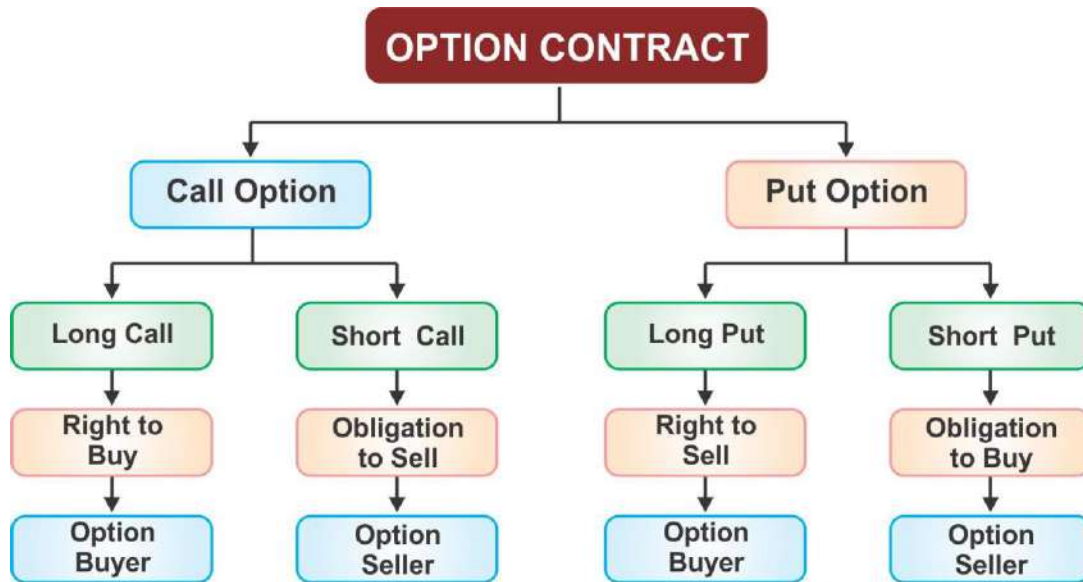
ΔF = Change in Future Price



Derivatives Analysis & Valuation (Options)

Study Session 7

LOS 1 : Introduction



Definition of Option Contract:

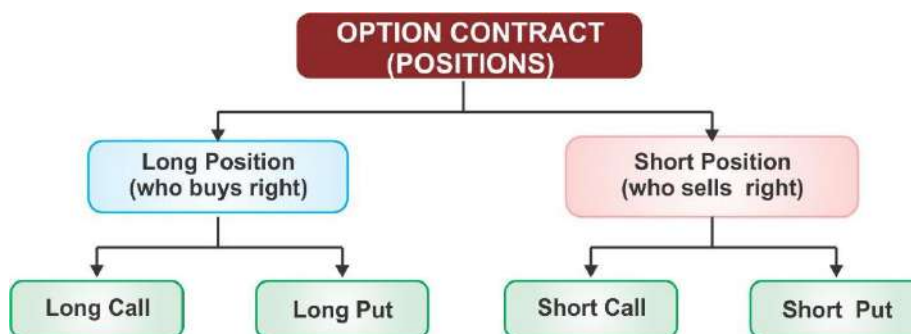
An option contract give its owner the right, but not the legal obligation, to conduct a transaction involving an underlying asset at a pre-determined future date(the exercise date) and at a pre-determined price (the exercise price or strike price)

There are four possible options position

- 1) **Long call** : The buyer of a call option → has the **right to buy** an underlying asset.
- 2) **Short call** : The writer (seller) of a call option → has the **obligation to sell** the underlying asset.
- 3) **Long put** : The buyer of a put option → has the **right to sell** the underlying asset.
- 4) **Short put** : The writer (seller) of a put option → has the **obligation to buy** the underlying asset.

Note:

Meaning of Long position & Short position under Option Contract

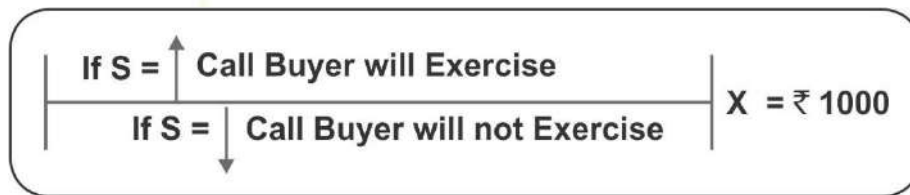


Note:

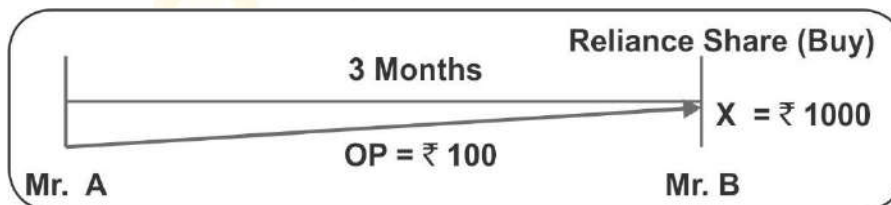
- ❖ If question is silent always assume Long Position.
- ❖ **Exercise Price/ Strike Price:**
The fixed price at which buyer of the option can exercise his option to buy/ sell an underlying asset. It always remain constant throughout the life of contract period.
- ❖ **Option Premium:**
 - ✓ To acquire these rights, owner of options must buy them by paying a price called the Option premium to the seller of the option.
 - ✓ Option Premium is paid by buyer and received by Seller.
 - ✓ Option Premium is non-refundable, non-adjustable deposit.

Note:

- ❖ The option holder will only exercise their right to act if it is profitable to do so.
- ❖ The owner of the Option is the one who decides whether to exercise the Option or not.

LOS 2 : Call Option**When Call Option Contract are exercised:**

- ❖ When $CMP > \text{Strike Price} \rightarrow$ Call Buyer Exercise the Option.
- ❖ When $CMP < \text{Strike Price} \rightarrow$ Call Buyer will not Exercise the Option.



Right to Buy reliance share @ 1000 after 3 months

LONG CALL

OP Paid

Obligation to Sell reliance share @ 1000 after 3 months if buyer approaches to do so.

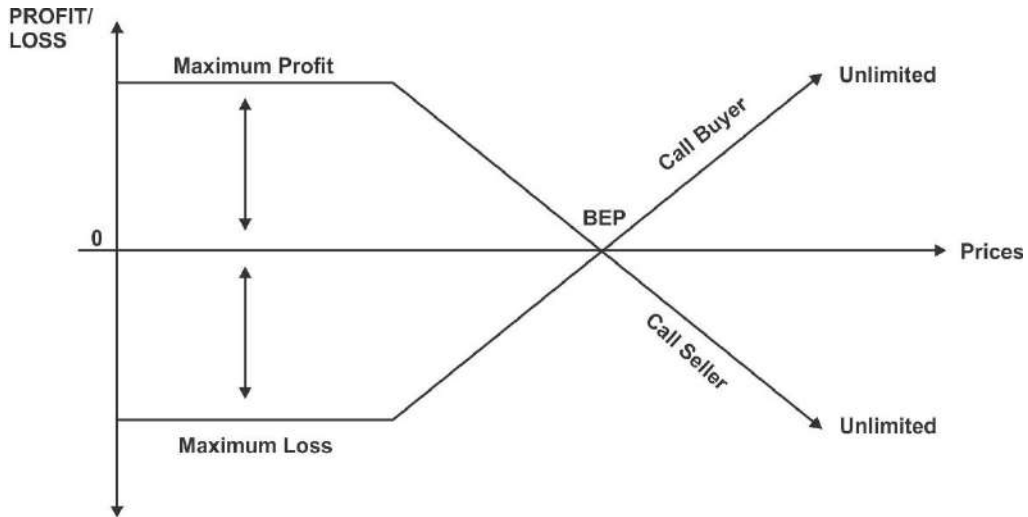
SHORT CALL

OP Received

Note :

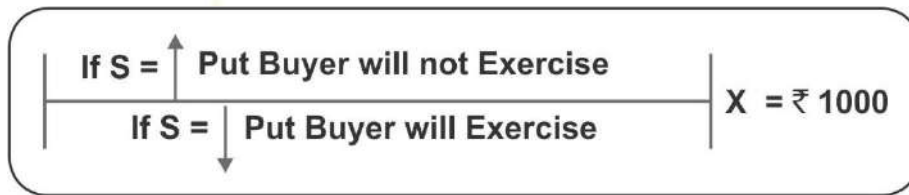
- ❖ The call holder will exercise the option whenever the stock's price exceeds the strike price at the expiration date.
- ❖ The sum of the profits between the Buyer and Seller of the call option is always Zero. Thus, Option trading is ZERO-SUM GAME. The long profits equal to the short losses.
- ❖ Position of a Call Seller will be just opposite of the position of Call Buyer.
- ❖ In this chapter, we first see whether the Buyer of Option opt or not & then accordingly we will calculate Profit & Loss

PAY-OFF DIAGRAM

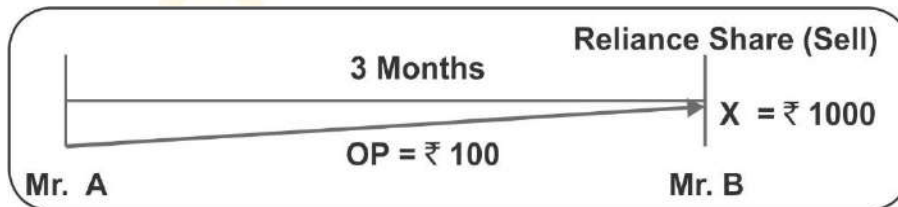


LOS 3 : Put Option

When Put Option Contract are exercised:



- ❖ When $CMP > Strike\ Price \rightarrow$ Put Buyer will not Exercise the Option.
- ❖ When $CMP < Strike\ Price \rightarrow$ Put Buyer will Exercise the Option.

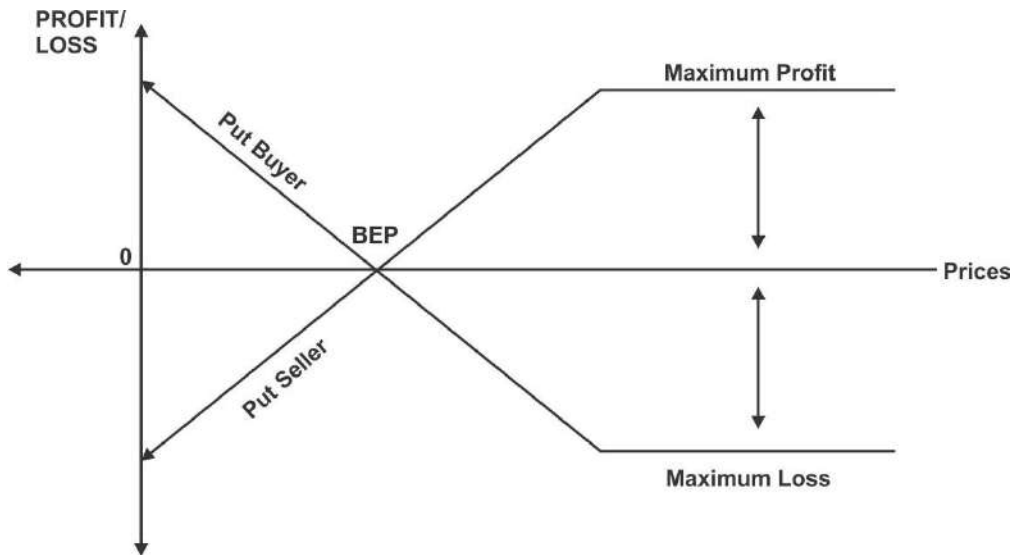


Right to Sell reliance share @ 1000 after 3 months
LONG PUT
OP Paid

Obligation to Buy reliance share @ 1000 after 3 months if buyer approaches to do so.
SHORT PUT
OP Received

Note:

- ❖ Put Buyer will only exercise the option when actual market price is less the exercise price.
- ❖ Profit of Put Buyer = Loss of Put Seller & vice-versa. Trading Put Option is a Zero-Sum Game.

PAY-OFF DIAGRAM**Profit or Loss/ Pay off of call Option & Put Option**

While calculating profit or loss, always consider option Premium,

Call Buyers (Long Call)	
If $S - X > 0$ Exercise the option Net Profit = $S - X - OP$	If $S - X < 0$ Not Exercise Loss = Amount of Premium
Put Buyers (Long Put)	
If $X - S > 0$ Exercise the option Net Profit = $X - S - OP$	If $X - S < 0$ Not Exercise Loss = Amount of Premium

Calculation of **Maximum Loss, Maximum Gain, Breakeven Point** for **Call & Put Option**

Call Option		
	Maximum Loss	Maximum Gain
Buyer (Long)	Option Premium	Unlimited
Seller (Short)	Unlimited	Option Premium
Breakeven	$X + \text{Option Premium}$	

Put Option		
	Maximum Loss	Maximum Gain
Buyer (Long)	Option Premium	$X - \text{Option Premium}$
Seller (Short)	$X - \text{Option Premium}$	Option Premium
Breakeven	$X - \text{Option Premium}$	

LOS 4 : Concept of Moneyness of an Option

Moneyness refers to whether an option is *In-the money or Out- of the money*.

Case I : If immediate exercise of the option would generate *a positive pay-off*, it is in the money

Case II : If immediate exercise would result in loss (*negative pay-off*), it is out of the money.

Case III : When current Asset Price = Exercise Price, exercise will generate *neither gain nor loss* and the option is at the money.

	Call Option		Put Option
Case 1	$S - X > 0$	In-the-Money	$X - S > 0$
Case 2	$S - X < 0$	Out-of- the-Money	$X - S < 0$
Case 3	$S = X$	At-the-Money	$X = S$

Note:

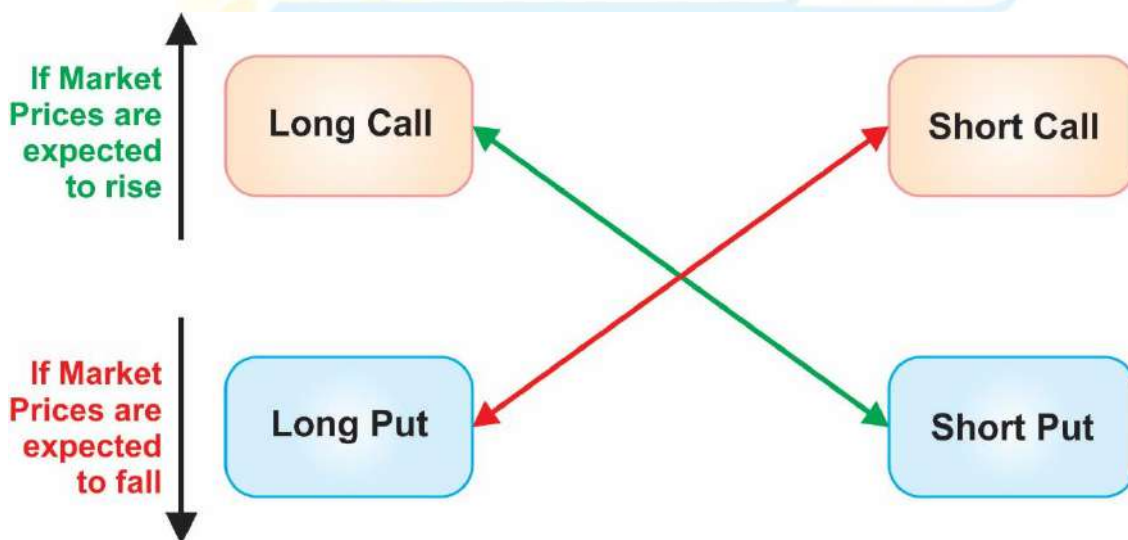
Do not consider option premium while Calculating Moneyness of the Option.

LOS 5 : European & American Options

American Option : American Option may be exercised at any time upto and including the contract’s expiration date.

European Option : European Options can be exercised only on the contract’s expiration date. The name of the Option does not imply where the option trades – they are just names.

LOS 6 : Action to be taken under Option Market



LOS 7 : Intrinsic Value & Time Value of Option

Option value (Premium) can be divided into two parts:-

- (i) Intrinsic Value
- (ii) Time Value of an Option (Extrinsic Value)

Option Premium = Intrinsic Value + Time Value of Option

Intrinsic Value:

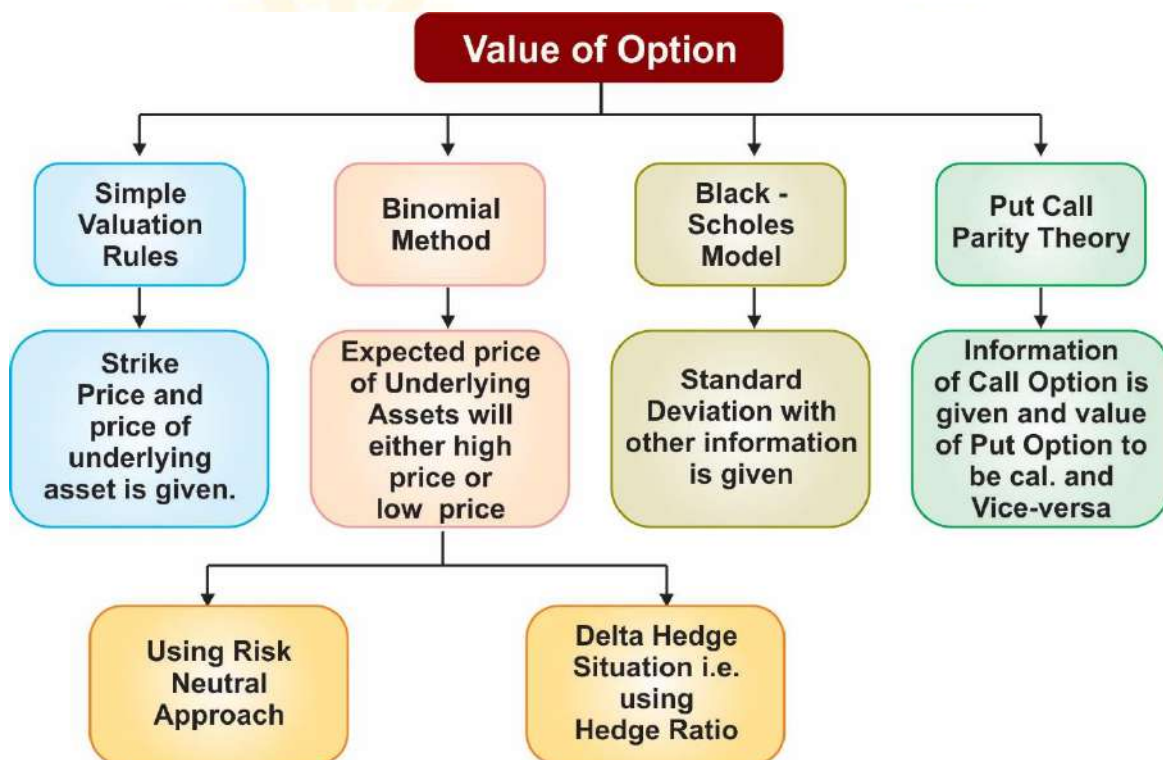
- ❖ An Option's intrinsic Value is the amount by which the option is In-the-money. It is the amount that the option owner would receive if the option were exercised.
- ❖ Intrinsic Value is the minimum amount charged by seller from buyer at the time of selling the right.
- ❖ An Option has ZERO Intrinsic Value if it is At-the-Money or Out-of-the-Money, regardless of whether it is a call or a Put Option.
- ❖ The Intrinsic Value of a Call Option is the greater of $(S - X)$ or 0. That is

$$C = \text{Max } [0, S - X]$$
- ❖ Similarly, the Intrinsic Value of a Put Option is $(X - S)$ or 0. Whichever is greater. That is:

$$P = \text{Max } [0, X - S]$$

Time Value of an Option (Extrinsic Value):

- ❖ The Time Value of an Option is the amount by which the option premium exceeds the intrinsic Value.
- ❖ Time Value of Option = Option Premium – Intrinsic Value
- ❖ When an Option reaches expiration there is no "Time" remaining and the time value is ZERO.
- ❖ The longer the time to expiration, the greater the time value and, other things equal, the greater the option's Premium (price).

Option Valuation**LOS 8 : Fair Option Premium/ Fair Value/ Fair Price of a Call on Expiration**

$$\text{Fair Premium of Call on Expiry} = \text{Maximum of } [(S - X), 0]$$

Note:

Option Premium can never be Negative. It can be Zero or greater than Zero.

LOS 9 : Fair Option Premium/ Fair Value/ Fair Price of a Put on Expiration

$$\text{Fair Premium of Put on Expiry} = \text{Maximum of } [(X - S), 0]$$

LOS 10 : Fair Option Premium/ Theoretical Option Premium/ Price of a Call before Expiry or at the time of entering into contract or As on Today

$$\text{Fair Premium of Call} = \left[S - \frac{X}{(1+\text{RFR})^t}, 0 \right] \text{Max}$$

Or

$$= \left[S - \frac{X}{e^{rt}}, 0 \right] \text{Max}$$

LOS 11 : Fair Option Premium/ Theoretical Option Premium/ Price of a Put before Expiry or at the time of entering into contract or As on Today

$$\text{Fair Premium of Put} = \left[\frac{X}{(1+\text{RFR})^T} - S, 0 \right] \text{Max}$$

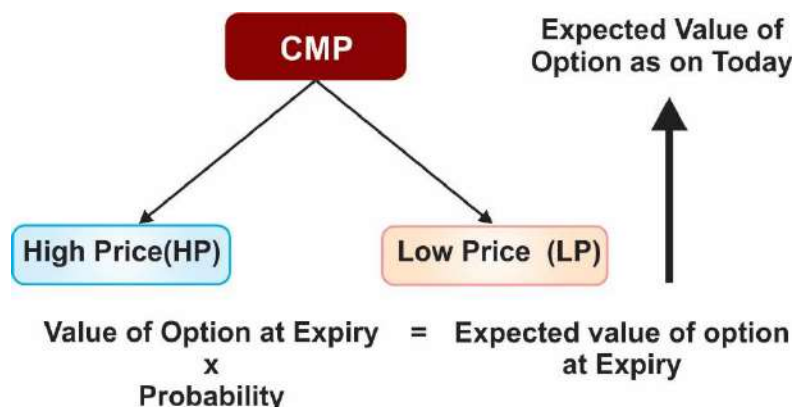
Or

$$= \left[\frac{X}{e^{rt}} - S, 0 \right] \text{Max}$$

LOS 12 : Expected Value of an Option on expiry

Under this approach, we will calculate the amount of Option premium on the basis of Probability.

$$\text{Expected value of an option at Expiry} = \sum \text{Value of Option at expiry} \times \text{Probability}$$

LOS 13 : Risk Neutral Approach for Call & Put Option(Binomial Model)

- ❖ Under this approach, we will calculate Fair Option Premium of Call & Put as on Today.
- ❖ The basic assumption of this model is that share price on expiry may be higher or may be lower than current price.

Step 1: Calculate Value of Call or Put as on expiry at high price & low price

Value of Call as on expiry = $\text{Max} [(S - X), 0]$

Value of Put as on expiry = $\text{Max} [(X - S), 0]$

Step 2: Calculate Probability of High Price & Low Price

$$\text{Probability of High Price} = \frac{\text{CMP} (1+r)^n - LP}{HP - LP} \quad \text{or} \quad \text{Probability of High Price} = \frac{\text{CMP} (e^{rt}) - LP}{HP - LP}$$

Step 3: Calculate expected Value/ Premium as on expiry by using Probability

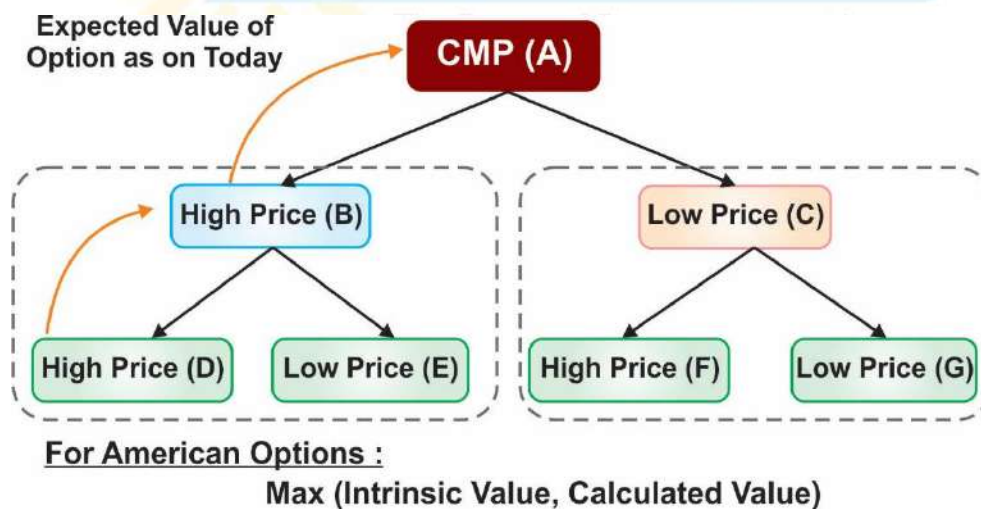
Step 4: Calculate Premium as on Today

$$\text{By Using normal Compounding} = \frac{\text{Expected Premium as on expiry}}{(1+r)^t}$$

$$\text{By Using Continuous Compounding} = \frac{\text{Expected Premium as on expiry}}{e^{rt}}$$

LOS 14 : Two Period Binomial Model

We divide the option period into two equal parts and we are provided with binomial projections for each path. We then calculate value of the option on maturity. We then apply backward induction technique to compute the value of option at each nodes.



LOS 15 : Arbitrage Opportunity in Option Contract

❖ When Arbitrage is possible under Option Contract?

Fair Option Premium \neq Actual Option Premium

❖ Arbitrage Opportunity on Call → Before Expiry

FOP = Fair Option Premium

AOP = Actual Option Premium

Case 1	Value	Option Market	Cash Market	Invest
FOP > AOP	Under-Valued	Long Call	Sell #	Net Amount

Assume investor is already holding the required shares.

Case 2	Value	Option Market	Cash Market	Borrow
FOP < AOP	Over-Valued	Short Call	Buy	Net Amount

* Arbitrage is not possible → Because there is an opportunity of Huge Loss

Arbitrage Opportunity on Put → Before Expiry

Case 1	Value	Option Market	Cash Market	Borrow
FP > AP	Under-Valued	Long Put	Buy	Net Amount

Case 2	Value	Option Market	Cash Market	Invest
FP < AP	Over-Valued	Short Put	Sell	Net Amount

* Arbitrage is not possible → Because there is an opportunity of Huge Loss

LOS 16 : Put Call Parity Theory (PCPT)

Put Call Parity is based on Pay-offs of two portfolio combination, a fiduciary call and a protective put.

Fiduciary Call

A Fiduciary Call is a combination of a pure-discount, riskless bond that pays X at maturity and a Call.

Protective Put

A Protective Put is a share of stock together with a put option on the stock.

$$PCPT \rightarrow \text{Value of Call} + \frac{X}{(1+RFR)^T} = \text{Value of Put} + S$$

Protective Put				
If on Maturity S > X			If on Maturity S < X	
Put option is lapse i.e. pay off	=	NIL	Put option is exercise i.e. pay off	= X - S
Stock is sold in the Market	=	S	Stock is sold in the Market	= S
		S		X
Fiduciary Call				
If on Maturity S > X			If on Maturity S < X	
Call option is exercise i.e. pay off	=	S - X	Call option is lapse i.e. pay off	= NIL
Bond is sold in the Market	=	X	Bond is sold in the Market	= X
		S		X

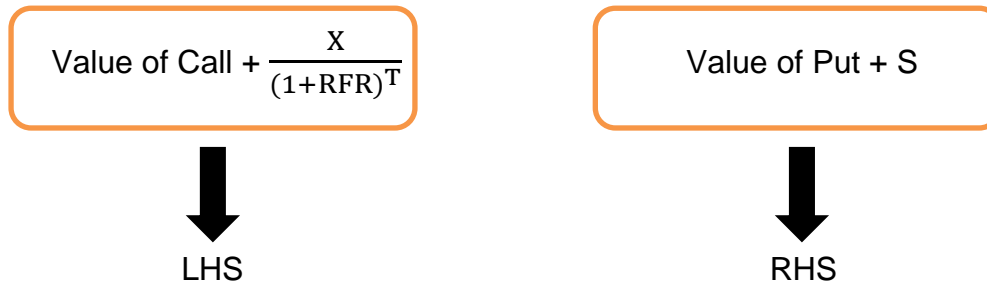
Through this theory, we can calculate either Value of Call or Value of Put provided other Three information is given.

Assumptions:

- ❖ Exercise Price of both Call & Put Option are same.
- ❖ Maturity Period of both Call & Put are Same.

LOS 17 : Put - Call Parity Theory → ARBITRAGE

As per PCPT,



Case I : If LHS = RHS, arbitrage is not possible.

Case II : If LHS ≠ RHS, arbitrage is possible.

A. If LHS > RHS, Call is Over-Valued & Put is Under-Valued

Option Market		Cash Market	Net Amount
Short Call i.e. Obligation to sell & Option Premium Received	Long Put i.e. Right to sell & Option Premium Paid	Buy i.e. Buy one share	Borrow S + P - C

B. If LHS < RHS, Call is Under-Valued & Put is Over-Valued

Option Market		Cash Market	Net Amount
Long Call i.e. Right to Buy & Option Premium Paid	Short Put i.e. Obligation to buy & Option Premium Received	Sell i.e. Sell one share	Invest S + P - C

LOS 18 : Option Strategies

Combination of Call & Put is known as OPTION STRATEGIES.

Types of Option Strategies:

Some important Option Strategies are as follows:

1. Straddle Position
2. Strangle Strategy
3. Strip Strategy
4. Strap Strategy
5. Butterfly Spread

1. Straddle Position :

Straddle may be of 2 types :

Long Straddle	Short Straddle
Buy a Call and Buy a Put on the same stock with both the options having the same exercise price.	Sell a Call and Sell a Put with same exercise price and same exercise date.
Option: Buy One Call and Buy One Put Exercise Date: Same of Both Strike Price / Exercise Price: Same of Both	Option: Sell One Call and Sell One Put Exercise Date: Same of Both Strike Price / Exercise Price: Same of Both
Note: A Long Straddle investor pays premium on both Call & Put.	Note: A Short Straddle investor receive premium on both Call and Put.

Note:

- ❖ When an investor is not sure whether the price will go up or go down, then in such case we should create a straddle position.
- ❖ If Question is Silent, always assume Long Straddle.

2. Strangle Strategy :

- ❖ An option strategy, where the investor holds a position in both a call and a put with **different strike** prices but with the same maturity and underlying asset is called Strangles Strategy.
- ❖ Selling a call option and a put option is called seller of strangle (i.e. Short Strangle).
- ❖ Buying a call and a put is called Buyer of Strangle (i.e. Long Strangle).
- ❖ If there is a **large price movement** in the near future but unsure of which way the price movement will be, this is a Good Strategy.

3. Strip Strategy (Bear Strategy)	4. Strap Strategy (Bull Strategy)
❖ Buy Two Put and Buy One Call Option of the same stock at the same exercise price and for the same period.	❖ Buy Two Calls and Buy One Put when the buyer feels that the stock is more likely to rise Steeply than to fall.
❖ Strip Position is applicable when decrease in price is more likely than increase.	❖ Strap Position is applicable when increase in price is more likely than decrease.
Option: Buy Two Put and Buy One Call Exercise Date: Same of Both Strike Price/ Exercise Price: Same of Both	Option: Buy Two Calls and Buy One Put Exercise Date: Same of Both Strike Price/ Exercise Price: Same of Both

5. Butterfly Spread :

In Butterfly spread position, an investor will undertake 4 call option with respect to 3 different strike price or exercise price.

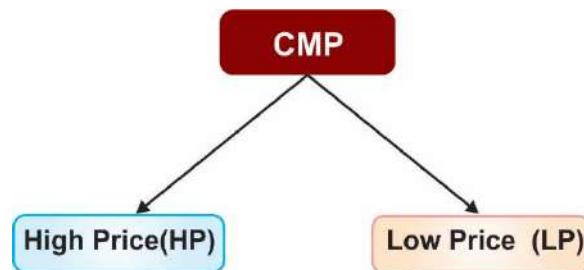
It can be constructed in following manner:

- ❖ Buy One Call Option at High exercise Price (S1)
- ❖ Buy One Call Option at Low exercise Price (S2)
- ❖ Sell two Call Option $\left(\frac{S_1 + S_2}{2}\right)$

LOS 19 : Binomial Model (Delta Hedging / Perfectly Hedged technique) for Call Writer

Under this concept, we will calculate option premium for call option.

It is assumed that expected price on expiry may be greater than Current Market Price or less than Current Market Price.



Steps involved:

Step 1: Compute the Option Value on Expiry Date at high price and at low price

$$\text{Value of Call as on expiry} = \text{Max} [(S - X), 0]$$

Step 2: Buy 'Delta' No. of shares 'Δ' at Current Market Price as on Today. Delta 'Δ' also known as Hedge Ratio.

$$\text{Hedge Ratio or '}\Delta\text{'} = \frac{\text{Change in Option Premium}}{\text{Change in Price of Underlying Asset}}$$

OR

$$= \frac{\text{Value of call on expiry at High Price} - \text{Value of call on expiry at Low Price}}{\text{High Price} - \text{Low Price}}$$

Step 3: Construct a Delta Hedge Portfolio i.e. Risk-less portfolio / Perfectly Hedge Portfolio

Sell one call option i.e. Short Call, Buy Delta no. of shares and borrow net amount.

Step 4: Borrow the net Amount required for the above steps

$$B = \frac{1}{1+r} [\Delta \times \text{HP} - V_C]$$

Or

$$B = \frac{1}{1+r} [\Delta \times \text{LP} - V_C]$$

Where r = rate of interest adjusted for period

Step 5: Calculate Value of call as on today

Borrowed Amount = Amount required to purchase of share – Option Premium Received

$$B = \Delta \times \text{CMP} - \text{OP}$$

Or

(Option Premium = $\Delta \times \text{CMP} - \text{Borrowed Amount}$)

Note: Calculation of Cash flow Position/ Value of holding after 1 year

❖ **If on Maturity Actual Market Price is HP**

$$\text{Cash Flow} = \Delta \times \text{HP} - V_c$$

❖ **If on Maturity Actual Market Price is S₂**

$$\text{Cash Flow} = \Delta \times \text{LP} - V_c$$

Cash Flow at HP and LP will always be same.

Meaning of perfectly hedge position under binomial model

Perfectly hedge position means Profit or Loss will be Zero or NIL. It can be achieved by buying Δ shares, sell one call option and borrowing the required amount.

Delta is the number of shares which makes the portfolio perfectly hedged i.e. whether the stock price on maturity goes up or decline, the value of portfolio doesn't vary i.e. our profit and loss position will be Zero.

LOS 20 : Black & Scholes Model

Assumptions of BSM Model :

- ❖ The price of underlying asset follows a log normal distribution
- ❖ Markets are frictionless. There is no taxes, no transaction cost, no restriction on short sale.
- ❖ The option valued are European options.
- ❖ Risk Free continuous compounding interest rate is known and constant.
- ❖ Annualized volatility of the stock is known and constant.
- ❖ The underlying asset has no cash flow as dividend, coupons etc.

For Call:

$$\text{Value of a Call Option/ Premium on Call} = S \times N(d_1) - \frac{X}{e^{rt}} \times N(d_2)$$

Calculation of d₁ and d₂

$$d_1 = \frac{\ln\left[\frac{S}{X}\right] + [r + 0.50\sigma^2] \times t}{\sigma \times \sqrt{t}}$$

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

Or

$$d_2 = \frac{\ln\left[\frac{S}{X}\right] + [r - 0.50\sigma^2] \times t}{\sigma \times \sqrt{t}}$$

For Put:

$$\text{Value of a Put Option/ Premium on Put} = \frac{X}{e^{rt}} \times [1 - N(d_2)] - S \times [1 - N(d_1)]$$

LOS 21 : BSM → when dividend amount is given in the question

Adjust Spot Price (S) or CMP as [Spot Price – PV of Dividend Income]

$$\text{Value of a Call Option} = [S - \text{PV of Dividend Income}] \times N(d_1) - \frac{X}{e^{rt}} \times N(d_2)$$

$$d_1 = \frac{\ln\left[\frac{S - \text{PV of Dividend Income}}{X}\right] + [r + 0.50\sigma^2] \times t}{\sigma \times \sqrt{t}}$$

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

LOS 22 : Put-Call Ratio

$$\text{Put- Call Ratio} = \frac{\text{Volume of Put Traded}}{\text{Volume of Call Traded}}$$

The ratio of the volume of put options traded to the volume of Call options traded, which is used as an indicator of investor's sentiment (bullish or bearish)

The put-call Ratio to determine the market sentiments, with high ratio indicating a bearish sentiment and a low ratio indicating a bullish sentiment.

LOS 23 : Option Greek Parameters

Option price depends on 5 factors:

Option Price = f [S, X, t, r, σ], out of these factors X is constant and other causing a change in the price of option.

We will find out a rate of change of option price with respect to each factor at a time, keeping others constant.

1. **Delta:** It is the degree to which an option price will move given a small change in the underlying stock price. For example, an option with a delta of 0.5 will move half a rupee for every full rupee movement in the underlying stock.

The delta is often called the hedge ratio i.e. if you have a portfolio short 'n' options (e.g. you have written n calls) then n multiplied by the delta gives you the number of shares (i.e. units of the underlying) you would need to create a riskless position - i.e. a portfolio which would be worth the same whether the stock price rose by a very small amount or fell by a very small amount.

2. **Gamma:** It measures how fast the delta changes for small changes in the underlying stock price i.e. the delta of the delta. If you are hedging a portfolio using the delta-hedge technique described under "Delta", then you will want to keep gamma as small as possible, the smaller it is the less often you will have to adjust the hedge to maintain a delta neutral position. If gamma is too large, a small change in stock price could wreck your hedge. Adjusting gamma, however, can be tricky and is generally done using options.
3. **Vega:** Sensitivity of option value to change in volatility. Vega indicates an absolute change in option value for a one percentage change in volatility.
4. **Rho:** The change in option price given a one percentage point change in the risk-free interest rate. It is sensitivity of option value to change in interest rate. Rho indicates the absolute change in option value for a one percent change in the interest rate.
5. **Theta:** It is a rate change of option value with respect to the passage of time, other things remaining constant. It is generally negative.

Foreign Exchange Exposure & Risk Management

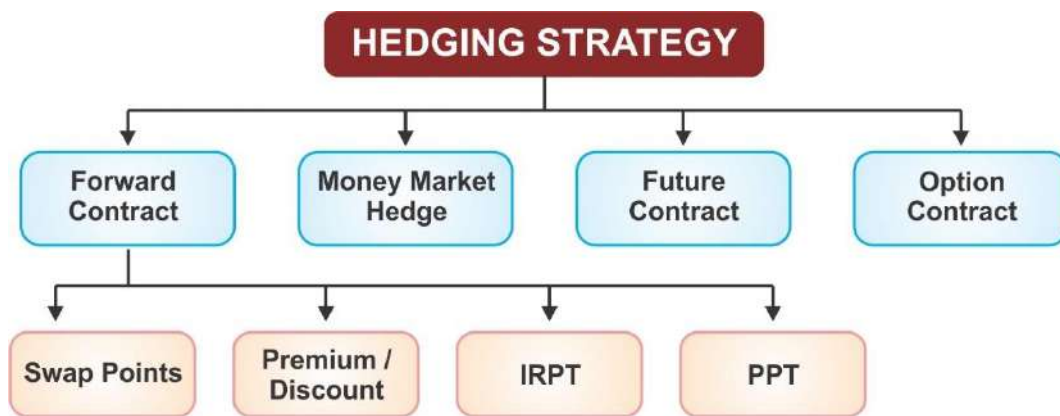
Study Session 8

LOS 1 : Introduction

Three types of transactions associated with foreign exchange risk:

1. Loans(ECB)
2. Investments (Bonds & Equity)
3. Export & Import

Foreign Exchange Risk



Foreign Exchange Market (3 Tier Market)



Note :

In India, Foreign Exchange Market is regulated by RBI.

What is Exchange Rate?

- ❖ The rate of conversion is the Exchange Rate.
- ❖ An exchange rate is the price of one country's currency expressed in terms of the currency of another country. E.g. A rate of ₹ 50 per US \$ implies that one US \$ costs ₹ 50.

Rule 1 : in an exchange rate two currencies are involved.

Rule 2 : in any transaction involving Foreign Currency, you are selling one currency and buying another.

LOS 2 : Home Currency & Foreign Currency

Home Currency: Country's own currency.

Example:

For India '₹'/INR is home currency

For USA 'US \$' or 'Dollar' is a home currency

For UK '£' or 'Pound' or 'GBP' is home currency

Foreign Currency: Any currency other than home currency will be a Foreign Currency

Example:

For India, \$, £, etc. will be a foreign currency.

For US '₹', £ will be foreign currency.

LOS 3 : Bid & Ask Rate

Bid Rate: Rate at which bank **BUYS** left hand side currency.

Ask Rate: Rate at which bank **SELLS** left hand side currency.

One-way Quote: [when Bid and Ask Rate are same]

Example:

1\$ = ₹ 65

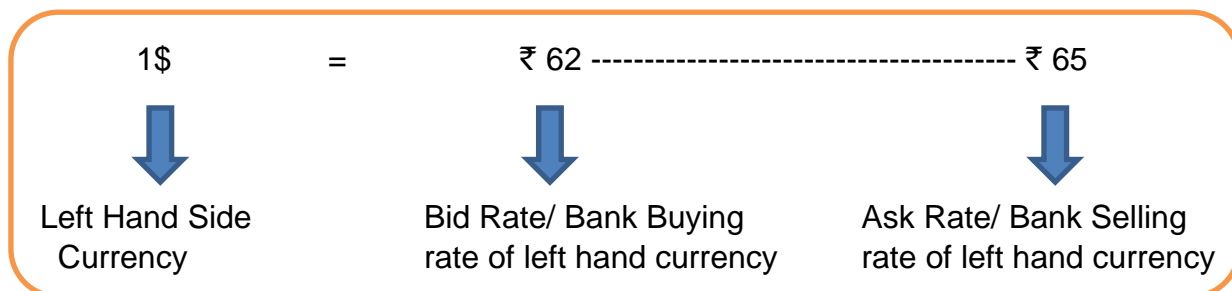
Explanation:

Bank buys 1\$ at ₹ 65.

Bank sells 1\$ at ₹ 65.

Two-way Quote: [when Bid and Ask Rate are separately given]

Example:



Note:

- ❖ Difference between Bid & Ask rate represents Profit Margin for the bank.
- ❖ Quotation/ Bid & Ask rate or Exchange Rate is always quoted from the point of view of bank.
- ❖ Bid Rate must always be less than Ask Rate.

Or

Ask Rate must always be greater than Bid Rate.

- ❖ Always solve question from the point of view of investor/ Customer unless otherwise stated.
- ❖ The difference between the Ask & Bid rates is called *Spread*, representing the profit margin of dealer.

Spread = Ask Rate – Bid Rate

LOS 4 : Direct Quote & Indirect Quote

Direct Quote: Home Currency Price for 1 unit of foreign currency.

Example: 1\$ = ₹ 50 is DQ for Rupee.

Indirect Quote: Foreign Currency Price for 1 unit of Home Currency.

Example: 1Re = 0.0200\$ is IDQ for Rupee.

Note:

- ❖ If a given quotation is direct for one country, then the same quotation will be indirect for another country and vice-versa.
- ❖ The concept of DQ and IDQ is only theoretical and don't have any practical relevance.

LOS 5 : Conversion of Direct Quote into Indirect Quote and vice-versa

Case 1: One-way Quote [When bid & ask rates are same]

- ❖ Direct Quote can be converted into indirect quote by taking the reciprocal of direct quote.

$$\text{IDQ} = \frac{1}{\text{DQ}}$$

Case 2: Two-way Quote [When bid & ask rates are separately given]

- ❖ Direct Quote (DQ) can be converted into Indirect Quote (IDQ) by taking the reciprocal of direct quote and switching the position.

Example: \$1 = ₹ 47.25 --- ₹ 47.85 (1st Quote)

Convert DQ into the IDQ.

Solution:

DQ => \$1 = ₹ 47.25 --- ₹ 47.85

IDQ => 1 Re. = $\frac{1}{47.25}$ --- $\frac{1}{47.85}$

$$1 \text{ Re.} = \frac{1}{47.85} \text{ --- } \frac{1}{47.25}$$

OR 1 Re. = 0.02090 --- 0.02116 (2nd Quote)

Conversion Rules :

- ❖ Which currency is given in the question, we need that currency in the LHS of the quote.
- ❖ Decide whether to Buy that currency or Sell.
- ❖ If you Buy \longrightarrow Bank Sells \longrightarrow Use Ask Rate
- ❖ If you Sell \longrightarrow Bank Buys \longrightarrow Use Bid Rate
- ❖ Always Solve question from the point of view of Customer.

LOS 6 : Spot Rate & Forward Rate

Spot Rate: Rate used for buying & selling of foreign currency at 'As on Today or Immediately'

Forward rate: Rate used for buying & selling of foreign currency at some future Date i.e. Forward rate is the rate contracted today for exchange of currencies at a specified future date.

LOS 7 : Premium or Discount

Premium: If the currency is costly or Expensive in future as compared to spot it is said to be at a premium.

$$SR \Rightarrow 1\$ = ₹ 45$$

$$FR \Rightarrow 1\$ = ₹ 50$$

In the above quote \$ is at Premium.

Discount: If the currency is Cheaper in future as compared to spot it is said to be at a discount.

$$SR \Rightarrow 1\text{Re.} = \frac{1}{45} \$ = 0.0222$$

$$FR \Rightarrow 1\text{Re.} = \frac{1}{50} \$ = 0.02$$

We can say that rupee is at discount.

Calculation of Premium or Discount

$$\left[\frac{FR - SR}{SR} \right] \times \frac{12}{\text{Forward Period}} \times 100$$

Note: This formula is applicable only for left hand currency

Conclusion:

- ❖ If one currency is at a premium, then another currency must be at a discount. However, the rate of premium may not be equal to the rate of discount.
- ❖ On account of base effect, premium is slightly higher than the discount.

LOS 8 : Calculation of Forward Rate when Spot Rate & Premium or Discount is given**Example 1:**

$$SR \rightarrow 1\$ = ₹ 48.50$$

\$ is at premium = 5%

Calculate FR?

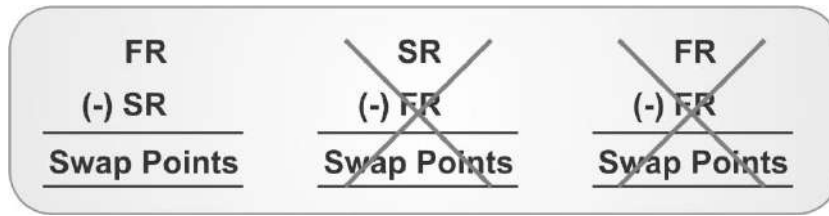
Solution:

$$FR \rightarrow 1\$ = ₹ 48.50 (1 + 0.05)$$

$$1\$ = ₹ 50.925$$

LOS 9 : SWAP POINTS/ Forward Margin/ Forward-Spot Differential

Difference between Forward Rate and Spot Rate is known as **Swap Points**.



How to ADD or DEDUCT Swap Points

- ❖ Swap Point should be Added or Deducted from the last decimal point in the Reverse Order.
- ❖ Premium → Add Swap Points
- ❖ Discount → Less Swap Points

If Premium / Discount is not mentioned, we observe the following rules:

Case 1: When Swap Points are in increasing order:

- ❖ It indicates premium on left hand currency.
- ❖ In this case, we will add swap points with spot rates to calculate forward rates.

Case 2: When Swap Points are in decreasing order:

- ❖ It indicates discount on left hand currency.
- ❖ In this case, we will deduct swap points from Spot Rate to calculate forward rates.

Note : Don't apply the rule if Premium or Discount is used in the question.

LOS 10 : Cross Rate

Cross Rate between ant two currencies is derived with the help of quotations between these currencies & third currency.

- ❖ Cross Rate is normally used in finding out any missing exchange rate.
- ❖ The calculation of cross rate simply requires you to focus on cancellation of common currencies, to do so you have to multiply with DQ & IDQ.
- ❖ Always check ASK Rate > BID Rate.

LOS 11 : Squaring-up the position or Covering the Position or Closing-out the Position under FOREX

Covering the Position means taking an opposite or reverse position to calculate profit and loss i.e. we cover our position to book Profit or Loss.



LOS 12 : Exchange Margin

Exchange Margin is the extra amount or percentage charged by the bank over and above the rate quoted by it. Eg. Commission, transaction charges, etc.

Actual Selling Rate of Bank: (Add Exchange Margin)

= Ask Rate (1+ Exchange Margin)

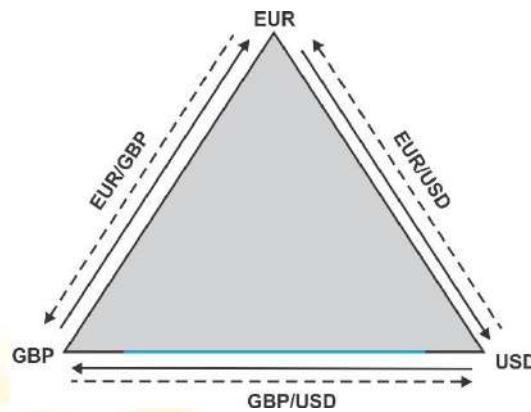
Actual Buying Rate of Bank: (Deduct Exchange Margin)

= Bid Rate (1 – Exchange Margin)

LOS 13 : Triangular Arbitrage

It involves 3 currencies represented by 3 corner points of triangle. We will be starting with one currency, pass through the other two currencies and come back to the original currency. There are two paths → clockwise and Anticlockwise.

One path will result in profit while the other path will result in Loss.



LOS 14 : Purchasing Power Parity Theory (PPPT)

Calculation of Spot Rate

The Future of Finance starts with you

- ❖ PPPT is based on the concept of 'Law of One Price'.
- ❖ PPPT is based on the fact that price of a commodity in two different market will always be same.
- ❖ If Price of a commodity in two different market are not same, there will be an arbitrage opportunity exists in the market.
- ❖ Suppose Price of a Commodity in India is ₹ X & In USA is \$Y. Spot Rate is 1\$ = ₹ SR

$$\text{Then } X = Y \times \text{SR}$$

$$\text{SR} = \frac{X}{Y}$$

$$\text{Spot Rate (₹ / \$)} = \frac{\text{Current Price (Rs.)}}{\text{Current Price (\$)}}$$

- ❖ Exchange Rate = Price Ratio

Calculation of Forward Rate

PPPT is also applicable in case of inflation. Suppose Inflation Rate of India is I_{Rs} and in US is $I_{\$}$ Forward Rate 1\$ = ₹ F. Now as per PPPT, we have after 1 year:

$$X (1 + I_{₹}) = Y (1 + I_{\$}) \times \text{FR}$$

$$\text{FR} = \frac{X (1 + I_{Rs})}{Y (1 + I_{\$})}$$

$$FR = SR \times \frac{1 + I_{Rs}}{1 + I_{\$}}$$

$$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{1 + \text{Rupee Inflation}}{1 + \text{Dollar (\$) Inflation}}$$

Note:

- ❖ The above equation is applicable for any two given currency.
- ❖ Determination of Premium or Discount with the help of Inflation Rate: If Inflation Rate of a country is higher, then the currency of that Country will be at a discount in future and Vice- Versa.

Inflation rate in above equation must be adjusted according to forward period.

Case1: When Period is less than 1 Year.	Case2: When Period is more than 1 Year.
$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{1 + \text{Periodic Inflation Rate (Rs.)}}{1 + \text{Periodic Inflation Rate (\$)}}$	$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{(1 + \text{Inflation Rate (Rs.)})^n}{(1 + \text{Inflation Rate (\$)})^n}$

LOS 15 : Interest Rate Parity Theory (IRPT)

- ❖ IRPT states that exchange rate between currencies are directly affected by their Interest Rate.
- ❖ **Assumption:** Investment opportunity in any two different market will always be same.

$$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{1 + \text{Interest Rate (Rs.)}}{1 + \text{Interest Rate (\$)}}$$

Note:

- ❖ The above equation is applicable for any two given currency.
- ❖ Interest Rate should be adjusted according to forward period.

Case1: When Period is less than 1 Year.	Case2: When Period is more than 1 Year.
$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{1 + \text{Periodic Interest Rate (Rs.)}}{1 + \text{Periodic Interest Rate (\$)}}$	$\frac{FR (Rs./\$)}{SR (Rs./\$)} = \frac{(1 + \text{Interest Rate (Rs.)})^n}{(1 + \text{Interest Rate (\$)})^n}$

Note:

- ❖ Determination of Premium or Discount with the help of Interest Rate: If Interest rate of a country is higher, than the currency of that country will be at a discount in future and vice-versa.
- ❖ If IRPT holds, arbitrage is not possible. In that case, it doesn't matter whether you invest in domestic country or foreign country, your rate of return will be same.

LOS 16 : Covered Interest Arbitrage (CIA)

Type 1	Type 2
When Bid and Ask rates are same.	If Bid & Ask rates are given separately.
When Investment & Borrowing rates are same in one country.	Investment & Borrowing rate of a given currency is separately given.
# (Short – cut is available)	# (Hit & Trial method is used)

- ❖ When Investment opportunity in any two given countries are different, covered Interest Arbitrage is possible.
- ❖ When IRPT is not applicable, then covered interest arbitrage will be applicable.

- ❖ The rule is to “ Borrow from one country & Invest in another Country ”.
- ❖ Suppose Interest Rate of India is $INT_{\text{₹}}$ And USA is $INT_{\text{\$}}$. Spot Rate is $1\$ = ₹ SR$, Forward Rate $\Rightarrow 1\$ = ₹ FR$

Let assume Investor is having ₹ A for investment

Option 1: When investor invest ₹ A in India:

Amount of ₹ Received after one year

$$A_1 = A (1 + INT_{\text{₹}})$$

Option 2: When investor invest ₹ A in USA:

Amount of Equivalent ₹ Received after one year

$$A_2 = \left[\frac{A}{SR} \$ (1 + INT_{\text{\$}}) \right] \times FR$$

IF $A_1 = A_2$	IF $A_1 > A_2$	IF $A_1 < A_2$
No arbitrage opportunity.	Arbitrage Opportunity is Possible. Arbitrager should invest in India (Home Country) & borrow from USA (Foreign Country)	Arbitrage opportunity is possible. Arbitrager should invest in USA (Foreign Country) & borrow from India (Home Country)

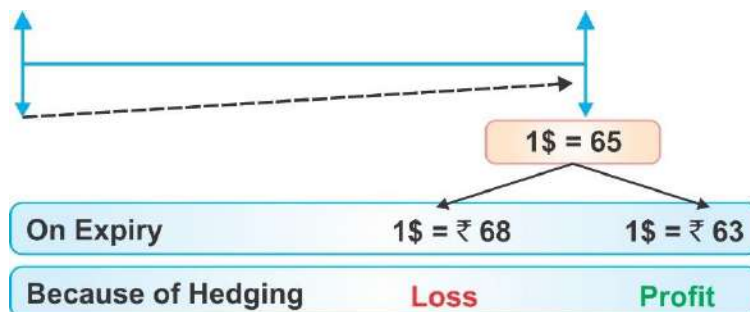
Note:

If in 1st try we have arbitrage profit, then no need to solve 2nd case.

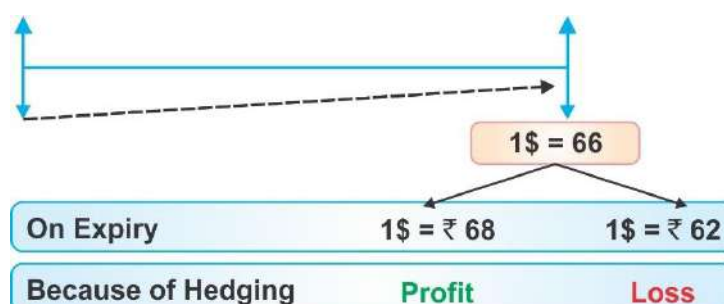
If in 1st try we have arbitrage loss, then 2nd case must be solved.

LOS 17 : Forward Contract

- ❖ Transaction exposure arises when a firm has a known amount of foreign currency payable or receivable but home currency equivalent of which is unknown.
- ❖ Hedging is defined as an activity converted uncertainty into certainty. The simplest hedging strategy is hedging through forward contract.
- ❖ In case of foreign currency is to be **received** in future

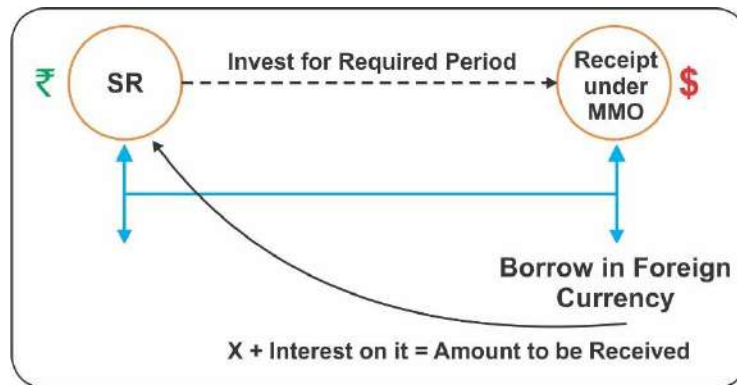


- ❖ In case of foreign currency is to be **Paid** in future



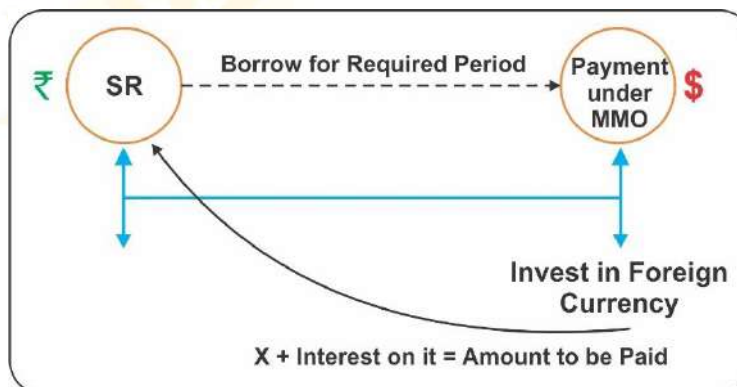
LOS 18 : Money Market Operations

Case 1 : If Foreign Currency is to be received in future:



- Step 1:** Borrow in Foreign Currency: Amount of borrowing should be such that Amount Borrowed + Interest on it becomes equal to the amount to be received.
- Step 2:** Convert the borrowed foreign currency into home currency by using spot Rate.
- Step 3:** Invest this home currency amount for the required period.
- Step 4:** Pay the borrowed amount of foreign currency with interest using the amount to be received in foreign currency. [May be Ignored]

Case 2: When foreign currency is to be paid in future



- Step 1:** Invest in Foreign currency. Amount of investment should be such that, "Amount Invested + Interest on it" becomes equal to amount to be paid
- Step 2:** Borrow in Home Currency, equivalent amount which is to be invested in foreign currency using Spot rate.
- Step 3:** Pay the borrowed amount with interest in Home Currency on Maturity.
- Step 4:** Pay the outstanding amount with the amount received from investment. [May be ignored]

LOS 19 : Adjusting Exchange rate quotation when exchange margin is attached to it

Example:

1 Euro = £ 1.7846 ± 0.0004

Solution:

1 Euro = £ 1.7842 ---- 1.7850

LOS 20 : Foreign Capital Budgeting

Two approaches are followed in case investment is undertaken in foreign country:

- ❖ Home Currency Approach
- ❖ Foreign Currency Approach

Home Currency Approach:

Step 1: Compute all cash inflows & outflows arising in foreign currency.

Step 2: Convert these cash Inflows & outflows into home currency by using appropriate exchange rates (i.e. Forward Rate) (Calculate through Swap Point or IRPT)

Step 3: Compute a suitable discount rate.

Step 4: Compute Home Currency (NPV)

Foreign Currency Approach:

Step 1: Compute all cash inflows & outflows arising in foreign currency.

Step 2: Compute a suitable discount rate (RADR).

Step 3: Compute Foreign Currency (NPV)

Step 4: Convert foreign currency NPV into Home currency by using Spot Rate

Note:

- ❖ Answer by both approach will be same.
- ❖ Discount Rate to be used should be risk-adjusted discount rate (RADR), Since foreign project involves risk.

$$(1 + \text{RADR}) = (1 + \text{Risk-free rate}) (1 + \text{Risk Premium})$$

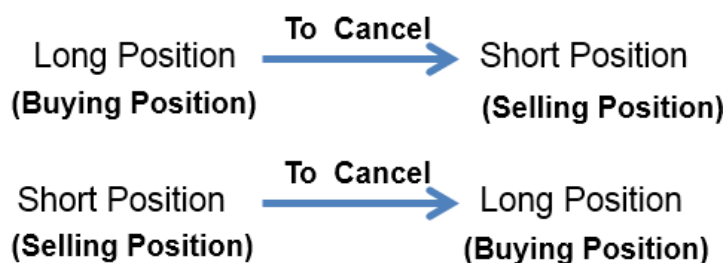
- ❖ Discount Rate or RADR of both the country are different.
- ❖ Risk Premium of both home country and foreign country are assumed to be same.

LOS 21 : Cancellation/Modification under Forward Contract

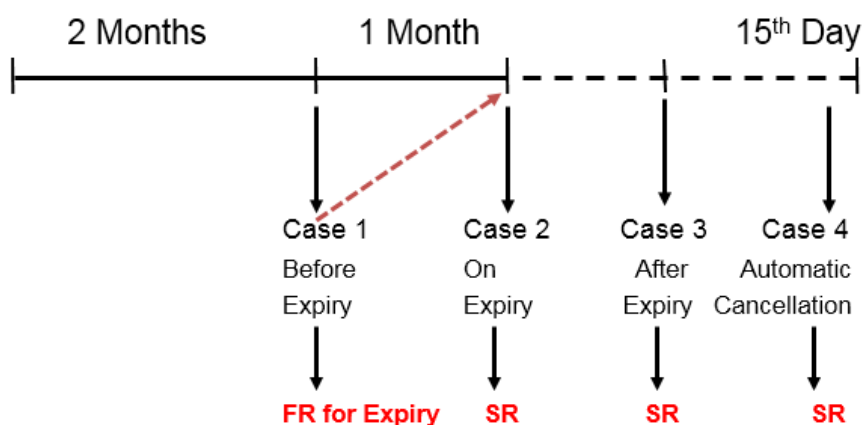
Forward Contract are legal binding contracts, which must be fulfilled by each and every party. In case of cancellation of Forward Contracts, following rules must be followed:

How to cancel Forward Contract

Forward Contracts must be cancelled by entering into a reverse contract.

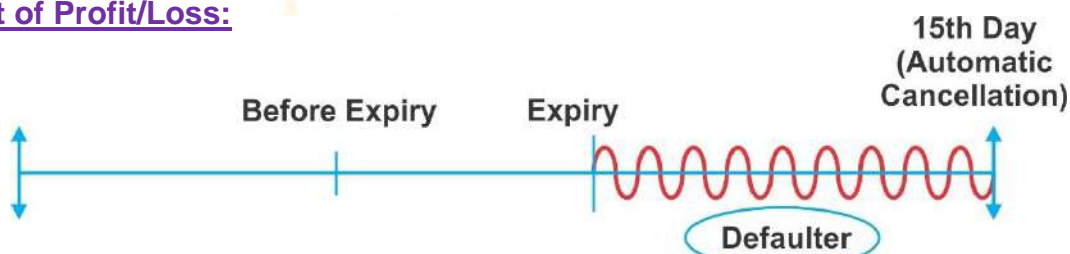


Rate at which contract needs to be Cancelled



Case 1	Cancelled before expiry	Forward Rate prevailing as on today for expiry
Case 2	Cancelled on expiry	Spot Rate of expiry
Case 3	Cancelled after expiry	Spot Rate of the date when customer contracted with the bank.
Case 4	Automatic Cancellation	Spot Rate prevailing on 15 th day i.e. when grace period ends.

Settlement of Profit/Loss:



Case 1	Cancelled on or before expiry	Customer will be eligible for both profit/Loss.
Case 2	Cancelled after expiry or automatic cancellation	Customer will be eligible only for Loss

LOS 22 : Extension of Forward Contract

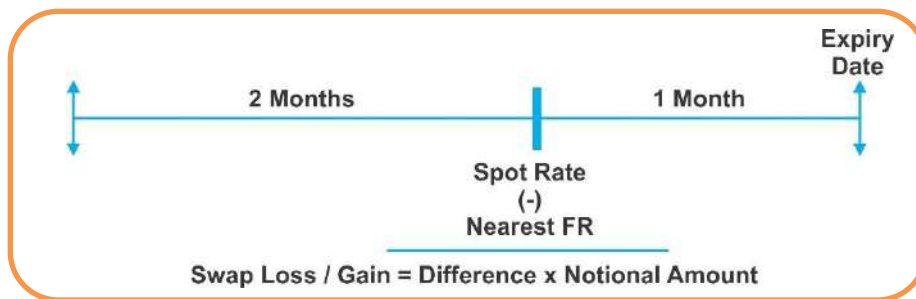
Step 1: Cancellation of original Contract

Step 2: Entering into a new forward contract for the extended period.

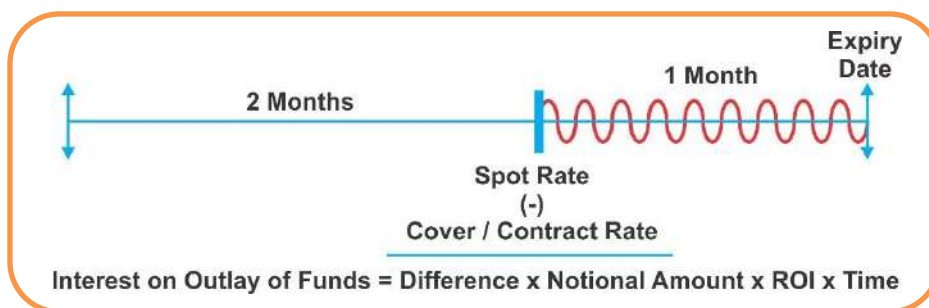
LOS 23 : Early Delivery

The bank may accept the request of customer of delivery at the before due date of forward contract provided the customer is ready to bear the loss if any that may accrue to the bank as a result of this. In addition to some prescribed fixed charges bank may also charge additional charges comprising of:

- a) **Swap Difference:** This difference can be loss/ gain to the bank. This arises on account of offsetting its position earlier created by early delivery as bank normally covers itself against the position taken in the original forward contract.



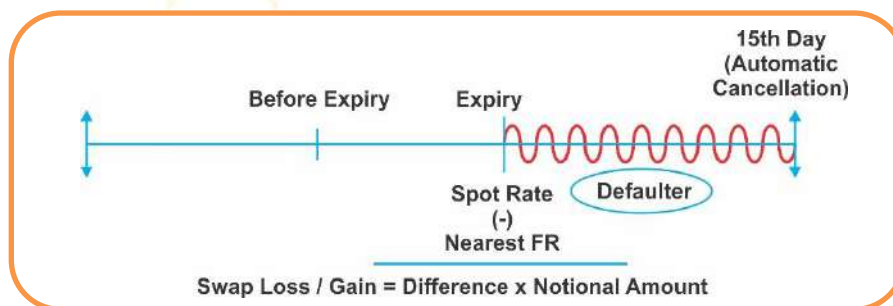
- b) **Interest on Outlay of Funds:** It might be possible early delivery request of a customer may result in outlay of funds. In such bank shall charge from the customer at a rate not less than prime lending rate for the period of early delivery to the original due date. However, if there is an inflow of funds the bank at its discretion may pass on interest to the customer at the rate applicable to term deposits for the same period.



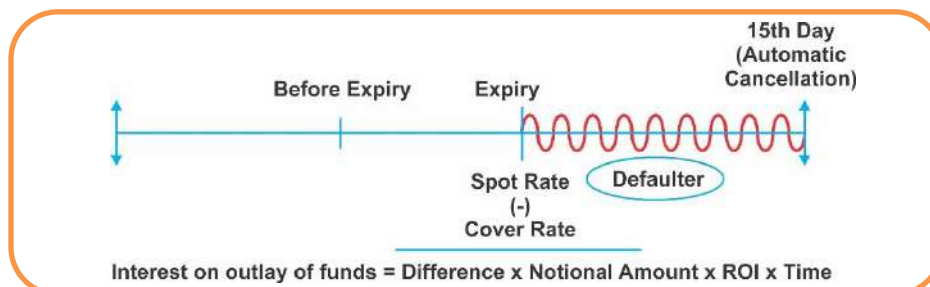
LOS 24 : Cancellation after Due Date/ Automatic Cancellation Late Delivery / Extension after due date

In these cases the following cancellation charges may be payable:

1. Exchange Difference
2. Swap Loss



3. Interest on outlay of funds



LOS 25 : Centralized Cash Management & Decentralized Cash Management System

- ❖ Under Decentralized Cash Management, every branch is viewed as separate undertaking. Cash Surplus and Cash Deficit of each branch should not be adjusted.
- ❖ Under Centralized Cash Management, every branch cash position is managed by single centralized authority. Hence, Cash Surplus and Cash Deficit of each branch with each other is accordingly adjusted

LOS 26 : Contribution to Sales Ratio based decision under FOREX

$$\text{Contribution to Sales Ratio} = \frac{\text{Contribution (Sales-VC)}}{\text{Sales}} \times 100$$

Decision:

Higher the C/S Ratio, Better the position.

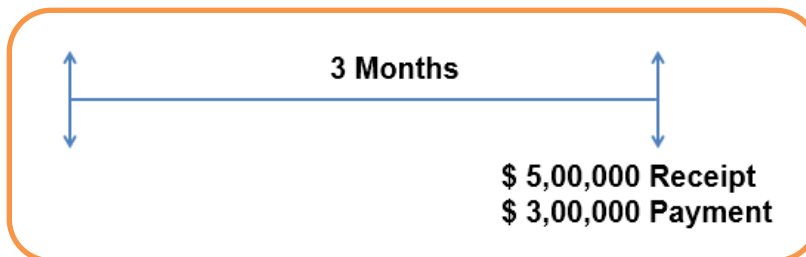
LOS 27 : Leading & Lagging

- ❖ Leading means advancing the timing of payments and receipts.
- ❖ Lagging means postponing or delaying the timing of payments and receipts.



LOS 28 : Exposure Netting

Netting means adjusting receivable and payables (or inflows & Outflows)



Two conditions must be fulfilled:

1. Netting can be done for same currency.
2. Netting can be done for same period.

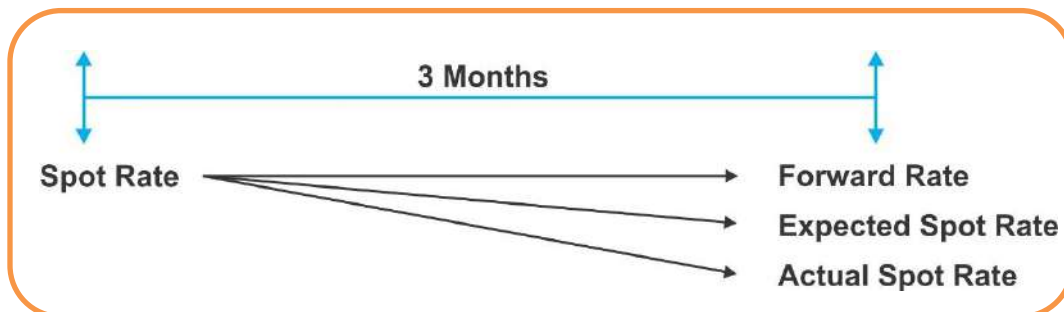
Note: In case of Netting, No. of forward contracts can be reduced.

LOS 29 : Currency Pairs

Currency Pairs are written by ISO Currency codes of the base currency and the counter currency, separating them with a slash character.

**Example:**

A price quote of EUR/USD at 1.30851 means
1 Euro = 1.30851 \$

LOS 30 : Gain/Loss under FOREX

The Future of Finance starts with you

LOS 31 : Evaluation of Quotation from two Banks

When quotations are received from two banks, customer should select that quotation which is more beneficial to him.

Example:

	Sell	
HDFC Bank 1£ =	\$ 1.9650	— \$ 1.9670
Axis Bank 1£ =	\$ 1.9550	— \$ 1.9560 Buy
<ul style="list-style-type: none"> • Buy 1 £ = \$ 1.9560 (HDFC) • Sell 1 £ = \$ 1.9650 (ICICI) 		

LOS 32 : Expected Spot Rate

$$\text{Expected Spot Rate} = \sum \text{Spot Rates} \times \text{Probability}$$

LOS 33 : Currency Futures**Steps Involved:**

Step1: Decide Position

- ❖ Long Position
- ❖ Short Position

Note: First we will decide which currency will buy or which currency we will sell then check the currency on the LHS of the quotation & then accordingly decide Long Position & Short Position



Step 2 : Calculation of Number of contracts/Lots

$$\text{No. of Lots} = \frac{\text{Value of Position}}{\text{Value of one Contract}} = \frac{\text{£}}{\text{£}} = \frac{\text{£}}{\cancel{\text{£}}}$$

Note: Convert exposure amount in the same currency as of Lot Size/Contract Size & it will be converted at CONTRACT RATE.

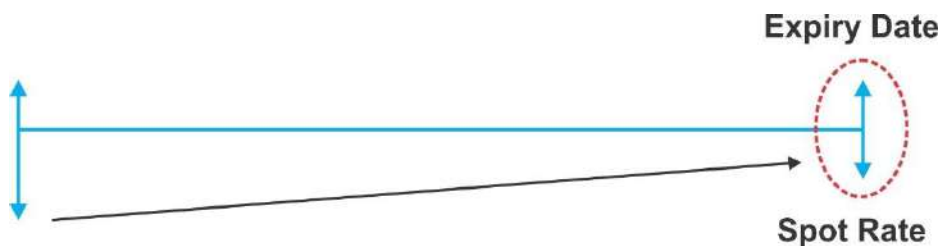
Step 3: Calculate Settlement Amount/ Total Outflow/Inflow under Future Contract

1. Calculate Profit and Loss under Future Contract



$$\text{Change in Future Price} \times \text{No. of Lots} \times \text{Value of One Contract}$$

2. Calculate Total Receipt/Total Payment using SR on Expiry



3. Calculation of opportunity cost of initial margin if Given

Total Outflow / Inflow under Future Hedging

LOS 34 : Currency Options

Steps Involved:

Step1: Decide Position

Long Call

~~Short Call~~

Long Put

~~Short Put~~

Note: First we will decide which currency will buy or which currency we will sell then check the currency on the LHS of the quotation & then accordingly decide Long Call & Long Put



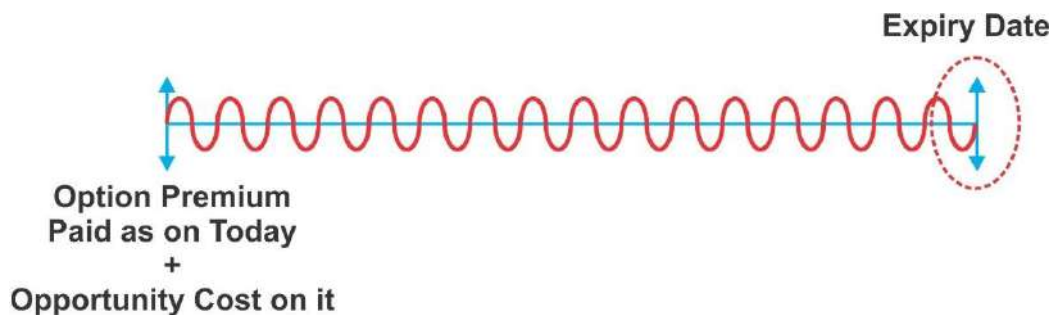
Step2 : Calculation of Number of contracts/Lots

$$\text{No. of Lots} = \frac{\text{Value of Position}}{\text{Value of one Contract}} = \frac{\$}{\$} = 17.35 \text{ or } 17 \text{ lots}$$

Note: Convert exposure amount in the same currency as of Lot Size/Contract Size & it will be converted at CONTRACT RATE.

Step 3: Now the UNHEDGE POSITION should be hedge through forward market as there is no lot size requirement under forward market.

Step 4: Calculation of Option Premium paid as on today with opportunity cost on it.



Step 5: Calculate / Total Outflow/Inflow under Option Contract

- (i) Option Premium paid as on today with opportunity cost on it.
- (ii) Unhedged Position under forward contract
- (iii) Under Option Contract using Exercise Price

Total Outflow / Inflow under Option Hedging

LOS 35 : Calculation of Return under FOREX

$$\text{Return (In terms of Home Currency)} = \left[1 + \frac{P_1 - P_0 + I}{P_0} \right] (1 + C) - 1$$

P_0 = Price at the beginning

P_1 = Price at the End

I = Income from Interest/Dividend

C = Change in exchange rate.

LOS 36 : Broken Date Contracts

A Broken Date Contract is a forward contract for which quotation is not readily available.

Example: If quotes are available for 1 month and 3 months but a customer wants a quote for 2 months, it will be a Broken Date Contract. It can be calculated by interpolating between the available quotes for the preceding and succeeding maturities.

LOS 37 : Implied Differential in Interest Rate

Interest rate is just another name of premium or discount of one country currency in relation to another country currency (As per IRPT).

Premium or Discount = Difference in Interest Rate

Equation:

$$\frac{\text{FR (Rs./\$)} - \text{SR (Rs./\$)}}{\text{SR}} \times \frac{12}{\text{Forward Period}} \times 100 = \text{Interest Rate (₹)} - \text{Interest Rate (\$)}$$

LOS 38 : Savings due to Time Value (Discount) & Currency Fluctuation

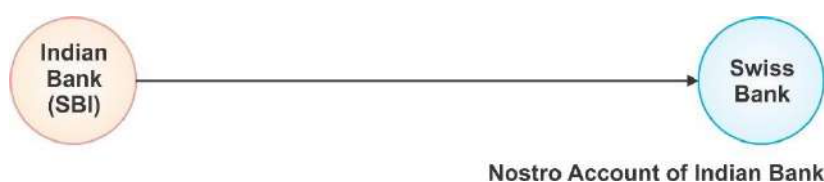
If the firm decides to pay today rather than in future he may get two types of benefits:

- ❖ Benefit on account of discount for pre-payment.
- ❖ Benefit on account of currency fluctuation.

LOS 39 : Nostro Account, Vostro Account and LORO Account**Nostro Account [Ours account with you]**

This is a current account maintained by a domestic bank/dealer with a foreign bank in foreign currency.

Example: Current account of SBI bank (an Indian Bank) with swizz bank in Swizz Franc. (CHF) is a Nostro account.

**Vostro Account [Yours account with us]**

This is a current account maintained by a foreign bank with a domestic bank/dealer in Rupee currency.

Example: Current account of Swizz bank in India with SBI bank in Rupee (₹) currency

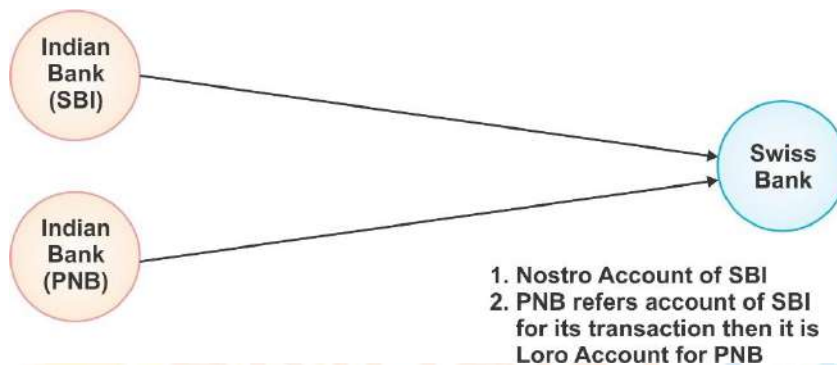


Loro Account [Our account of their Money with you]

This is a current account maintained by one domestic bank on behalf of other domestic bank in foreign bank in a foreign currency.

In other words, Loro account is a Nostro account for one bank who opened the bank and Loro account for other bank who refers first one account.

Example: SBI opened Current account with swizz bank. If PNB refers that account of SBI for its correspondence, then it is called Loro account for PNB and it is Nostro account for SBI.



Note:

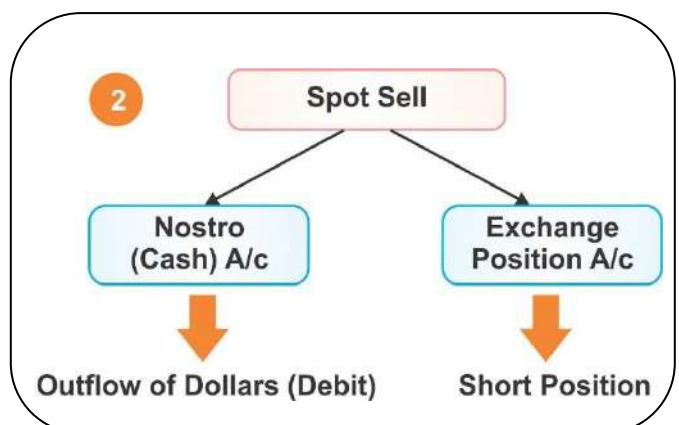
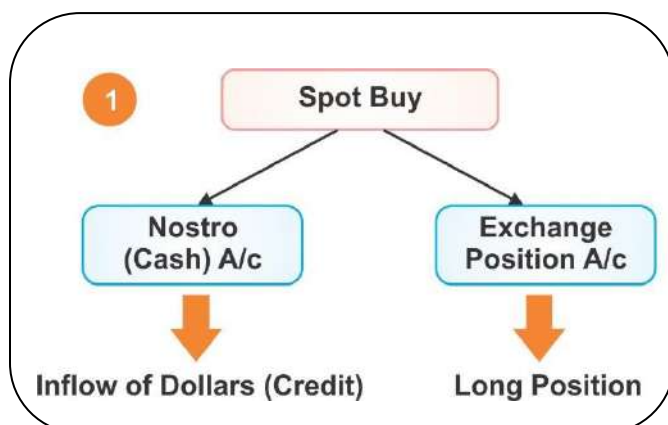
- ❖ SPOT purchase/sale of CHF affects both exchange position as well as Nostro account.
- ❖ However, forward purchase/sale affects only the exchange position.

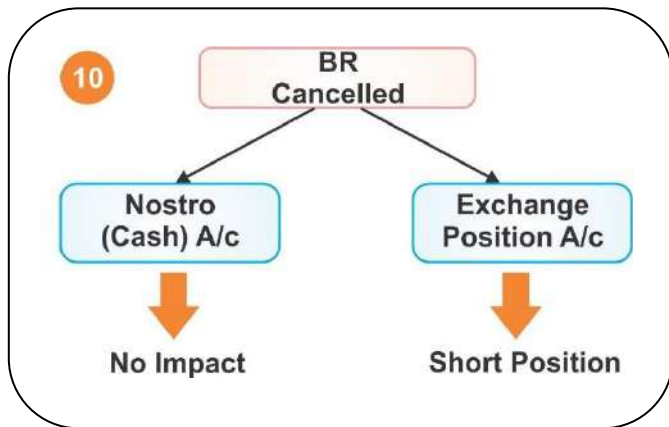
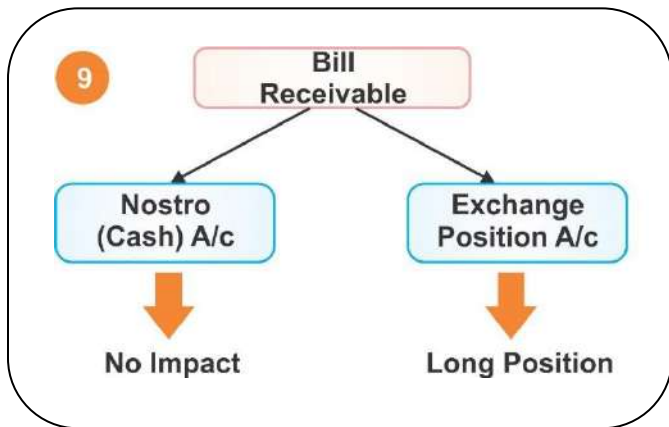
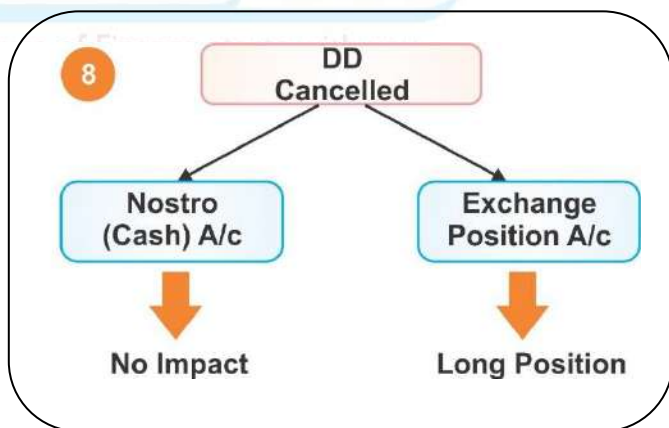
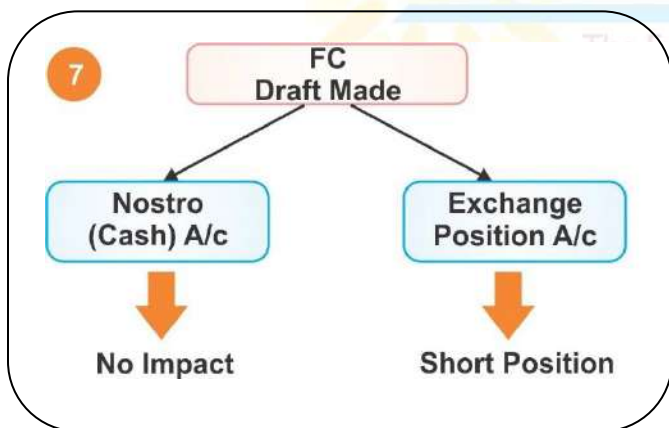
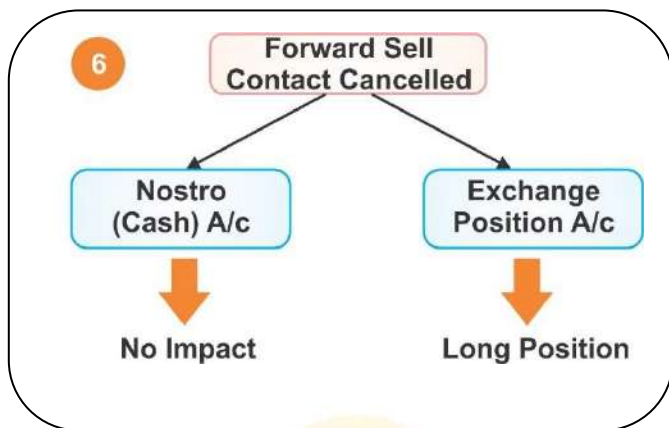
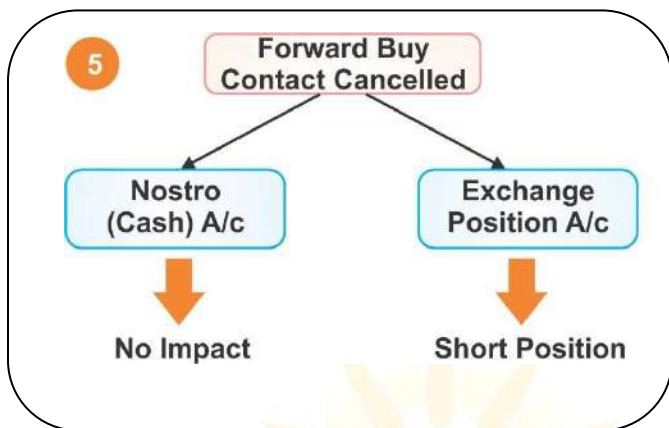
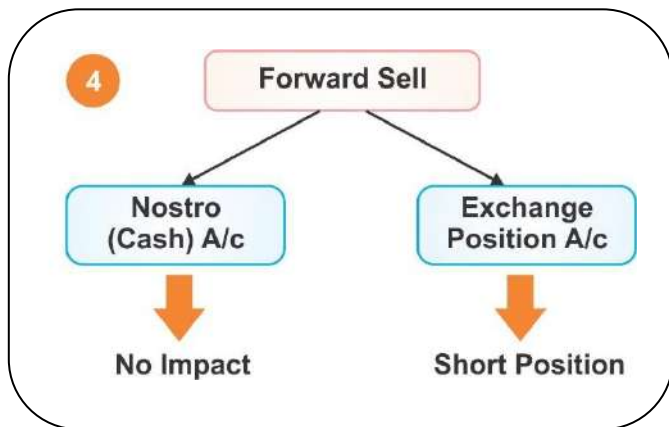
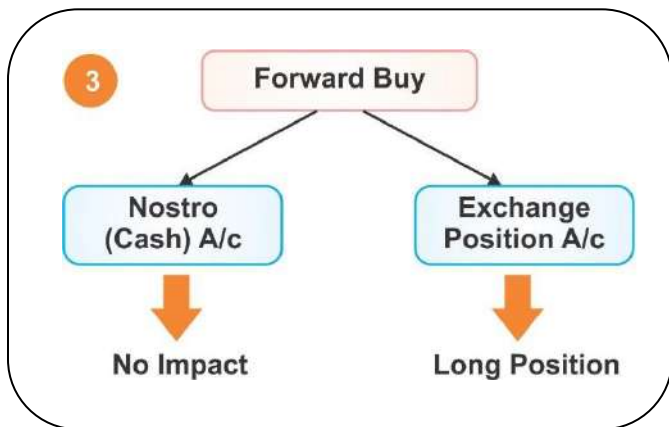
1. Nostro A/c (Cash A/c) in Foreign Currency

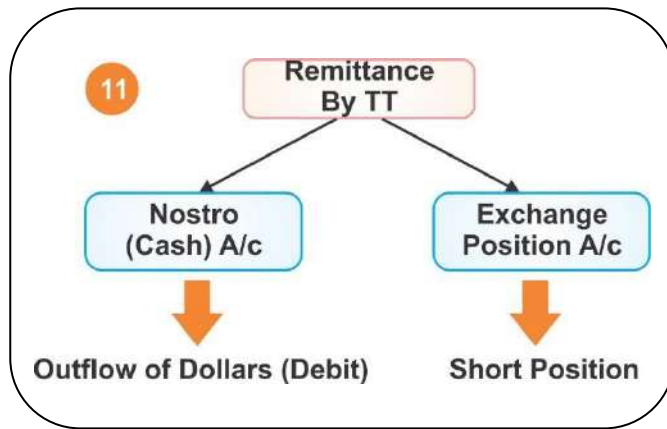
Particulars	Dr. [Debit] outflow of Dollars (FC)	Cr. [Credit] Inflow of Dollars (FC)
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2. Exchange Position A/c/

Particulars	Long Dollar Buy (FC)	Short Dollar Sell (FC)
-------------	----------------------	------------------------





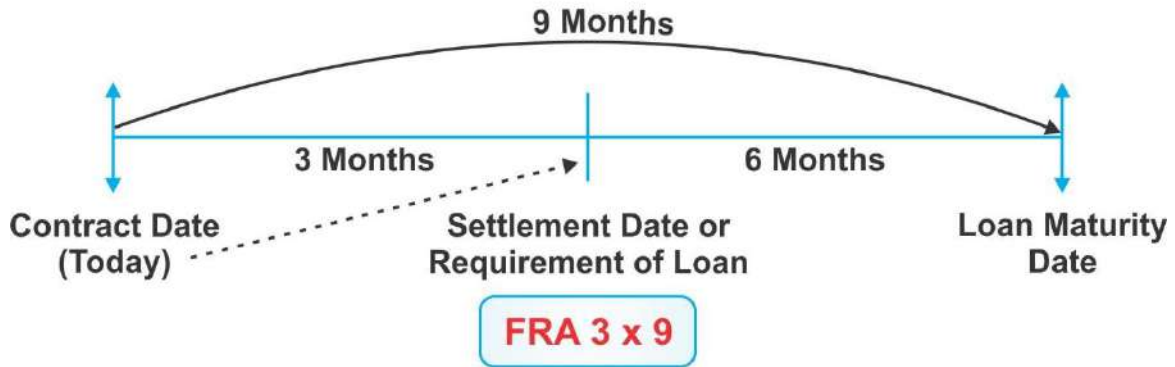


Interest Rate Risk Management

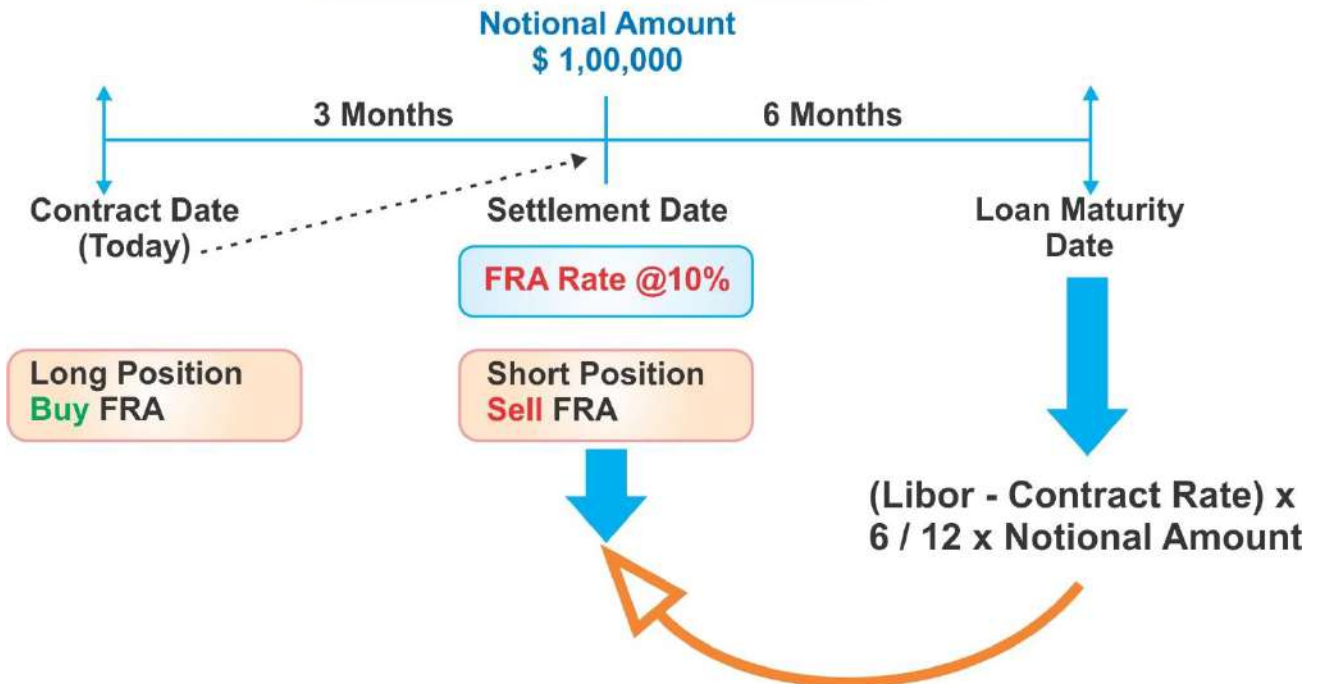
Study Session 9

LOS 1: Forward Rate Agreement (FRA)

I want to take loan after 3 months for 6 months contract a FRA



TYPE 1 : CASH SETTLEMENT



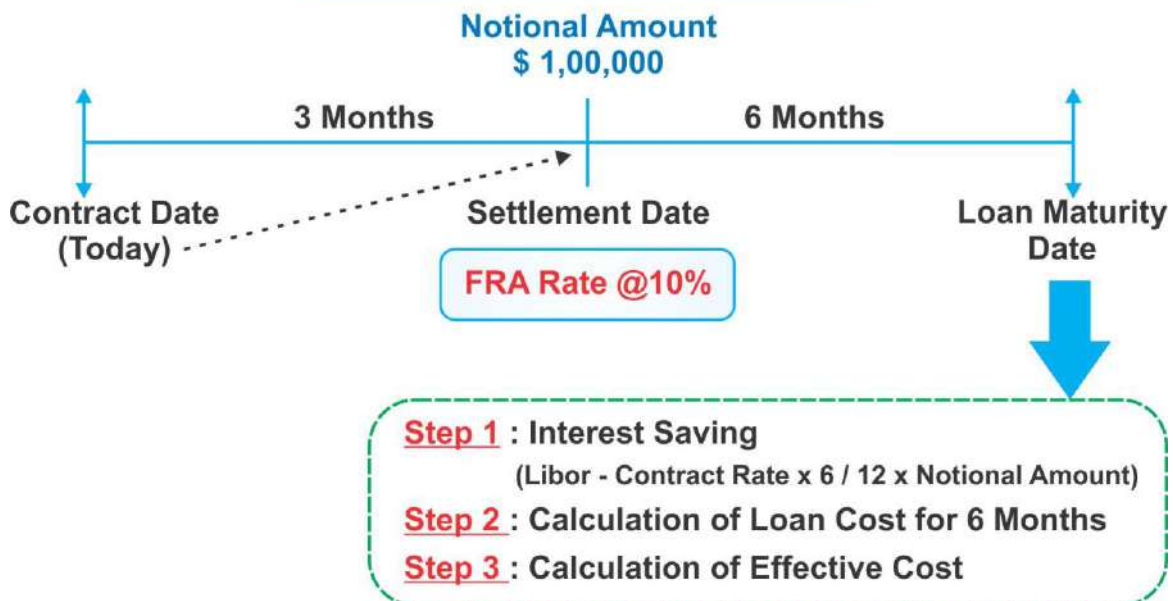
- ❖ A forward rate Agreement can be viewed as a forward contract to borrow/lend money at a certain rate at some future date.
- ❖ These Contracts settle in cash.
- ❖ The long position in an FRA is the party that would borrow the money. If the floating rate at contract expiration is above the rate specified in the forward agreement, the long position in the contract can be viewed as the right to borrow at below market rates & the long will receive a payment.

- ❖ If reference rate at the expiration date is below the contract rate, the short will receive a cash from the long.
- ❖ FRA helps borrower to eliminate interest rate risk associated with borrowing or investing funds.
- ❖ Adverse movement in the interest rates will not affect liability of the borrower.

Payment to the long at settlement is:

$$\text{Notional Principal} \times \frac{[\text{Floating (LIBOR)} - \text{Forward Rate}] \times \frac{\text{days}}{360}}{1 + \text{Floating rate (LIBOR)} \times \frac{\text{days}}{360}}$$

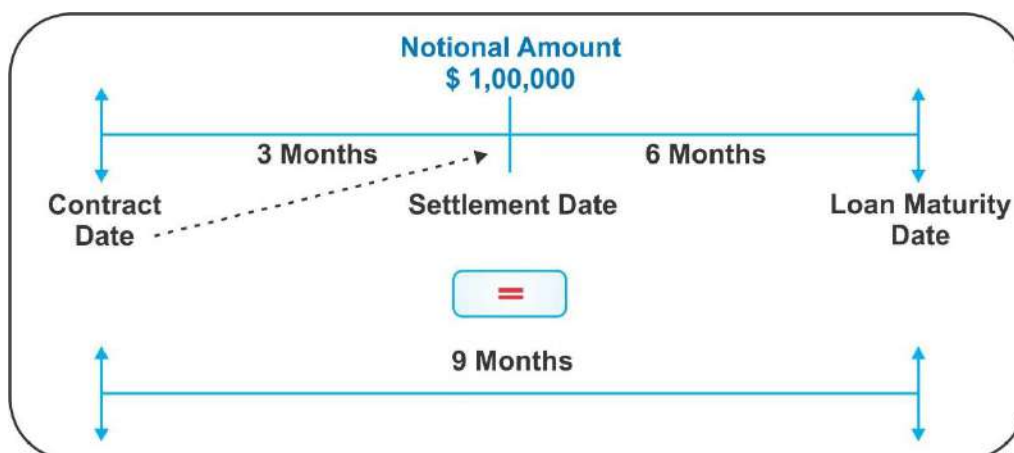
TYPE 2 : EFFECTIVE COST



FRA ARBITRAGE

Step 1 : Calculation of Fair Forward Rate

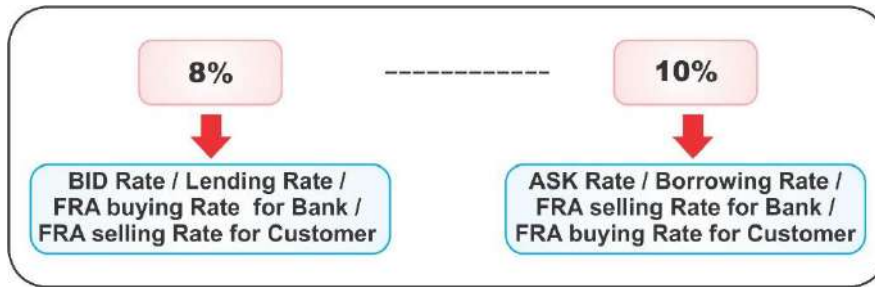
6 Months Forward rate 3 months from now



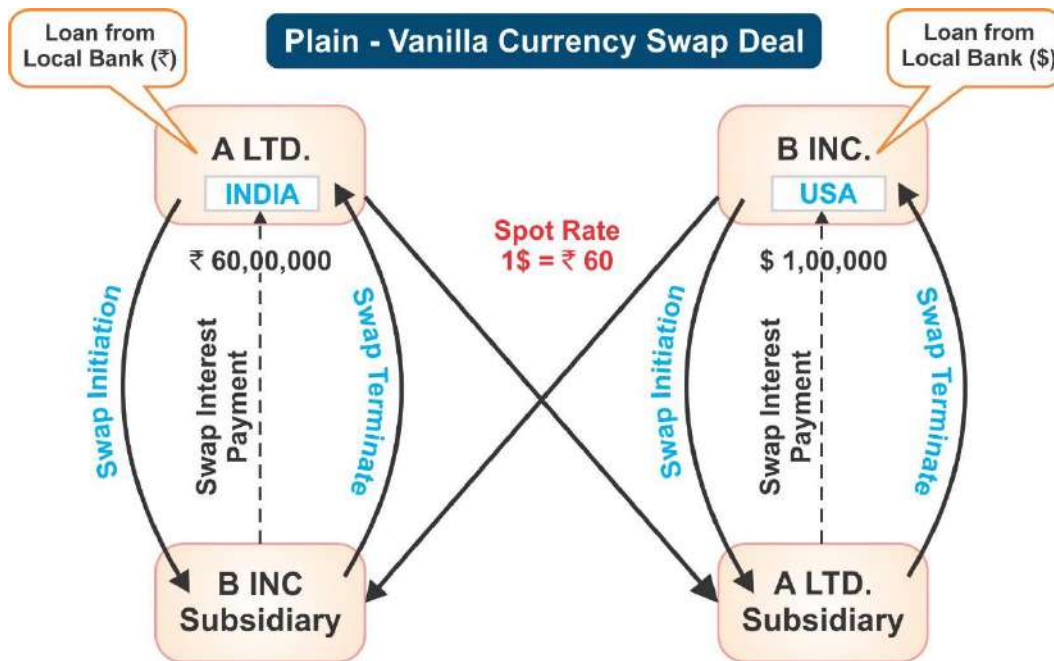
Step 2 : Decide from where we should borrow and where should we invest

Step 3 : Calculation of Arbitrage Profit

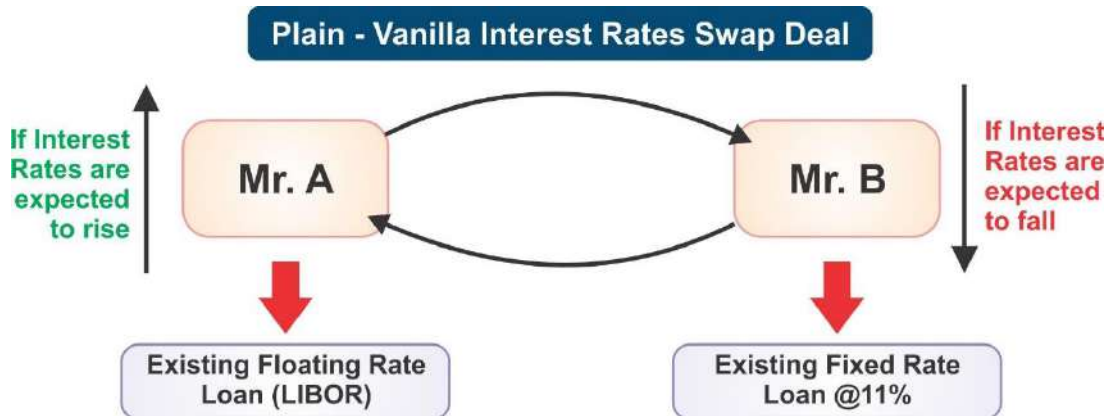
FRA Quotation: Suppose 3 × 9 FRA (Quoted by Bank)



LOS 2 : Currency SWAP



LOS 3 : Interest Rate Swap [Two Party]



Under SWAP Deal :
 Mr. A pays Fixed rate @11% → Fixed rate payer
 Mr. B pays Floating rate @ LIBOR → Floating rate payer

- ❖ Two parties exchange their interest rate obligation.
- ❖ The plain vanilla interest rate swap involves trading fixed interest rate payments for floating rate payments.
- ❖ The party who wants fixed-rate interest payments agrees to pay fixed-rate interest.
- ❖ The Counter party, who receives the fixed payments agrees to pay variable-rate interest/floating rate interest.
- ❖ The difference between the fixed rate payment and the floating rate payment is calculated and paid to the appropriate counterparty.
- ❖ Net interest is paid by the one who owes it.
- ❖ Swaps are zero-sum game. What one party gains, the other party losses.

The Net formulae for the Fixed-Rate payer, based on a 360-day year and a floating rate of LIBOR is:

$$(\text{Net Fixed Rate Payment})_t = [\text{Swap Fixed Rate} - \text{LIBOR}_{t-1}] \left[\frac{\text{No. of Days}}{360} \right] [\text{National Principal}]$$

Note:

- ❖ If this number is positive, fixed-rate payer pays a net payment to the floating-rate party.
- ❖ If this number is negative, then the fixed-rate payer receives a net flow from the floating rate payer

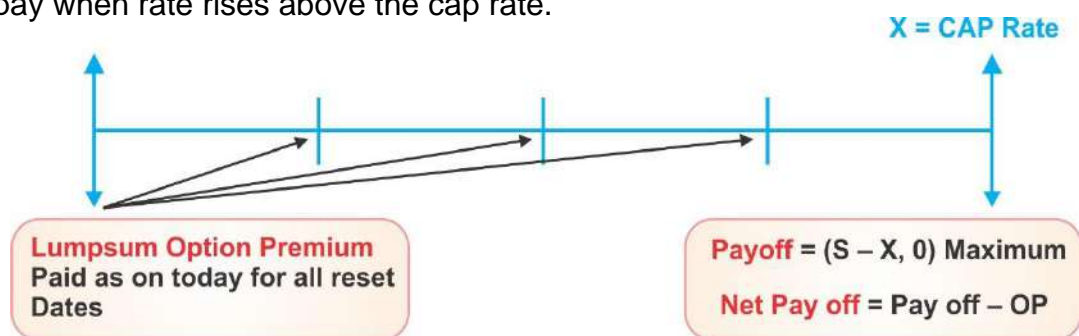
LOS 4 : Interest Rate Caps, Floor & Collar

CAP → Maximum Rate → Borrowings → Floating Rate
 FLOOR → Minimum Rate → Investments → Floating Rate

Interest Rate Cap : (Maximum Rate For Borrowing @ Floating)

If a firm borrows at floating rate, it is afraid of interest rate rising, to hedge against the same, it will buy an interest rate cap i.e. Long call at $X = \text{Cap rate}$

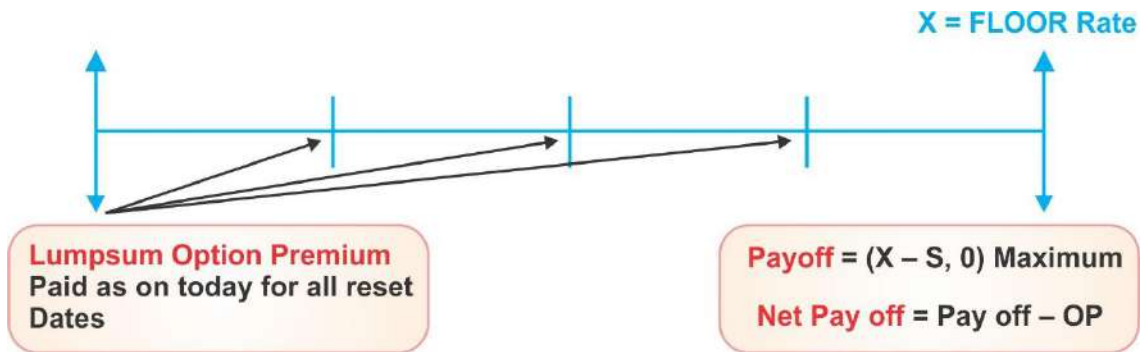
- ❖ It is a series/portfolio of interest rate Call option on interest rates.
- ❖ Each particular call option being called a CAPLET.
- ❖ Caps pay when rate rises above the cap rate.



Interest Rate Floor : (Minimum Rate For Investment @ Floating)

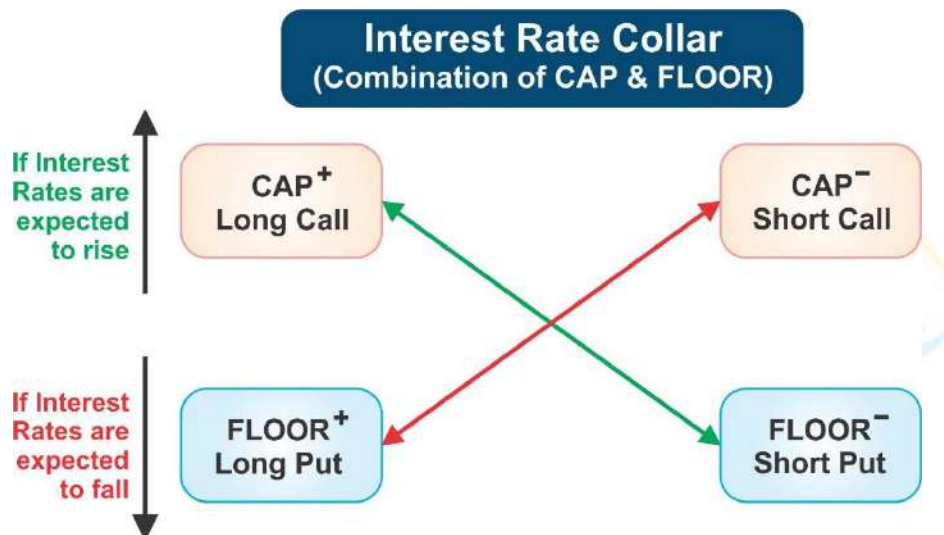
If a firm invest at floating rate, it is afraid of interest rate falling, to hedge against the same, it will buy an interest rate Floor i.e. Long put at $X = \text{Floor rate}$

- ❖ It is a series/portfolio of Interest rate put Option on interest rate. Such particular put option being called a FLOORLET
- ❖ Floor pays when rate falls below the Floor Rate.



Interest Rate Collar:

- ❖ It is a combination of a Cap and a Floor.
- ❖ Premium paid on one option would be compensated with the premium received on selling another option.
- ❖ If premium paid on caps is equal to the premium received on floor, then it would be called Zero Cost Collar.



- ❖ A floating rate borrower may buy a cap [C⁺] & simultaneously sells a floor i.e.[P⁻]. Initial outflow will reduce.(C⁺ =Long Call & P⁻=Short Put)
- ❖ Similarly, a floating rate investor may buy a Floor (P⁺) & simultaneously sell a Cap (C⁻). Initial outflow will reduce.(P⁺=Long Put & C⁻=Short Call)

Fixed Income Securities

Study Session 10

LOS 1 : Introduction (Fixed Income Security)

Bonds are the type of long term obligation which pay periodic interest & repay the principal amount on maturity.

Three types of Cash Flows

- (i) Interest
- (ii) Principal Repayment
- (iii) Re-Investment Income

Purpose of Bond's indenture & describe affirmative and negative covenants

- ❖ The contract that specifies all the rights and obligations of the issuer and the owners of a fixed income security is called the Bond indenture.
- ❖ These contract provisions are known as covenants and include both negative covenants (prohibitions on the borrower) and affirmative covenants (actions that the borrower promises to perform) sections.

1. Negative Covenants : This Includes

- a) Restriction on asset sales (the company can't sell assets that have been pledged as collateral).
- b) Negative pledge of collateral (the company can't claim that the same assets back several debt issues simultaneously).
- c) Restriction on additional borrowings (the company can't borrow additional money unless certain financial conditions are met).

2. Affirmative Covenants: This Includes

- a) Maintenance of certain financial ratios.
- b) Timely payment of principal and interest.

Common Options embedded in a bond Issue, Options benefit the issuer or the Bondholder

- ❖ Security owner options:
 - a) Conversion option
 - b) Put provision
 - c) Floors set a minimum on the coupon rate
- ❖ Security issuer option:
 - a) Call provisions
 - b) Prepayment options
 - c) Caps set a maximum on the coupon rate

LOS 2 : Terms used in Bond Valuation

(i)	Face Value	₹ 1,000
(ii)	Maturity Year	10 Years
(iii)	Coupon rate	10%

(iv)	Coupon Amount	₹ 1,000 × 10% = ₹ 100 p.a.
(v)	B ₀ / Value of the Bond as on Today/ Current Market Price/Issue Price/ Net Proceeds	₹ 950
(vi)	Yield to Maturity/ K _d / Discount Rate / Required return of investor / Cost of debt / Expected Return/ Opportunity Cost / Market Rate of Interest	12%
(vii)	Redemption Value/ Maturity Value	₹ 1,200

Note :

- Coupon Rate is used to calculate Interest Amount.
- Face Value is always used to calculate Interest Amount.
- If Maturity Value is not given, then it is assumed to be equal to Face Value.
- If Face Value is not given, then it is assumed to be ₹ 100 or ₹ 1000 according to the Question.
- If Maturity Year is not given, then it is assumed to be equal to infinity.

LOS 3 : Valuation of Straight Bond / Plain Vanilla Bond

Straight Coupon Bonds are those bonds which pay equal amount of interest and repay principal amount on Maturity.

Step 1: Estimates the cash flows over the Life of the bond.

Step 2: Determine the appropriate discount rate.

Step 3: Calculate the present value of the estimated cash flow using appropriate discount rate.

$$B_0 = \frac{\text{Interest}}{(1+YTM)^1} + \frac{\text{Interest}}{(1+YTM)^2} + \dots + \frac{\text{Interest}}{(1+YTM)^n} + \frac{\text{Maturity value or Par value}}{(1+YTM)^n}$$

Or

$$\text{Interest} \times \text{PVAF (Yield \%, n year)} + \text{Maturity Value} \times \text{PVF (Yield \%, nth year)}$$

n = No. of years to Maturity

LOS 4 : Coupon Rate Structures**1. Zero – Coupon Bond (Pure Discount Securities)**

- They do not pay periodic interest.
- They pay the Par value at maturity and the interest results from the fact that Zero – Coupon Bonds are initially sold at a price below Par Value. (i.e. They are sold at a significant discount to Par Value).

2. Step – up Notes

- They have coupon rates that increase over – time at a specified rate.
- The increase may take place one or more times during the life cycle of the issue.

3. Deferred – Coupon Bonds

- They carry coupons, but the initial coupon payments are deferred for some period.
- The coupon payments accrue, at a compound rate, over the deferral period and are paid as a lump sum at the end of that period.
- After the initial deferment period has passed, these bonds pay regular coupon interest for the rest of the life of the issue (to maturity).

4. Floating – Rate Securities

- These are bond for which coupon interest payments over the life of security vary based on a specified reference rate.
- Reference Rate may be LIBOR [London Interbank Offered Rate] or EURIBOR or any other rate and then adds or subtracts a stated margin to or from that reference rate.

$$\text{New coupon rate} = \text{Reference rate} \pm \text{quoted margin}$$

5. Inflation – indexed Bond (TIPS)

They have coupon formulas based on inflation.

$$\text{E.g.: Coupon rate} = 3\% + \text{annual change in CPI}$$

LOS 5 : Valuation of Perpetual Bond/ Irredeemable Bond/ Non – Callable Bond

They are infinite bond, never redeemable, non- callable bond.

$$\text{Value of Bond} = \frac{\text{Annual Interest}}{\text{YTM}}$$

LOS 6 : Valuation of Zero-Coupon Bond

- ❖ Zero- coupon Bond has only a single payment at maturity.
- ❖ Value of Zero- Coupon Bond is simply the PV of the Par or Face Value.

$$\text{Bond value} = \frac{\text{Maturity Value}}{(1 + \text{YTM})^n}$$

LOS 7 : Confusion regarding Coupon Rate & YTM

YTM → Required Return / Investor's Expectation / Mkt. Rate of Interest.

- ❖ YTM is always subjected to change according to Market Conditions.

Coupon Rate → Rate of Interest paid by the company.

- ❖ Coupon Rate is always constant throughout the life of the bond and it is not affected by change in market condition.
- ❖ Sometimes interest is expressed in terms of Basis Point i.e. 1% = 100 Basis Points

LOS 8 : Valuation of Semi – annual Coupon Bonds

Pay interest every six months

a) $\frac{\text{YTM p.a.}}{2}$

b) $\frac{\text{Coupon rate p.a}}{2}$

c) $n \times 2$

Note:

If quarterly use 4 instead of 2

If monthly use 12 instead of 2

LOS 9 : Valuation of Bond with Changing Coupon Rate

Coupon rate changes from one year to another year as per the terms of bond-indenture.

LOS 10: Over – Valued & Under – Valued Bonds

Case	Value	Decision
PV of MP of Bond < Actual MP of Bond	Over – Valued	Sell
PV of MP of Bond > Actual MP of Bond	Under – Valued	Buy
PV of MP of Bond = Actual MP of Bond	Correctly Valued	Either Buy/ Sell

LOS 11: Self – Amortization Bond

- ❖ They make periodic interest and principal payments over the life of the bond. i.e. at regular interval.
- ❖ Interest is calculated on balance amount.

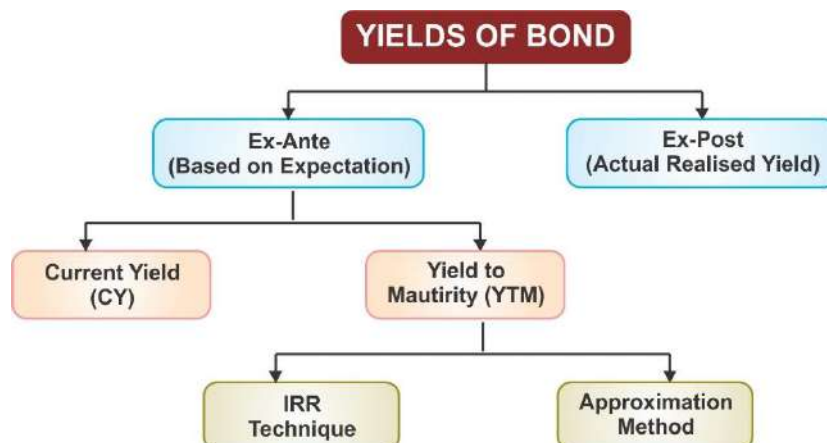
LOS 12: Holding Period Return (HPR) for Bonds

$$\text{HPR} = \frac{B_1 - B_0 + I_1}{B_0}$$

$$= \frac{B_1 - B_0}{B_0} + \frac{I_1}{B_0}$$

↓
↓

(Capital gain Yield/ Return) (Interest Yield /Current Yield)



LOS 13 : Calculation of Current Yield/ Interest Yield

$$\text{Current Yield} = \frac{\text{Annual Cash Coupon Payment}}{\text{Bond Price or Market Price}}$$

Note: Current Yield is always calculated on per annum basis.

1. If existing bond :-

B_0 = Current Market Price of Bond (1st preference)

Or

Present value Market Price of Bonds (2nd preference)

2. If new bond issued :-

B_0 = Issue Price

Issue Price = Face value – Discount + Premium

3. Company Point of view :-

B_0 = Net Proceeds

Net Proceeds = Face value – Discount + Premium (-) Floating Cost

LOS 14 : YTM (Yield to Maturity) / K_d / Cost of debt/ Market rate of Interest/ Market rate of return

- ❖ YTM is an annualized overall return on the bond if it is held till maturity.
- ❖ YTM is the IRR of a Bond
- ❖ It is the annualized rate of return on the investment that the investor expect (on the date of investment) to earn from the date of investment to the date of maturity. It is also referred to as required rate of return.

Alternative 1: By IRR technique.

$$B_0 = \frac{\text{Interest}}{(1+YTM)^1} + \frac{\text{Interest}}{(1+YTM)^2} + \dots + \frac{\text{Interest}}{(1+YTM)^n} + \frac{\text{Maturity value or Par value}}{(1+YTM)^n}$$

❖ YTM & price contain the same information

- If YTM given, calculate Price.
- If Price given, calculate YTM.

$$\text{YTM} = \text{Lower Rate} + \frac{\text{Lower Rate NPV} - \text{Higher Rate NPV}}{\text{Lower Rate NPV} - \text{Higher Rate NPV}} \times \text{Difference in Rate}$$

Alternative 2: By approximation formula

$$\text{YTM} = \frac{\text{Interest} + \frac{\text{Maturity Value} - \text{CMP}/B_0}{n}}{\frac{\text{Maturity Value} + \text{CMP}/B_0}{2}}$$

LOS 15 : YTM (Yield to Maturity) of Semi-Annual Bond

$$\text{YTM per 6 months} = \frac{\text{Interest for 6 months} + \frac{\text{Maturity Value} - \text{CMP}/B_0}{n \times 2}}{\frac{\text{Maturity Value} + \text{CMP}/B_0}{2}}$$

YTM per annum = YTM of 6 month × 2

LOS 16 : YTM of a Zero – Coupon Bond

$$\text{Bond value} = \frac{\text{Maturity Value}}{(1 + \text{YTM})^n}$$

- ❖ If YTM is given, calculate B_0 .
- ❖ If B_0 is given, Calculate YTM.

LOS 17 : YTM of a Perpetual Bond

$$\text{Bond value} = \frac{\text{Annual Interest}}{\text{YTM}}$$

- ❖ If YTM is given, calculate B_0 .
- ❖ If B_0 is given, Calculate YTM.

LOS 18 : Calculation of K_d in case of Floating Cost

- ❖ Floating Cost is cost associated with issue of new bonds.
e.g. Brokerage, Commission, etc
- ❖ We should take Bond value (B_0) Net of Floating Cost.

$$K_d = \frac{\text{Interest}(1 - \text{tax rate}) + \frac{\text{Maturity Value} - \text{Net Proceeds}}{n}}{\frac{\text{Maturity Value} + \text{Net Proceeds}}{2}}$$

LOS 19 : Treatment of Tax

Tax is important part for our analysis, it must be considered if it is given in question.
Two types of Tax rates are given :-

1. Interest Tax rate/ Normal Tax Rate

We should take Interest Net of Tax i.e. Interest Amount (1 – Tax)

2. Capital Gain Tax rate

Take Maturity value after Capital Gain Tax i.e. Maturity Value – Capital Gain Tax Amount
 Maturity value – (Maturity value – B_0) × Capital gain tax rate

$$YTM = \frac{\text{Interest}(1 - \text{Tax rate}) + \frac{\text{MV net of CG Tax} - B_0}{n}}{\frac{\text{MV net of CG Tax} + B_0}{2}}$$

LOS 20 : Yield to call (YTC) & Yield to Put (YTP)

1. Yield to Call

Callable Bond : When company call its bond or Re-purchase its bond prior to the date of Maturity.
Call Price: Price at which Bond will call by the Company.
Call Date: Date on which Bond is called by the Company prior to Maturity.
n : No. of Years upto Call Date.

$$YTC = \frac{\text{Interest} + \frac{\text{Call Price} - B_0}{n}}{\frac{\text{Call Price} + B_0}{2}}$$

2. Yield to Put

Puttable Bond: When investor sell their bonds prior to the date of maturity to the company.
Put Price: Price at which Bond will put/ Sell to the Company.
Put Date: Date on which Bond is sold by the investor prior to Maturity.
n : No. of years upto Put Date.

$$YTP = \frac{\text{Interest} + \frac{\text{Put Price} - B_0}{n}}{\frac{\text{Put Price} + B_0}{2}}$$

LOS 21 : Yield to worst

- ❖ It is the lowest yield between YTM, YTC, YTP, Yield to first call.
- ❖ Yield to worst is lowest among all.

LOS 22 : Conversion Value/ Stock Value of Bond

- ❖ Converted into equity shares after certain period.
- ❖ Conversion Ratio = No. of share Received per Convertible Bond
- ❖ When **Conversion Value > Bond value**, option can be exercised otherwise not.

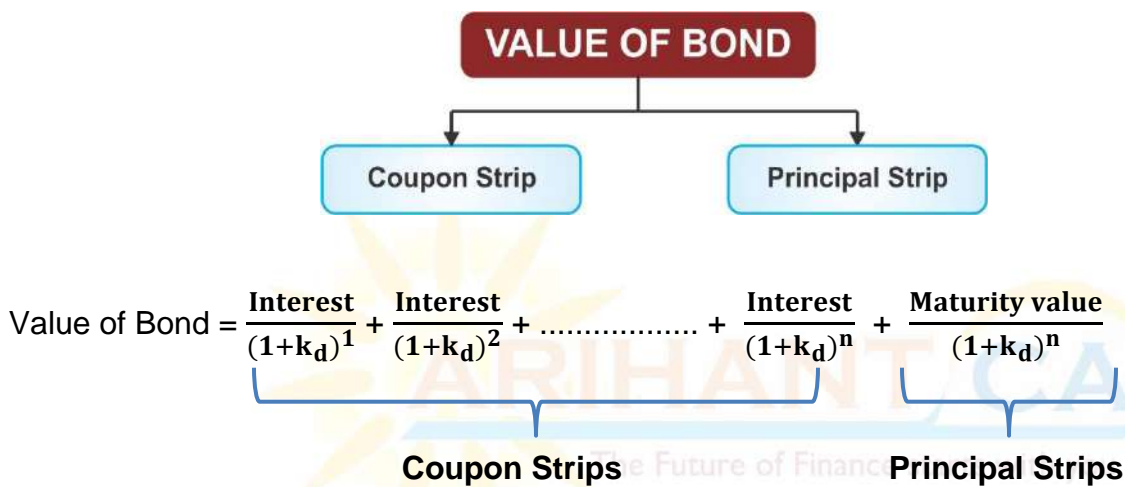
$$\text{Conversion Value} = \text{No. of equity shares issued} \times \text{MPS at the time of Conversion}$$

LOS 23 : Credit Rating Requirement

- ❖ As per SEBI regulation, no public or right issue of debt/bond instruments shall be made unless credit rating from credit rating agency has been obtained and disclosed in the offer document.
- ❖ Rating is based on the track record, financial statement, profitability ratios, debt – servicing capacity ratios, credit worthiness & risk associated with the company.
- ❖ Higher rated Bonds means low risk and a lower rated bond means high risk.
- ❖ Higher the risk higher will be the expectation and higher will be the discount rate.

LOS 24 : Strips (Separate Trading of Registered Interest & Principal Securities) Program

Under this, Strip the coupons from the principal, repackage the cash flows and sell them separately as Zero – Coupon Bonds, at discount.

**LOS 25 : Relationship between Coupon Rate & YTM**

Bonding Selling At	
Par	Coupon Rate = Yield to Maturity
Discount	Coupon Rate < Yield to Maturity
Premium	Coupon Rate > Yield to Maturity

LOS 26 : Cum Interest & Ex-interest Bond Value

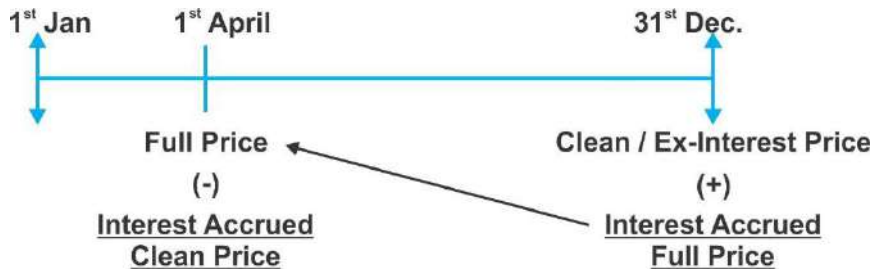
- ❖ When Bond value include amount of interest it is known as Cum-Interest Bond Value, other - wise not.
- ❖ If question is Silent, we will always assume ex-interest.
- ❖ Assume value of Bond (B_0) as ex – interest.
- ❖ If it is given Cum-Interest then deduct Interest and proceeds your calculations.

$$\text{Full Price} = \text{Clean Price} + \text{Interest accrued}$$

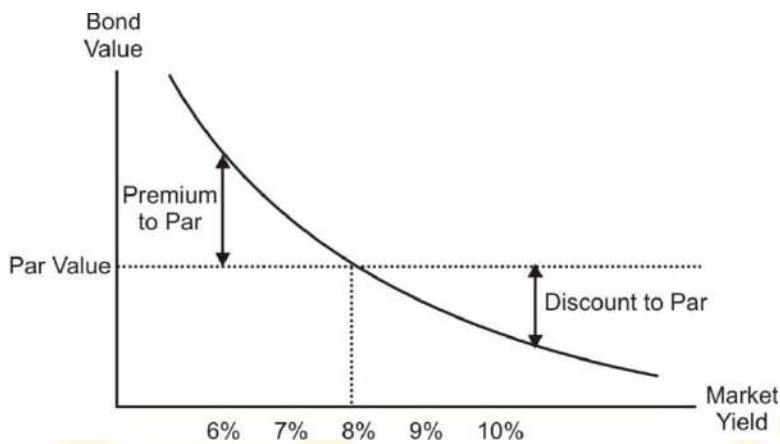
Or

$$\text{Cum - Interest Price} = \text{Ex - Interest Price} + \text{Interest Accrued}$$

Valuation of a Bond between two coupon dates



LOS 27 : Relationship between Bond Value & YTM



- ❖ When the coupon rate on a bond is equal to its market yield, the bond will trade at its par value.
- ❖ If yield required in the market subsequently rises, the price of the bond will fall & it will trade at a discount.
- ❖ If required yield falls, the bond price will increase and bond will trade at a premium.

Crux:

- ❖ If YTM increases, bond value decreases & vice-versa, other things remaining same.
- ❖ YTM & Bond value have inverse relationship.

Convexity of a Bond

- ❖ However, this relationship is not a straight line relationship but it is convex to the origin.
- ❖ So, we find that price rise is greater than price fall, we call it positive convexity (i.e. % rise is greater than % fall)

LOS 28 : Value of the Bond at the end of each Year

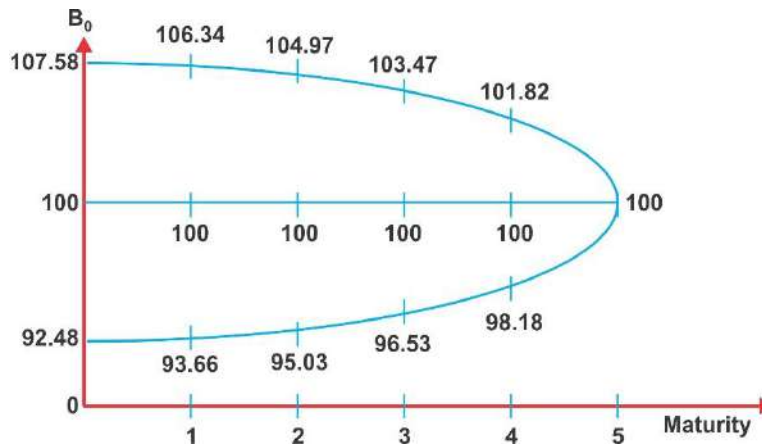
$$B_0 = \frac{B_1 + I_1}{(1 + YTM)^1}$$

$$B_1 = \frac{B_2 + I_2}{(1 + YTM)^1}$$

So on

LOS 29 : Relationship between Bond Value & Maturity

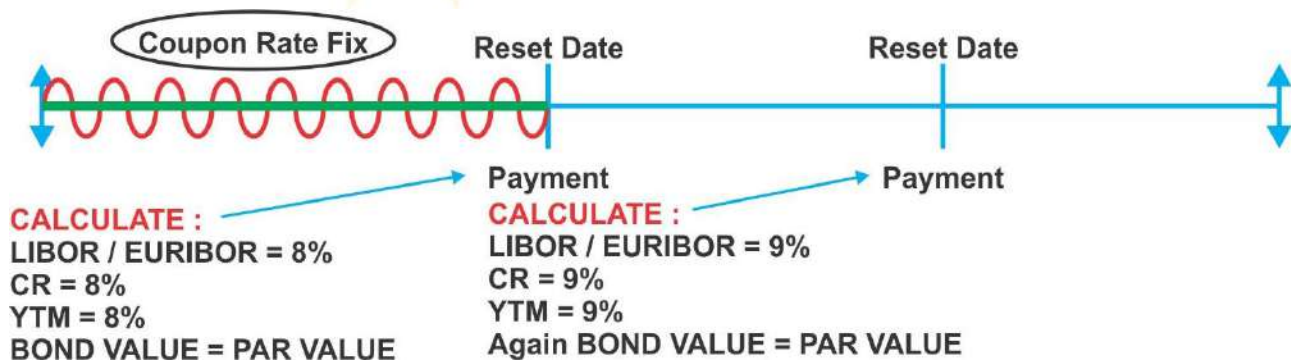
- ❖ Prior to Maturity, a bond can be selling at significant discount or premium to Par value.
- ❖ Regardless of its required yield, the price will converge to par value as Maturity approaches.
- ❖ Value of premium bond decrease to par value , value of Discount bond increases to Par value.
- ❖ Premium and discount vanishes.



LOS 30 : Floating Rate Bonds

- ❖ Floating Rate Bonds are those bonds where coupon rate is decided according to the Reference rate (Market Interest Rate).
- ❖ Coupon Rate should be changed with the change in Reference rate (Market Interest Rate).
- ❖ In this case

$$\text{Coupon Rate} = \text{YTM}$$



LOS 31 : Duration of a Bond (Macaulay Duration)

- ❖ Duration of the bond is a weighted average of the time (in years) until each cash flow will be received i.e. our initial investment is fully recovered.
- ❖ Duration is a measurement of how long in years it takes for the price of a bond to be repaid by its internal cash flows.
- ❖ Duration of bond will always be less than or equal to maturity years.

Duration =

$$\frac{1 \times \frac{\text{Interest}}{(1+YTM)^1} + 2 \times \frac{\text{Interest}}{(1+YTM)^2} + \dots + n \times \frac{\text{Interest}}{(1+YTM)^n} + n \times \frac{\text{Maturity value}}{(1+YTM)^n}}{CMP/B_0}$$

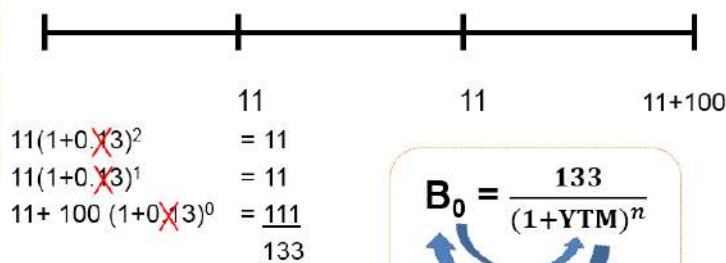
LOS 32 : Duration of a Zero - Coupon Bond

Duration of a Zero Coupon Bond will always be equal to its Maturity Years

LOS 33 : Relationship between Duration of Bond & YTM

- ❖ If YTM increases, Bond Value decreases so duration of the bond decreases (recovery is less) & vice versa.
- ❖ Higher the YTM, lower will be duration of a bond. Lower the YTM, higher will be duration of a bond, other things remaining constant.

LOS 34 : Calculation of yield when Coupon Payment is not available for Re-Investment



- If YTM is given, calculate B_0 .
- If B_0 is given, Calculate YTM.

LOS 35 : Modified Duration/ Sensitivity/ Volatility/ Effective Duration

- ❖ Volatility measures the sensitivity of interest rate to bond prices.
- ❖ Duration of a bond can be used to estimate the price sensitivity. It can be calculated through below formula.
- ❖ Modified duration will always be lower than Macaulay's Duration.
- ❖ Volatility measures the % change in the bond value with 1% change in YTM.

Example:

If Volatility is 5%, it means if YTM increases by 1% bond value will decrease by 5% or vice versa.

Method 1:

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{1 + YTM}$$

Method 2:

$$\text{Effective Duration} = \frac{BV_{-\Delta Y} - BV_{+\Delta Y}}{2 \times BV_0 \times \Delta Y}$$

Convexity Adjustment

As mentioned above duration is a good approximation of the percentage of price change for a small change in interest rate. However, the change cannot be estimated so accurately of convexity effect as duration base estimation assumes a linear relationship.

This estimation can be improved by adjustment on account of 'convexity'. The formula for convexity is as follows:

$$C^* \times (\Delta y)^2 \times 100$$

Δy = Change in Yield

$$C^* = \frac{V_+ + V_- - 2V_0}{2V_0(\Delta^2)}$$

V_0 = Initial Price

V_+ = price of Bond if yield increases by Δy

V_- = price of Bond if yield decreases by Δy

LOS 36 : Ratios related to Convertible Bond1. Conversion Premium/ Premium over Conversion Value

$$= \frac{\text{Market value of Convertible bond} - \text{CV (No. of Shares} \times \text{MPS)}}{\text{CV (No. of Shares} \times \text{MPS)}}$$

$$\% \text{ Conversion Premium} = \frac{\text{Conversion Premium}}{\text{Conversion Value}}$$

2. Conversion Premium per share

$$= \frac{\text{Conversion Premium}}{\text{Conversion Ratio}}$$

3. Conversion Parity Price/ No Gain No Loss / Market Conversion Price

When the market value of convertible bond = Conversion Value.

$$= \frac{\text{Market value of Convertible bond}}{\text{No. of equity share issued on Conversion}}$$

OR

$$= \text{Current MPS} + \text{Conversion Premium per share}$$

4. Premium Pay Back Period or Break Even Period of Convertible Bond

It is a time period, when bond would be converted into equity share so that the loss on conversion would be set-off by income from interest.

$$\text{Break Even Period} = \frac{\text{Conversion Premium}}{\text{Favourable Income Differential}}$$

OR

$$= \frac{\text{Market Price of Bond} - \text{Conversion Value}}{\text{Interest on Bond} - \text{Dividend on Share}}$$

5. Downside Risk or Premium over Non-Convertible Bond

Downside Risk reflects the extent of decline in market value of convertible bonds at which conversion option become worthless.

$$= \text{Market value of Convertible bond} \\ (-) \\ \text{Market value of Non- Convertible bond}$$

$$\% \text{ Downside Risk/ \% Price Decline} = \frac{\text{Downside Risk}}{\text{Market value of Non-convertible bond}}$$

6. Premium Over Investment Value of Non-Convertible bond / MV of NCB :

$$= \frac{\text{Market Price of CB} - \text{Investment Value} / \text{MV of Non-Convertible Bond}}{\text{Investment Value} / \text{MV of Non-Convertible Bond}}$$

7. Floor Value : Floor Value is the maximum of :

- a) Conversion Value
- b) Market Value of Non-Convertible Bond.

Note: Market Value of Convertible Bond (Assume 5 Years)

$$= \frac{\text{Interest}}{(1+YTM)^1} + \frac{\text{Interest}}{(1+YTM)^2} + \dots + \frac{\text{Interest}}{(1+YTM)^5} + \frac{\text{Conversion Value (CV}_5\text{)}}{(1+YTM)^5}$$

$$\text{CV}_5 = \text{MPS at the end of Year 5} \times \text{No. of Shares.}$$

LOS 37: Callable Bond

Those bonds which can be called before the date of Maturity.

Step 1 : Calculate Net Initial Outflow.

Step 2 : Calculate Tax Saving on Call Premium & Unamortized Issue Cost.

Step 3 : Calculate Annual Saving on Cash Outflow.

Step 4 : Calculation of Overlapping Interest

Step 5: Calculate Present Value of Total Net Savings by replacing Outstanding Bonds with New Bonds.

LOS 38: Spot Rate

- ❖ Yield to maturity is a single discount rate that makes the present value of the bond's promised cash flow equal to its Market Price.
- ❖ The appropriate discount rates for individual future payments are called Spot Rate.
- ❖ Discount each cash flow using a discount rate i.e. specific to the maturity of each cash flow.

LOS 39: Relationship between Forward Rate and Spot Rate

Forward Rate is a borrowing/ landing rate for a loan to be made at some future date.

${}_1f_0$ = Spot Rate or Current YTM (rate of 1 year loan)

${}_1f_1$ = Rate for a 1 year loan, one year from now

${}_1f_2$ = Rate for a 1 year loan to be made two years from now

Relationship:

$$(1+S_1)^1 = (1 + {}_1f_0)$$

$$(1+S_2)^2 = (1 + {}_1f_0) (1 + {}_1f_1)$$

$$\text{Or } S_2 = \{(1 + {}_1f_0) (1 + {}_1f_1)\}^{1/2} - 1$$

$$(1 + S_3)^3 = (1+{}_1f_0) (1+ {}_1f_1) (1 + {}_1f_2)$$

$$\text{Or } S_3 = \{(1 + {}_1f_0) (1 + {}_1f_1) (1 + {}_1f_2)\}^{1/3} - 1$$

LOS 40 : Calculation of After-tax yield of a taxable security & tax-equivalent yield of a tax-exempt security

$$\text{After-tax yield} = \text{taxable yield} \times (1 - \text{marginal tax rate})$$

Taxable-equivalent yield is the yield a particular investor must earn on a taxable bond to have the same after-tax return they would receive from a particular tax-exempt issue.

$$\text{Taxable-equivalent yield} = \frac{\text{tax-free yield}}{(1 - \text{marginal tax rate})}$$

LOS 41 : Duration of a Portfolio

It is simply the weighted average of the durations of the individual securities in the Portfolio.

$$\text{Portfolio Duration} = W_1D_1 + W_2D_2 + W_3D_3 + \dots + W_nD_n$$

$$W_i = \frac{\text{Market value of bond } i}{\text{Market value of Portfolio}}$$

D_i = Duration of bond (i)

N = No. Of bonds in the Portfolio

Note :

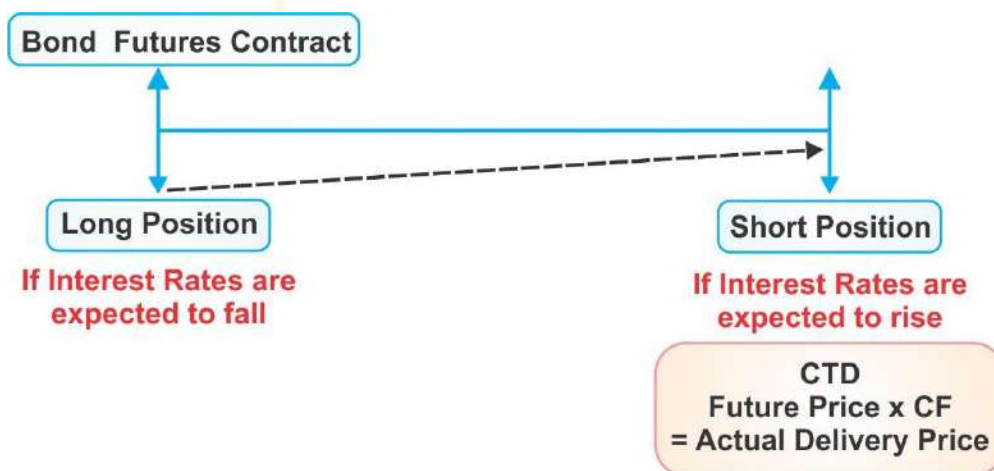
- ❖ Other factors are constant, Long term bonds are more volatile than Short term bonds.

- ❖ Other factors are constant, Lower coupon bonds are more volatile than Higher coupon bonds.
- ❖ Other factors are constant, Lower Yield bonds are more volatile than Higher Yield bonds.

LOS 42 : Interest Rate anticipation Strategy

Bond Portfolio Management	
Interest Rate is expected to Fall	Interest Rate is expected to Rise
↓	↓
Bond Price are expected to Rise	Bond Prices are expected to Fall
↓	↓
To Profit from the same, portfolio duration should be increased by shifting from Short Term Bonds to the Long Term Bonds	To Protect / Hedge against the same, portfolio duration should be decreased by shifting from Long Term Bonds to the Short Term Bonds

LOS 43: Hedging Interest Rate Risk using Bond Futures



Profit of seller of futures

= (Futures Settlement Price x Conversion factor) – Quoted Spot Price of Deliverable Bond

Loss of Seller of futures

= Quoted Spot Price of deliverable bond – (Futures Settlement Price x Conversion factor)

An interest rate future is a contract between the buyer and seller agreeing to the future delivery of any interest-bearing asset. The interest rate future allows the buyer and seller to lock in the price of the interest-bearing asset for a future date.

Interest rate futures are used to hedge against the risk that interest rates will move in an adverse direction, causing a cost to the company.

For example, borrowers face the risk of interest rates rising. Futures use the inverse relationship between interest rates and bond prices to hedge against the risk of rising interest rates.

A borrower will enter to sell a future today. Then if interest rates rise in the future, the value of the future will fall (as it is linked to the underlying asset, bond prices), and hence a profit can be made when closing out of the future (i.e. buying the future).

Bonds form the underlying instruments, not the interest rate. Further, IRF, settlement is done at two levels:

- ❖ Mark-to-Market settlement done on a daily basis and
- ❖ physical delivery which happens on any day in the expiry month.

Final settlement can happen only on the expiry date. In IRF following are two important terms:

a) **Conversion factor**: All the deliverable bonds have different maturities and coupon rates. To make them comparable to each other, RBI introduced Conversion Factor.

$(\text{Conversion Factor}) \times (\text{futures price}) = \text{actual delivery price for a given deliverable bond.}$

b) **Cheapest to Deliver (CTD)** : It is called CTD bond because it is the least expensive bond in the basket of deliverable bonds.

Profit & Loss = the difference between cost of acquiring the bonds for delivery and the price received by delivering the acquired bond.



Portfolio Management

Study Session 11

LOS 1 : Introduction

- ❖ **Portfolio** means combination of various underlying assets like bonds, shares, commodities, etc.
- ❖ **Portfolio Management** refers to the process of selection of a bundle of securities with an objective of maximization of return & minimization of risk.

Steps in Portfolio Management Process

- ❖ **Planning:** Determine Client needs and circumstances, including the client's return objectives, risk tolerance, constraints and preferences. Create, and then periodically review and Update, an investment policy statement (IPS) that spells out these needs and Circumstances.
- ❖ **Execution:** Construct the client portfolio by determining suitable allocations to various asset classes and on expectations about macroeconomic variables such as inflation, interest rates and GDP Growth (top-down analysis). Identify attractive price securities within an asset class for client portfolios based on valuation estimates from security analysis (bottom-up analysis).
- ❖ **Feedback:** Monitor and rebalance the portfolio to adjust asset class allocations and securities holdings in response to market performance. Measure & report performance relative to the performance benchmark specified in the IPS.

LOS 2 : Major return Measures

(i) Holding Period Return (HPR) :

HPR is simply the percentage increase in the value of an investment over a given time period.

$$\text{HPR} = \frac{\text{Price at the end} - \text{price at the beggining} + \text{Dividend}}{\text{price at the beggining}}$$

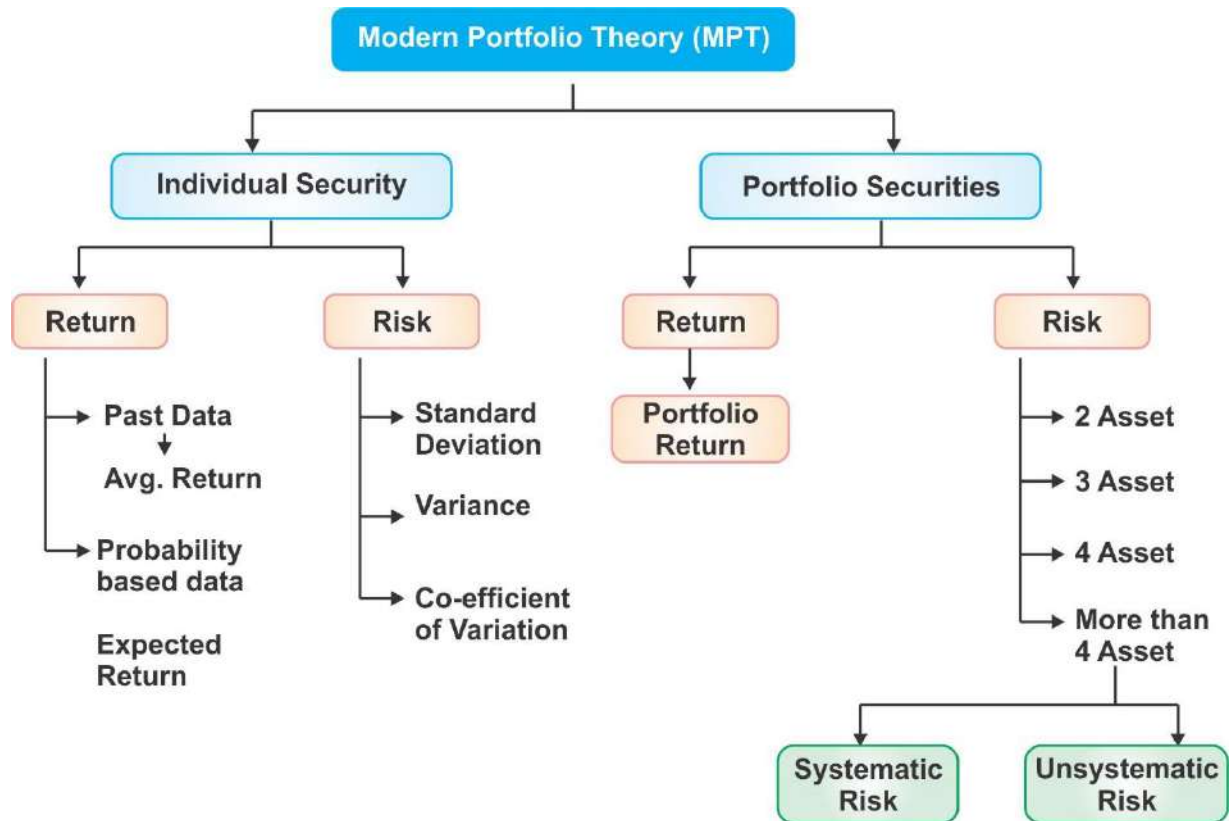
(ii) Arithmetic Mean Return (AMR) :

It is the simple average of a series of periodic returns.

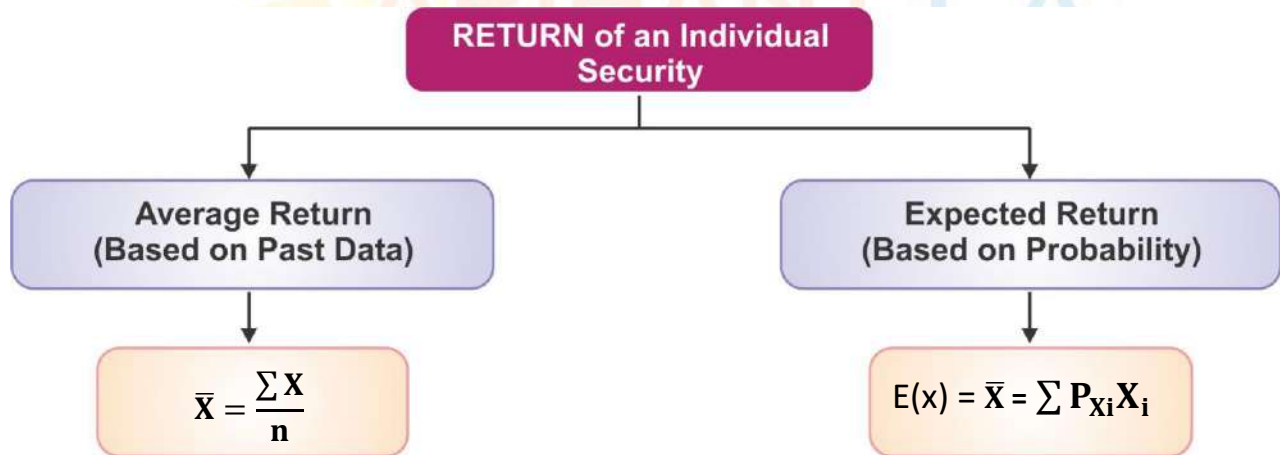
$$\text{Average Return} = \frac{R_1 + R_2 + R_3 + R_4 + \dots + R_n}{n}$$

(iii) Geometric Mean Return (GMR) :

$$\text{GMR} = \sqrt[n]{(1 + R_1)(1 + R_2)(1 + R_3)(1 + R_4) \dots \dots (1 + R_n)} - 1$$

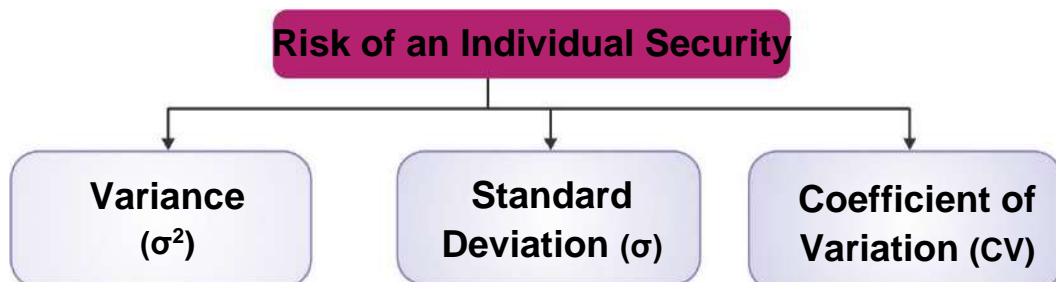


LOS 3 : Calculation of Return of an individual security

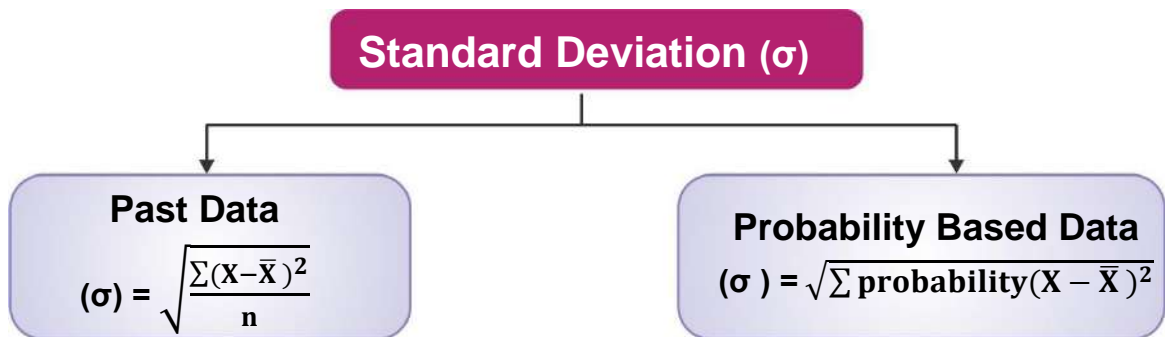


LOS 4 : Calculation of Risk of an individual security

Risk of an individual security will cover under following heads:



1. **Standard Deviation of Security (S.D)** :- (S.D) or σ (sigma) is a measure of total risk / investment risk.

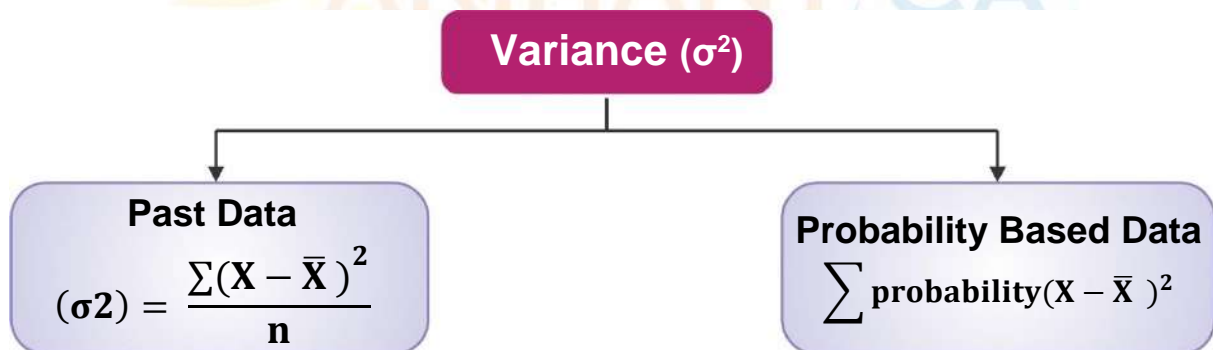


Note:

- ❖ For sample data, we may use (n-1) instead of n in some cases.
 x = Given Data, \bar{X} = Average Return, n = No. of events/year
- ❖ $\sum(X - \bar{X})$ will always be Zero (for Past Data)
- ❖ $\sum(X - \bar{X})$ may or may not be Zero in this case. (for Probability Based Data)
- ❖ S.D can never be negative. It can be zero or greater than zero.
- ❖ S.D of risk-free securities or government securities or U.S treasury securities is always assumed to be zero unless, otherwise specified in question.

Decision: Higher the S.D, Higher the risk and vice versa.

2. **Variance**



Decision:

Higher the Variance, Higher the risk and vice versa.

3. **Co-efficient of Variation (CV) :**

CV is used to measure the risk (variable) per unit of expected return (mean)

$$CV = \frac{\text{Standard Deviation of X}}{\text{Average/Expected value of X}}$$

Decision:

Higher the C.V, Higher the risk and vice versa.

LOS 5 : Rules of Dominance in case of an individual Security or when two securities are given

Rule No. 1: For a given 2 securities, given same S.D or Risk, select that security which gives higher return

	X Ltd.	Y Ltd.
σ	5	5
Return	10	15

Decision: Select Y. Ltd.

Rule No. 2: For a given 2 securities, given same return, select which is having lower risk in comparison to other.

	X Ltd.	Y Ltd.
σ	5	10
Return	15	15

Decision Select X. Ltd.

Rule No. 3:

	X Ltd.	Y Ltd.
σ	5	10
Return	10	25

Decision: Based on CV (Co-efficient of Variation).

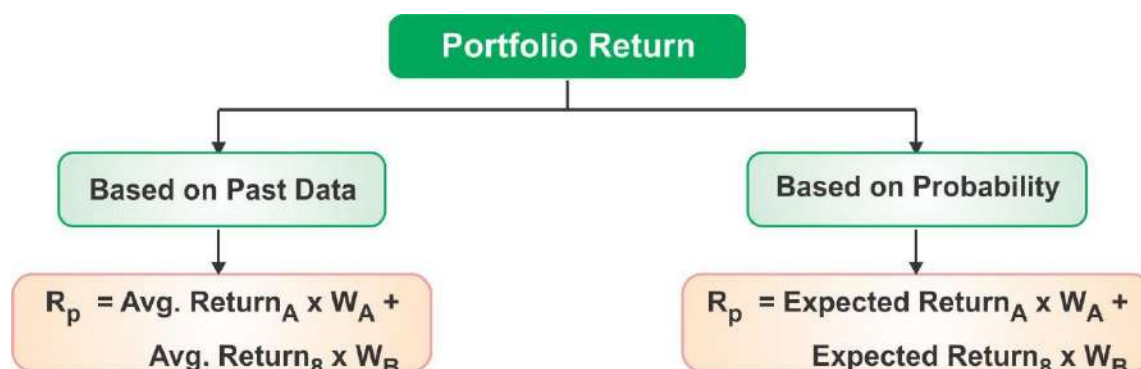
When Risk and return are different, decision is based on CV.

$$CV_x = 5/10 = 0.50 \quad CV_y = 10/25 = 0.40$$

Decision:- Select Y. Ltd.

LOS 6 : Calculation of Return of a Portfolio of assets

It is the weighted average return of the individual assets/securities.



Where, $W_i = \frac{\text{Market Value of investments in asset}}{\text{Market Value of the Portfolio}}$

Sum of the weights must always =1 i.e. $W_A + W_B = 1$

LOS 7 : Risk of a Portfolio of Assets**1. Standard Deviation of a Two-Asset Portfolio**

$$\sigma_{1,2} = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2\sigma_1 w_1 \sigma_2 w_2 r_{1,2}}$$

where

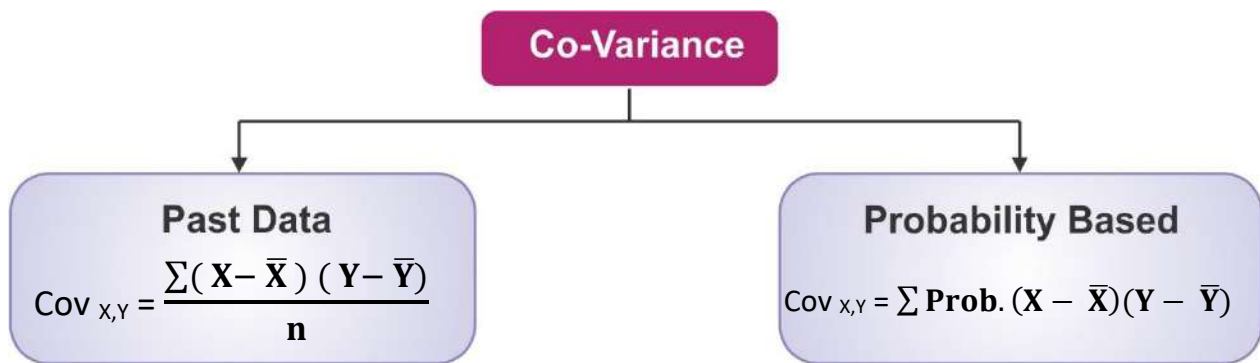
$r_{1,2}$ = Co-efficient of Co-relation

w_1 = Weight of Security 1

σ_1 = S.D of Security 1

w_2 = Weight of Security 2

σ_2 = S.D of Security 2

2. Variance of a Two-Asset Portfolio = (SD)²**3. Co-Variance**

X = Return on Asset 1

\bar{X} = mean return on Asset 1

n = No. of Period

Y = Return on Asset 2

\bar{Y} = mean return on Asset 2

Co-variance measures the extent to which two variables move together over time.

- ❖ A positive co-variance's means variables (e.g. Rates of return on two stocks) are trend to move together.
- ❖ Negative co-variance means that the two variables trend to move in opposite directions.
- ❖ A co-variance of Zero means there is no linear relationship between the two variables.
- ❖ Co-Variance or Co-efficient of Co-relation between risk-free security & risky security will always be zero.

4. Co-efficient of Correlation

$$r_{1,2} = \frac{\text{Cov}_{1,2}}{\sigma_1 \sigma_2}$$

Or

$$\text{Cov}_{1,2} = r_{1,2} \sigma_1 \sigma_2$$

Or

$$\text{S.D of two-asset Portfolio } (\sigma_{1,2}) = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2w_1 w_2 \text{COV}_{1,2}}$$

- ❖ The correlation co-efficient has no units. It is a pure measure of co-movement of the two stock's return and is bounded by -1 and +1.
- ❖ +1 means that deviations from the mean or expected return are always proportional in the same direction, They are perfectly Positively Correlated. It is a case of maximum Portfolio risk.
- ❖ -1 means that deviation from the mean or expected values are always proportional in opposite directions. They are perfectly negatively correlated. It is a case of minimum portfolio risk.
- ❖ A correlation coefficient of ZERO means no linear relationship between the two stock's return.

LOS 8 : Portfolio risk as Correlation varies

Example:

Consider 2 risky assets that have return variance of 0.0625 and 0.0324, respectively. The assets standard deviation of returns are then 25% and 18%, respectively. Calculate standard deviations of portfolio returns for an equal weighted portfolio of the two assets when their correlation of return is 1, 0.5, 0, -0.5, -1.

Solution:

$$\sigma_{\text{portfolio}} = \sqrt{\sigma_1^2 w_1^2 + \sigma_2^2 w_2^2 + 2\sigma_1 w_1 \sigma_2 w_2 r_{1,2}} = \sqrt{(\sigma_1 w_1 + \sigma_2 w_2)^2}$$

r = correlation = +1

$$\sigma_{\text{portfolio}} = w_1 \sigma_1 + w_2 \sigma_2$$

$$\sigma = \text{portfolio standard deviation} = 0.5(25\%) + 0.5(18\%) = 21.5\%$$

r = correlation = 0.5

$$\sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.0324 + 2(0.5)(0.5)(0.5)(0.25)(0.18)} = 18.70\%$$

r = correlation = 0

$$\sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.0324} = 15.40\%$$

r = correlation = (-) 0.5

$$\sigma = \sqrt{(0.5)^2 0.0625 + (0.5)^2 0.0324 + 2(0.5)(0.5)(-0.5)(0.25)(0.18)} = 11.17\%$$

r = correlation = -1

$$\sigma_{\text{portfolio}} = w_1 \sigma_1 - w_2 \sigma_2$$

$$\sigma = \text{portfolio standard deviation} = 0.5(25\%) - 0.5(18\%) = 3.5\%$$

Note:

- ❖ The portfolio risk falls as the correlation between the asset's return decreases.
- ❖ The lower the correlation of assets return, the greater the risk reduction (diversification) benefit of combining assets in a portfolio.
- ❖ If assets return when perfectly negatively correlated, portfolio risk could be minimum.

❖ If assets return when perfectly positively correlated, portfolio risk could be maximum.

Portfolio Diversification refers to the strategy of reducing risk by combining many different types of assets into a portfolio. Portfolio risk falls as more assets are added to the portfolio because not all assets prices move in the same direction at the same time. Therefore, portfolio diversification is affected by the:

- Correlation between assets:** Lower correlation means greater diversification benefits.
- Number of assets included in the portfolio:** More assets means greater diversification benefits.

LOS 9 : Standard-deviation of a 3-asset Portfolio

$$\sigma_{1,2,3} = \sqrt{\sigma_1^2 W_1^2 + \sigma_2^2 W_2^2 + \sigma_3^2 W_3^2 + 2 \sigma_1 \sigma_2 W_1 W_2 r_{1,2} + 2 \sigma_1 \sigma_3 W_1 W_3 r_{1,3} + 2 \sigma_2 \sigma_3 W_2 W_3 r_{2,3}}$$

Or

$$\sigma_{1,2,3} = \sqrt{\sigma_1^2 W_1^2 + \sigma_2^2 W_2^2 + \sigma_3^2 W_3^2 + 2 W_1 W_2 \text{Cov}_{1,2} + 2 W_1 W_3 \text{Cov}_{1,3} + 2 W_2 W_3 \text{Cov}_{2,3}}$$

Portfolio consisting of 4 securities

$$\sigma_{1,2,3,4} = \sqrt{\sigma_1^2 W_1^2 + \sigma_2^2 W_2^2 + \sigma_3^2 W_3^2 + \sigma_4^2 W_4^2 + 2 \sigma_1 \sigma_2 W_1 W_2 r_{1,2} + 2 \sigma_2 \sigma_3 W_2 W_3 r_{2,3} + 2 \sigma_3 \sigma_4 W_3 W_4 r_{3,4} + 2 \sigma_4 \sigma_1 W_4 W_1 r_{4,1} + 2 \sigma_2 \sigma_4 W_2 W_4 r_{2,4} + 2 \sigma_1 \sigma_3 W_1 W_3 r_{1,3}}$$

LOS 10 : Standard Deviation of Portfolio consisting of Risk-free security & Risky Security

A = Risky Security

B = Risk-free Security

We know that S.D of Risk-free security is ZERO.

$$\sigma_{A,B} = \sqrt{\sigma_A^2 W_A^2 + \sigma_B^2 W_B^2 + 2 \sigma_A W_A \sigma_B W_B r_{A,B}} = \sqrt{\sigma_A^2 W_A^2 + 0 + 0}$$

$$\sigma_{A,B} = \sigma_A W_A$$

LOS 11 : Calculation of Portfolio risk and return using Risk-free securities and Market Securities

❖ Under this we will construct a portfolio using risk-free securities and market securities.

Case 1: Investment 100% in risk-free (R_f) & 0% in Market

[S.D of risk free security is always 0(Zero).]

Risk = 0%
Return = risk-free return

Case 2: Investment 0% in risk-free (RF) & 100% in Market

$$\begin{aligned} \text{Risk} &= \sigma_m \\ \text{Return} &= R_m \end{aligned}$$

Case 3: Invest part of the money in Market & part of the money in Risk-free (σ of RF = 0)

$$\begin{aligned} \text{Return} &= R_m W_m + R_F W_{RF} \\ \text{Risk of the portfolio} &= \sigma_m \times W_m \end{aligned}$$

Case 4: Invest more than 100% in market portfolio. Addition amount should be borrowed at risk-free rate.

Let the additional amount borrowed weight = x

$$\begin{aligned} \text{Return of Portfolio} &= R_m \times (1+x) - R_F \times x \\ \text{Risk of Portfolio} &= \sigma_m \times (1+x) \end{aligned}$$

LOS 12 : Optimum Weights

For Risk minimization, we will calculate optimum weights.

$$\begin{aligned} W_A &= \frac{\sigma_B^2 - \text{Covariance (A,B)}}{\sigma_A^2 + \sigma_B^2 - 2 \times \text{Covariance (A,B)}} \\ W_B &= 1 - W_A \text{ (Since } W_A + W_B = 1) \end{aligned}$$

We know that

$$\text{Covariance (A,B)} = r_{A,B} \times \sigma_A \times \sigma_B$$

LOS 13 : CAPM (Capital Asset Pricing Model)**For Individual Security:**

The relationship between Beta (Systematic Risk) and expected return is known as CAPM.
Required return/ Expected Return

$$= \text{Risk-free Return} + \frac{\text{Beta security}}{\text{Beta Market}} (\text{Return Market} - \text{Risk free return})$$

OR

$$E(R) = R_f + \beta_s (R_m - R_f)$$

Note:

- ❖ **Market Beta is always assumed to be 1.**
- ❖ Market Beta is a benchmark against which we can compare beta for different securities and portfolio.
- ❖ **Standard Deviation & Beta of risk free security is assumed to be Zero (0) unless otherwise stated.**
- ❖ $R_m - R_f =$ Market Risk Premium.

- ❖ If Return Market (R_m) is missing in equation, it can be calculated through HPR (Holding Period Return)
- ❖ R_m is always calculated on the total basis taking all the securities available in the market.
- ❖ Security Risk Premium = $\beta (R_m - R_f)$

For Portfolio of Securities:

Required return/ Expected Return = $R_f + \beta_{\text{Portfolio}} (R_m - R_f)$

LOS 14 : Decision Based on CAPM

Case	Decision	Strategy
CAPM Return > Estimated Return/ HPR	Over-Valued	Sell
CAPM Return < Estimated Return/ HPR	Under-Valued	Buy
CAPM Return = Estimated Return/ HPR	Correctly Valued	Buy, Sell or Ignore

- ❖ CAPM return need to be calculated by formula, $R_f + \beta (R_m - R_f)$
- ❖ Actual return / Estimated return can be calculated through HPR (Through data given)

LOS 15 : Interpret Beta/ Beta co-efficient / Market sensitivity Index

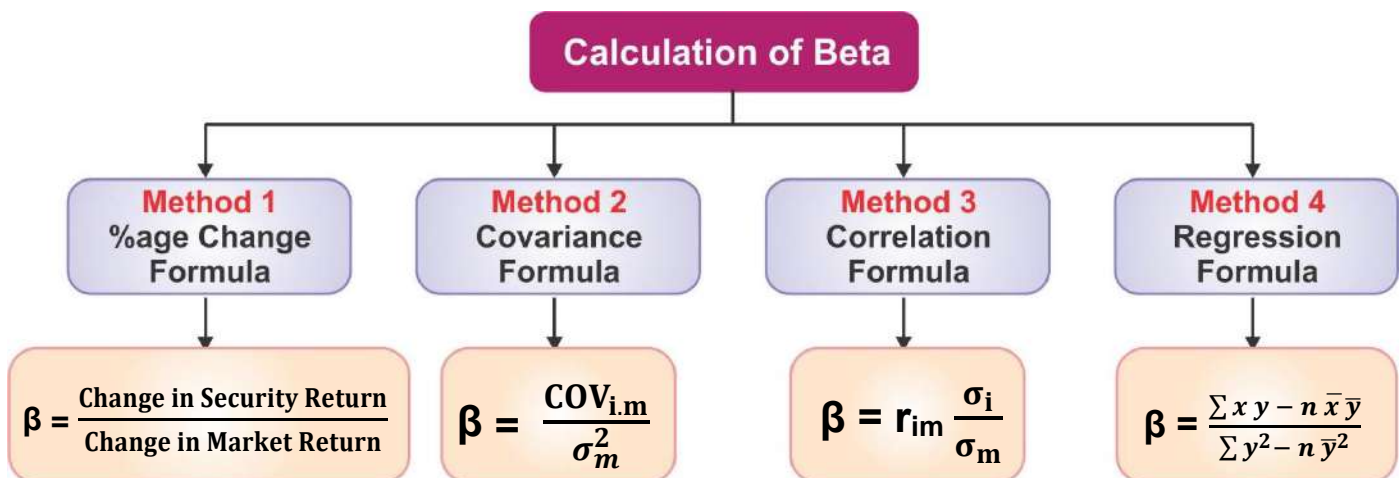
The sensitivity of an asset's return to the return on the market index in the context of market return is referred to as its Beta.

Note:

- ❖ Beta is a measure of Systematic Risk.
- ❖ However, Beta is not equal to Systematic Risk.

Example:

If Beta = 2, it means when market increases by 1%, security will increase by 2% and if market decrease by 1%, security will decrease by 2%.



Calculation of Beta**1. Beta Calculation with % change Formulae**

$$\text{Beta} = \frac{\text{Change in Security Return}}{\text{Change in Market Return}}$$

Note:

- ❖ This equation is normally applicable when two return data is given.
- ❖ In case more than two returns figure are given, we apply other formulas.

2. Beta of a security with Co-variance Formulae

$$\beta = \frac{\text{Co-variance of Asset i's return with the market return}}{\text{Variance of the Market Return}} = \frac{\text{COV}_{i,m}}{\sigma_m^2}$$

3. Beta of a security with Correlation Formulae

We know that Correlation Co-efficient (r_{im}) = $\frac{\text{COV}_{i,m}}{\sigma_i \sigma_m}$

to get $\text{Cov}_{im} = r_{im} \sigma_i \sigma_m$

Substitute Cov_{im} in β equation, We get $\beta_i = \frac{r_{im} \sigma_i \sigma_m}{\sigma_m^2}$

$$\beta = r_{im} \frac{\sigma_i}{\sigma_m}$$

4. Beta of a security with Regression Formulae

$$\beta = \frac{\sum xy - n \bar{x} \bar{y}}{\sum y^2 - n \bar{y}^2}$$

x = Security Return

y = Market Return

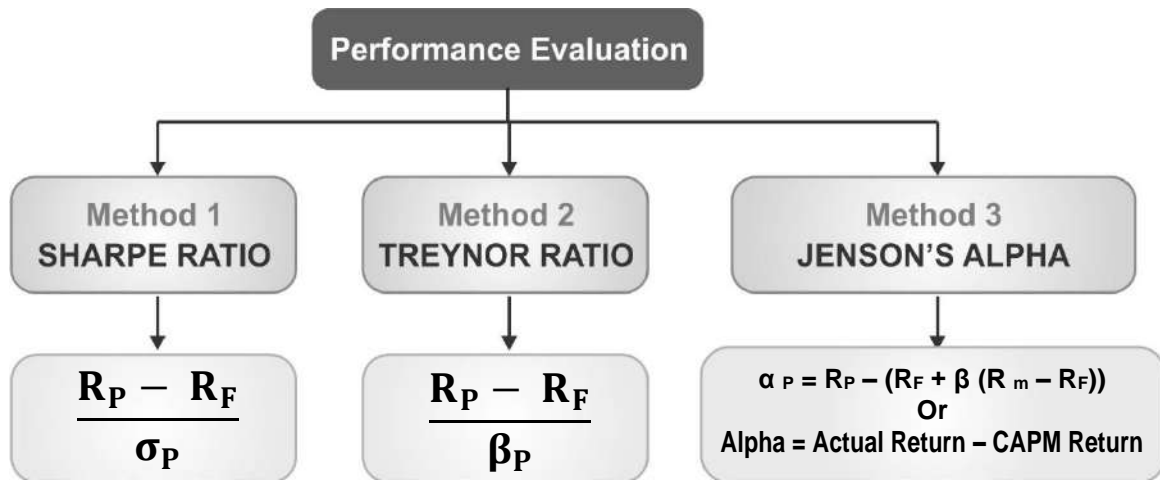
Note: Advisable to use Co-Variance formula to calculate Beta.
(Solve Question NO. 9B by using Regression Formulae)

LOS 16 : Beta of a portfolio

It is the weighted average beta of individual security.

$$\text{Beta of Portfolio} = \text{Beta}_{X \text{ Ltd.}} \times W_{X \text{ Ltd.}} + \text{Beta}_{Y \text{ Ltd.}} \times W_{Y \text{ Ltd.}}$$

Where, $W_i = \frac{\text{Market Value of investments in asset}}{\text{Market Value of the Portfolio}}$

LOS 17 : Evaluation of the performance of a portfolio (Also used in Mutual Fund)**1. Sharpe's Ratio (Reward to Variability Ratio):**

- ❖ It is excess return over risk-free return per unit of total portfolio risk.
- ❖ Higher Sharpe Ratio indicates better risk-adjusted portfolio performance.

$$\text{Sharpe's Ratio} = \frac{R_P - R_F}{\sigma_P}$$

Where R_P = Return Portfolio
 σ_P = S.D of Portfolio

Note:

- ❖ Sharpe Ratio is useful when Standard Deviation is an appropriate measure of Risk.
- ❖ The value of the Sharpe Ratio is only useful for comparison with the Sharpe Ratio of another Portfolio.

2. Treynor's Ratio (Reward to Volatility Ratio):

Excess return over risk-free return per unit of Systematic Risk (β)

$$\text{Treynor's Ratio} = \frac{R_P - R_F}{\beta_P}$$

Decision: Higher the ratio, Better the performance.

3. Jenson's Measure/Alpha:

This is the difference between a fund's actual return & CAPM return

$$\alpha_P = R_P - (R_F + \beta (R_m - R_F))$$

Or

$$\text{Alpha} = \text{Actual Return} - \text{CAPM Return}$$

It is excess return over CAPM return.

- ❖ If Alpha is +ve, performance is better.
- ❖ If Alpha is -ve, performance is not better.

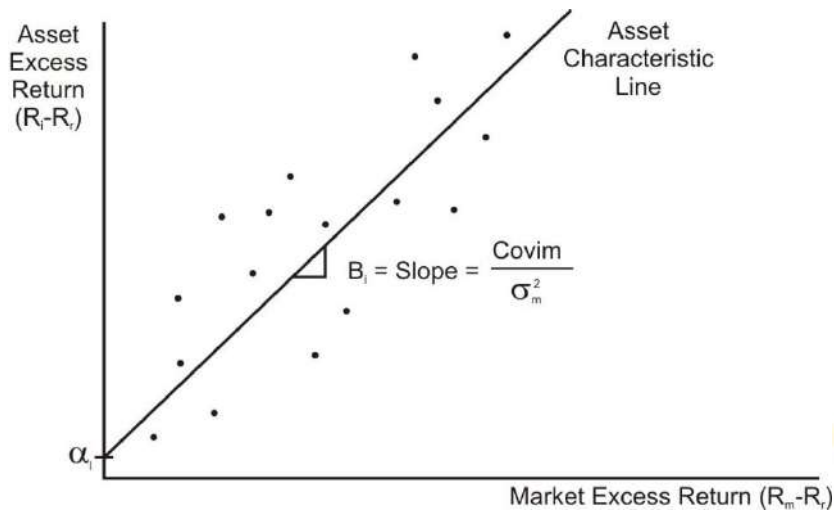
4. Market Risk - return trade – off:

Excess return of market over risk-free return per unit of total market risk.

$$\frac{R_M - R_F}{\sigma_M}$$

LOS 18 : Characteristic Line (CL)

Characteristic Line represents the relationship between Asset excess return and Market Excess return.



Equation of Characteristic Line:

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

Where $Y =$ Average return of Security

$X =$ Average Return of Market

$\alpha =$ Intercept i.e. expected return of an security when the return from the market portfolio is ZERO, which can be calculated as $Y - \beta \times X = \alpha$

$\beta =$ Beta of Security

Note:

The slope of a Characteristic Line is $\frac{COV_{i,M}}{\sigma_M^2}$ i.e. Beta

LOS 19 : New Formula for Co-Variance using Beta

$$(Cov_{A,B}) = \beta_A \times \beta_B \times \sigma^2_m$$

LOS 20 : New Formula for Correlation between 2 stocks

Correlation between A & B

$$r_{AB} = r_{A, Mkt.} \times r_{B, Mkt.}$$

LOS 21 : Co-variance of an Asset with itself is its Variance

Cov (m,m) = Variance m

Co-variance Matrix

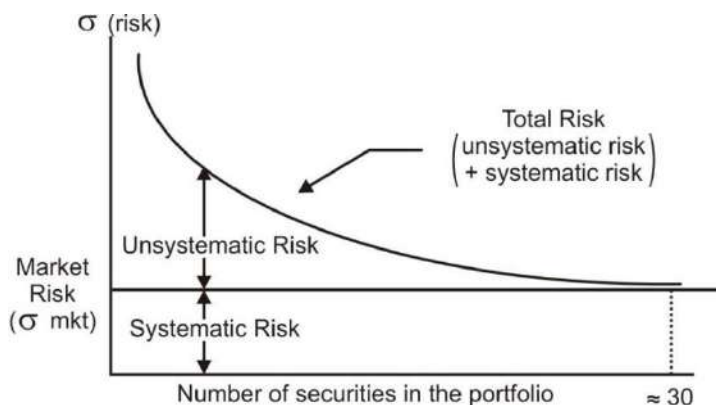
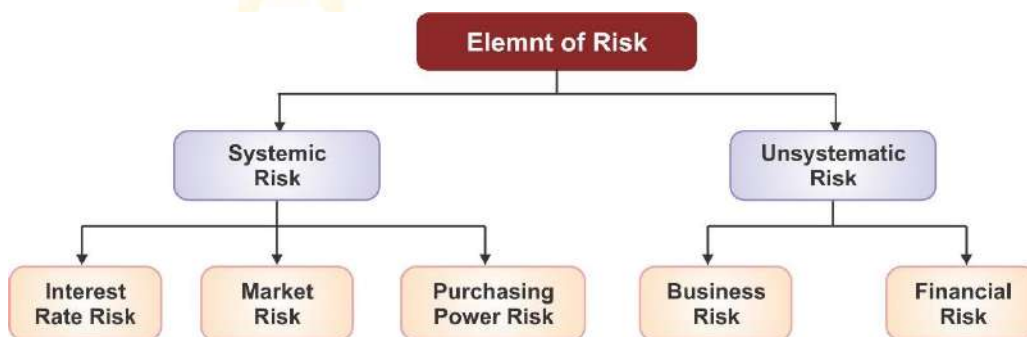
COV	A	B	C
A	σ_A^2	COV _{AB}	COV _{AC}
B	COV _{BA}	σ_B^2	COV _{BC}
C	COV _{CA}	COV _{CB}	σ_C^2

LOS 22 : Correlation of an Asset with itself is = 1

r (A,A) = 1

Correlation Matrix

or	A	B	C
A	1	r _{AB}	r _{AC}
B	r _{BA}	1	r _{BC}
C	r _{CA}	r _{CB}	1



Unsystematic Risk (Controllable Risk):-

- ❖ The risk that is eliminated by diversification is called Unsystematic Risk (also called unique, firm-specific risk or diversified risk). They can be controlled by the management of entity. E.g. Strikes, Change in management, etc.

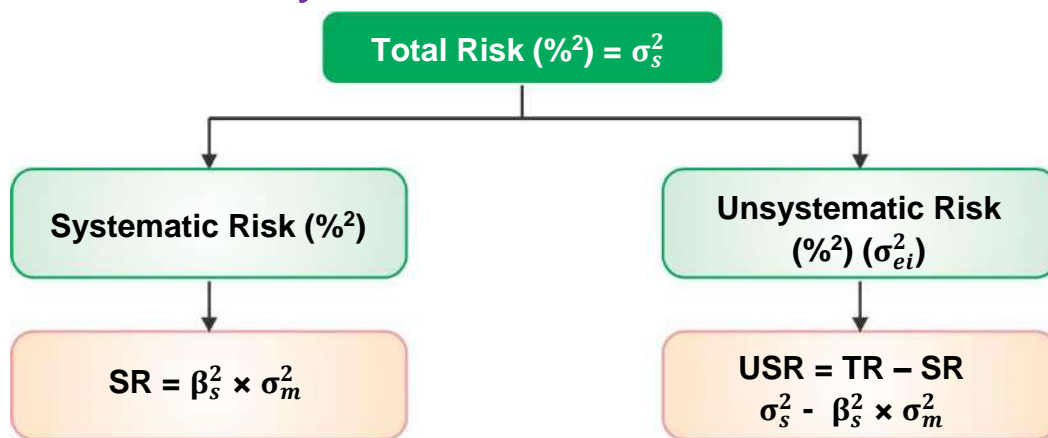
Systematic Risk (Uncontrollable Risk):-

- ❖ The risk that remains can't be diversified away is called systematic risk (also called market risk or non-diversifiable risk). This risk affects all companies operating in the market.
- ❖ They are beyond the control of management. E.g. Interest rate, Inflation, Taxation, Credit Policy

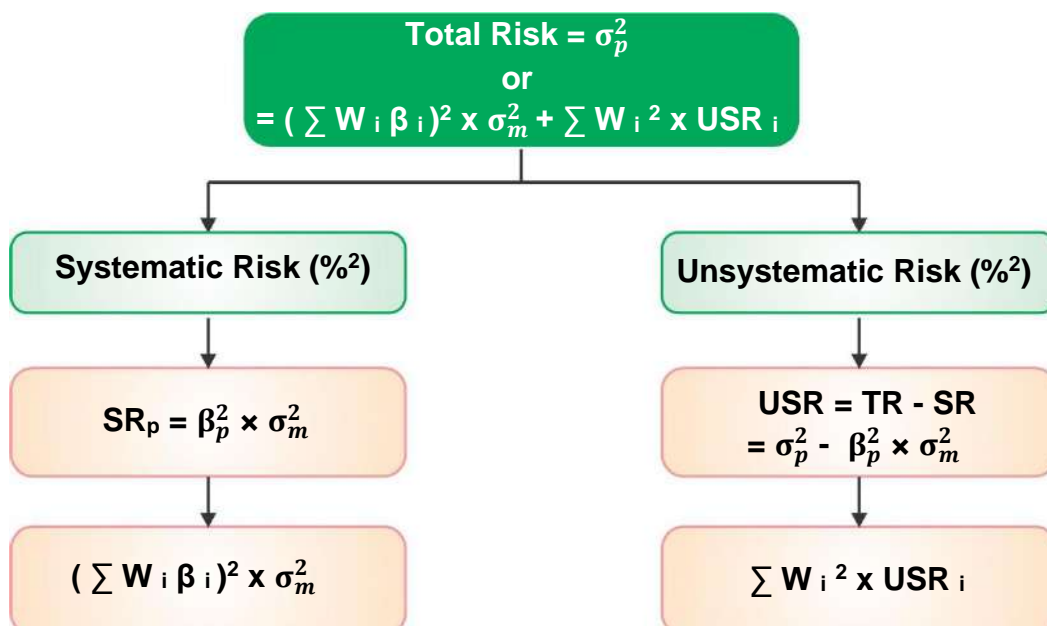
LOS 23 : Sharpe Index Model or Calculation of Systematic Risk (SR) & Unsystematic Risk (USR)

Risk is expressed in terms of variance.

$$\text{Total Risk (TR)} = \text{Systematic Risk (SR)} + \text{Unsystematic Risk (USR)}$$

For an Individual Security:

σ_{ei}^2 = USR/ Standard Error/ Random Error/ Error Term/ Residual Variance.

For A Portfolio of Securities:

LOS 24 : Co-efficient of Determination

- ❖ Co-efficient of Determination = (Co-efficient of co-relation)² = r^2
- ❖ Co-efficient of determination (r^2) gives the percentage of variation in the security's return i.e. explained by the variation of the market index return.

Example:

If $r^2 = 18\%$, In the X Company's stock return, 18% of the variation is explained by the variation of the index and 82% is not explained by the index.

- ❖ According to Sharpe, the variance explained by the index is the systematic risk. The unexplained variance or the residual variance is the Unsystematic Risk.

Use of Co-efficient of Determination in Calculating Systematic Risk & Unsystematic Risk:

- ❖ Explained by Index [Systematic Risk]

$$= \frac{SR}{TR} = r^2 \quad \text{or} \quad SR = TR \times r^2$$

$$\text{i.e. } \sigma_i^2 \times r^2$$

- ❖ Not Explained by Index [Unsystematic Risk]

$$= \frac{USR}{TR} = 1 - r^2 \quad \text{or} \quad USR = TR \times 1 - r^2$$

$$\text{i.e. } \sigma_i^2 \times (1 - r^2)$$

LOS 25 : Portfolio Rebalancing

- ❖ Portfolio re-balancing means balancing the value of portfolio according to the market condition.
- ❖ **Three policy of portfolio rebalancing:**
 - a) Buy & Hold Policy : ["Do Nothing" Policy]
 - b) Constant Mix Policy: ["Do Something" Policy]
 - c) Constant Proportion Portfolio Insurance Policy (CPPI): ["Do Something" Policy]

$$\text{Value of Equity (Stock)} = m \times [\text{Portfolio Value} - \text{Floor Value}]$$

Where m = multiplier

- ❖ The performance feature of the three policies may be summed up as follows:

a) Buy and Hold Policy

- (i) Gives rise to a straight line pay off.
- (ii) Provides a definite downside protection.
- (iii) Performance between Constant mix policy and CPPI policy.

b) Constant Mix Policy

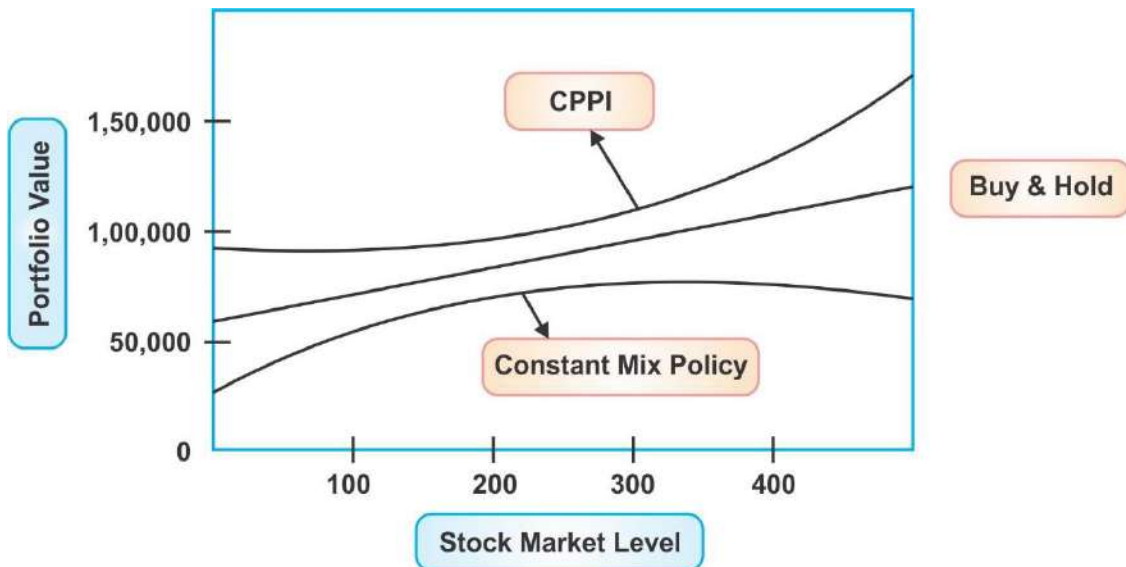
- (i) Gives rise to concave pay off drive.
- (ii) Doesn't provide much downward protection and tends to do relatively poor in the up market.
- (iii) Tends to do very well in flat but fluctuating market.

c) **CPPI Policy**

- (i) Gives rise to a convex pay off drive.
- (ii) Provides good downside protection and performance well in up market.
- (iii) Tends to do very poorly in flat but in fluctuating market.

Note:

- ❖ If Stock market moves only in one direction, then the best policy is CPPI policy and worst policy is Constant Mix Policy and between lies buy & hold policy.
- ❖ If Stock market is fluctuating, constant mix policy sums to be superior to other policies.

**LOS 26 : Arbitrage Pricing Theory/ Stephen Ross's Apt Model****Overall Return**

$$\begin{aligned}
 &= \text{Risk free Return} \\
 &+ \\
 &\{\text{Beta Inflation} \times \text{Inflation differential or factor risk Premium}\} \\
 &+ \\
 &\{\text{Beta GNP} \times \text{GNP differential or Factor Risk Premium}\} \\
 &+ \dots \dots \text{ \& So on.}
 \end{aligned}$$

Where, Differential or Factor risk Premium = [Actual Values – Expected Values]

LOS 27 : Adjustment in CAPM

When two or more Risk Free Rates are given, we are taking the Simple Average of given Rates.
Effect of Increase & Decrease in Inflation Rates

❖ **Increase in Inflation Rates:**

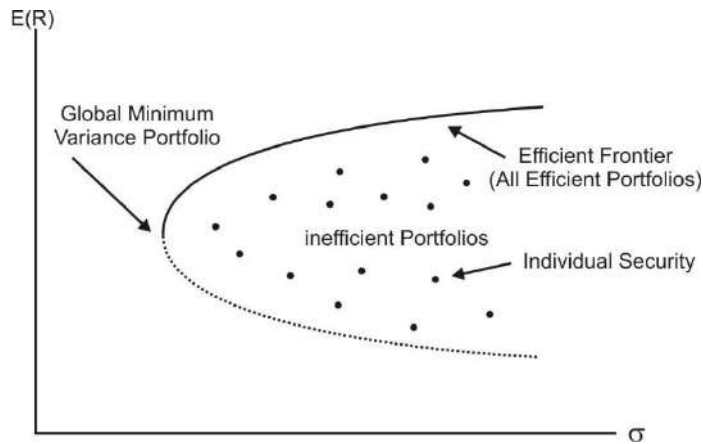
$$\text{Revised } R_F = R_F + R_F \times \text{Inflation Rate}$$

❖ **Decrease in Inflation Rates:**

$$\text{Revised } R_F = R_F - R_F \times \text{Deflation Rate}$$

LOS 28 : Modern Portfolio Theory/ Markowitz Portfolio Theory/ Rule of Dominance in case of selection of more than two securities

Under this theory, we will select the best portfolio with the help of efficient frontier.



Efficient Frontier:

- ❖ Those portfolios that have the greatest expected return for each level of risk make up the efficient frontier.
- ❖ All portfolios which lie on efficient frontier are efficient portfolios.

Efficient Portfolios:

Rule 1: Those Portfolios having same risk but given higher return.

Rule 2: Those Portfolios having same return but having lower risk.

Rule 3: Those Portfolios having lower risk and also given higher returns.

Rule 4: Those Portfolios undertaking higher risk and also given higher return

In-efficient Portfolios:

Which don't lie on efficient frontier.

Solution Criteria:

For selection of best portfolio out of the efficient portfolios, we must consider the risk-return preference of an individual investor.

- ❖ If investors want to take risk, invest in the Upper End of efficient frontier portfolios.
- ❖ If investors don't want to take risk, invest in the Lower End of efficient frontier portfolios.

Note:

CV is not used in this case, CV is only used for selection of one security between many securities & major drawback is that it always select securities with lower risk.

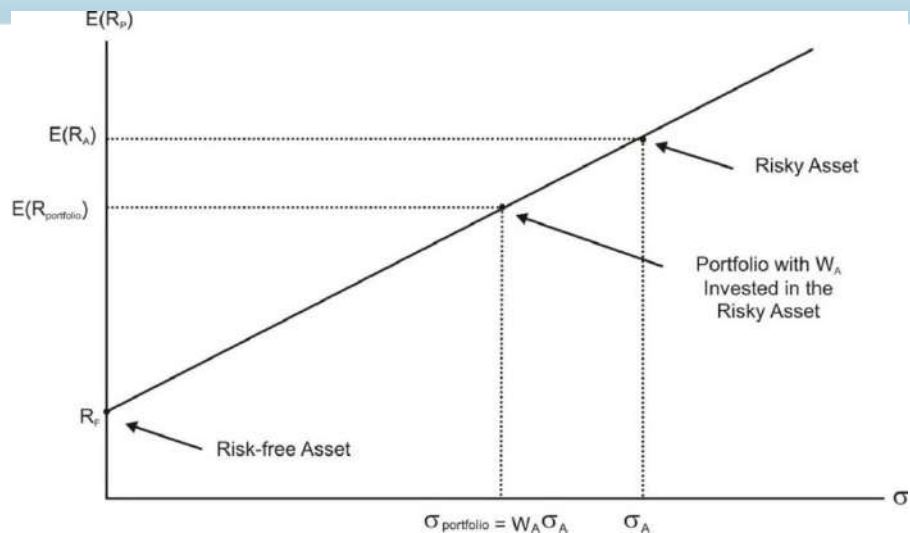
LOS 29 : Capital Market Line (CML)

The line of possible portfolio risk and Return combinations given the risk-free rate and the risk and return of a portfolio of risky assets is referred to as the Capital Allocation Line.

- ❖ Under the assumption of homogenous expectations (Maximum Return & Minimum Risk), the optimal CAL for investors is termed the Capital Market Line (CML).
- ❖ CML reflect the relationship between the expected return & total risk (σ).

Equation of this line:

$$E(R_p) = R_F + \frac{\sigma_p}{\sigma_m} [E(R_M) - R_F]$$



LOS 30 : SML (Security Market Line)

SML reflects the relationship between expected return and systematic risk (β)

Equation:

$$E(R_i) = RFR + \frac{COV_{i,Market}}{\sigma_{market}^2} [E(R_{Market}) - RFR]$$

↓
Beta

❖ If Beta = 0

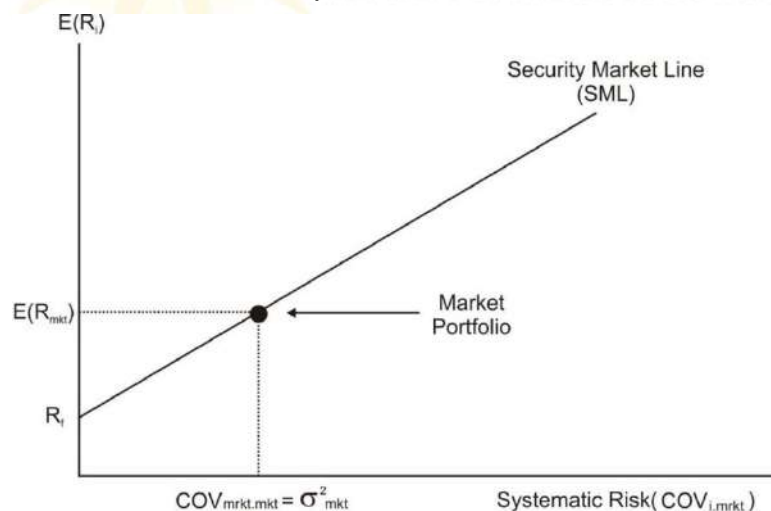
$$E(R) = R_f$$

❖ If Beta = 1

$$E(R) = R_m$$

Graphical representation of CAPM is SML.

According to CAPM, all securities and portfolios, diversified or not, will plot on the SML in equilibrium.



LOS 31 : Cut-Off Point or Sharpe's Optimal Portfolio

Calculate Cut-Off point for determining the optimum portfolio

Steps Involved

Step 1: Calculate Excess Return over Risk Free per unit of Beta i.e. $\frac{R_i - R_f}{\beta_i}$

Step 2: Rank them from highest to lowest.

Step 3: Calculate Optimal Cut-off Rate for each security.

Cut-off Point of each Security

$$C_i = \frac{\sigma_m^2 \sum_{i=1}^N \frac{(R_i - R_f \times \beta)}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum_{i=1}^N \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Step 4: The Highest Cut-Off Rate is known as “Cut-off Point”. Select the securities which lies on or above cut-off point.

Step 5: Calculate weights of selected securities in optimum portfolio.

a) Calculate Z_i of Selected Security

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left[\frac{(R_i - R_f)}{\beta_i} - \text{Cut off Point} \right]$$

b) Calculate weight percentage

$$W_i = \frac{Z_i}{\sum Z}$$

Miscellaneous

Study Session 13

LOS 1 : Buy Back of shares/Repurchase

Buyback is reverse of issue of shares of a company where the company offers to take back its share owned by the investors at a specified price.

LOS 2 : Right Shares

Right Shares are those shares which are issued to existing shareholders at a price which is normally less than Current Market Price.

Choice before Shareholder in respect of Right Issue	Effect on Shareholder's wealth
1. Exercise his rights and subscribe for Right shares.	No change in wealth
2. Do not exercise	Decrease in Wealth
3. Sell the rights in the market.	No change in wealth
4. Exercise his right for few shares and sell the balance rights in the market.	No change in wealth

Theoretical Post Right (Ex-Right) Price per share =

$$\frac{\text{MPS Cum Right} \times \text{Existing No. of Shares} + \text{Right Share Price} / \text{Offer Price} \times \text{No. of Right Share issued}}{\text{Existing No. of Equity Shares} + \text{New No. of Shares}}$$

LOS 3 : Venture Capital Investing

Venture Capital Investments are private, non-exchange-traded equity investments in a Business Venture.

Investments are usually made through limited partnerships, with investors anticipating relatively high returns in exchange for the illiquidity and high-risk profile of a venture capital investments.

Stages of Venture Capital Investing:

Seed Stage:

Investors are providing Capital in the early stage of the business and may help fund research and development of product ideas.

Early Stage:

Start-up Financing refers to Capital use to complete Product Development and fund initial marketing Efforts.

First-Stage : Financing refers to funding to commercial production and sales of the product.

Later Stage : Major Expansion of the Company.

Note:

- ❖ Conditional probability of failure i.e. 22% in 3rd Year refers to the probability of failing in the 3rd year provided success in the 1st and 2nd Year.
- ❖ Joint probability of failure cannot be calculated as joint probability of success because if failure in 1st Year cannot go in 2nd Year.

LOS 4 : Moving Averages

Two types of moving Average are:

1. AMA (Arithmetic Moving Average)
2. EMA (Exponential Moving Average)

AMA - Example:

Day	1	2	3	4	5	6	7	8	9	10
Closing Price	40	45	39	42	48	43	52	47	45	38

Calculate 5 day's AMA?

Solution:

Day	Closing Price	5 Days AMA
1	40	—
2	45	—
3	39	—
4	42	—
5	48	42.80
6	43	43.40
7	52	44.80
8	47	46.40
9	45	47.00
10	38	45.00

EMA

$$\text{EMA today} = \text{EMA}_{\text{Yesterday}} + a \times [\text{Price today} - \text{EMA}_{\text{Yesterday}}]$$

Note:

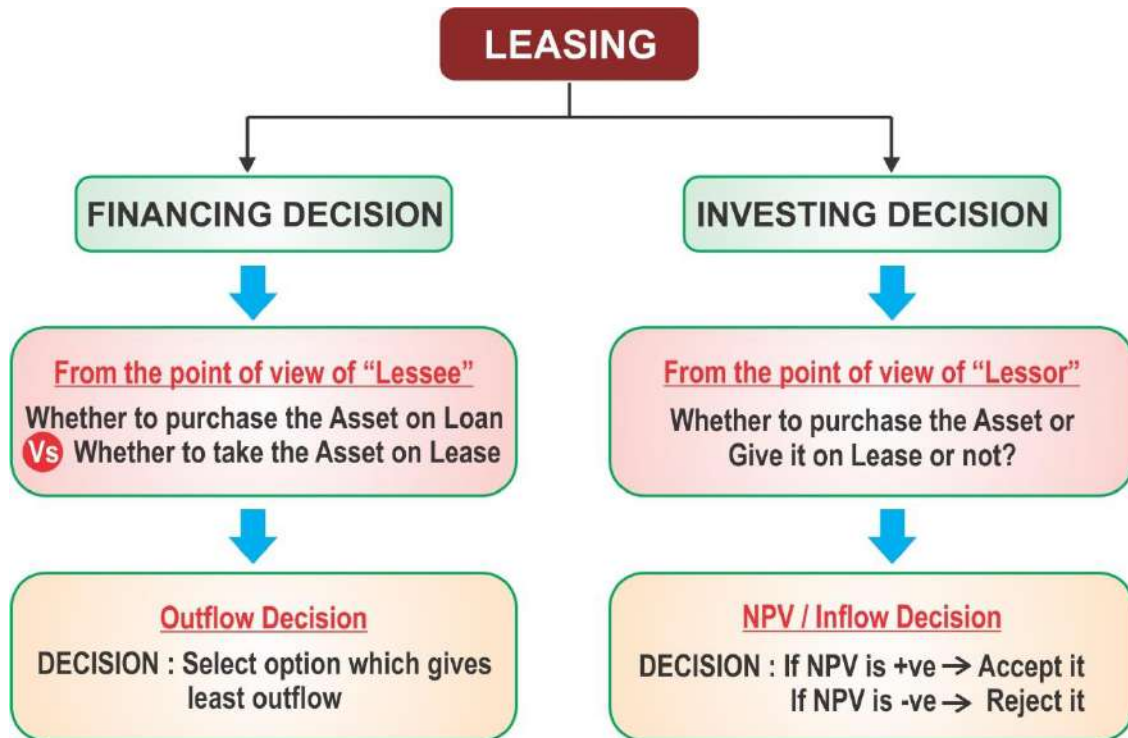
a = Exponent/ Multiplier/ Smoothing Constant.

' a ' will always be given in question, however ' a ' can also be calculated by using following relation:

$$a = \frac{2}{1 + \text{Period}}$$

LEASING

LOS 1 : Introduction



The Future of Finance starts with you

- Leasing is an important source of medium-term financing or leasing is the process of financing the cost of an asset.
- It is an arrangement under which an asset is financed and owned by one party but possessed and used by the other.

Parties to the lease agreement:-

1. LESSOR:

The OWNER of the asset is known as lessor-who gives assets on lease.

2. LESSEE:

The USER of the asset is known as lessee-who takes asset on lease.

- The lease agreement details out the specified period and timing of the sequential payments to be made by the lessee to the lessor as consideration for the use of the asset. It also incorporates repayment schedule.

LOS 2: Evaluation from the Point-of-view of Lessee/ Lease or Borrow & Buy Decision(A Financing Decision)

Loan Option	Lease Option
Outflows	Outflows

Interest Net of Tax	Lease Rentals Net of Tax
Principal Repayment	Repair & Maintenance Net of Tax
Expense Net of Tax	
Repair & Maintenance Net of Tax	
Inflows:	Inflows:
Tax Saving on Depreciation	Nil
Salvage value adjusted for Tax	
Calculation of Discount Rate	Calculation of Discount Rate
Kd = Interest Net of Tax →	Kd
	Leasing is an alternative of Loan Option
Ke →	Ke
Ko →	Ko
Present Value of outflow under Loan option	Present Value of outflow under Lease option

Decision: Select the option which gives the least outflow.

Adjustment No. 1

Common items under lease option and loan option can be ignored.

Exception to this rule:

1. Timing Difference.
2. If discount rate is different in both options.

Note :

Repair and Maintenance Expenses are always borne by the user of the Asset unless otherwise specifically stated.

Insurance expenses are always borne by the owner of the Asset unless otherwise specifically stated.

Adjustment No. 2

Loan / Principal Repayment

1. **Bullet Payment:** Principal will be repaid in one shot at the end of Loan term, in this case interest is calculated for each year.
2. **Principal amount of loan repayment:** Interest is calculated on Balance amount.
3. **Equated Annual Installments:** It includes Interest and Principal both.

Adjustment No. 3 : Equated Annual Installment (EAI)

(When installment is paid at the end of each year)

Step1: Equated annual loan repayment inclusive of interest (paid at the end of each year)

$$EAI = \frac{\text{Amount of loan}}{PVAF(r\%,n \text{ years})}$$

Where,
 $r\%$ = rate of interest before Tax (Charged by bank)
 n = Period of Loan

Step 2: Calculate Principal Repayment amount and interest amount from the total equated Annual Installment

Step 3: Calculate Interest Net of Tax.

When installment is paid from beginning of each year/ annuity due

$$EAI = \frac{\text{Amount of Loan}}{1 + PVAf(r\% (n-1)\text{years})}$$

❖ If silent, we will assume those rentals are paid at the end of each year.

LOS 3: Evaluation from the point of view of Lessor (Investment Decision)

Decision: “Whether to purchase asset and give asset on lease rent or Not”

Step 1: Calculate all cash inflows and all cash outflows of lessor. TABLE

Inflows of Lessor:	Out Flows for Lessor:
(i) Lease Rent received net of Tax. (ii) Tax Savings on Depreciation. (iii) Salvage Value adjusted for Tax.	Cost of Asset Purchased

Step 2: Compute a suitable Discount Rate.

K_0 = Cost of Capital

Or

$$K_0 = WACC = K_e W_e + K_d W_d + K_r W_r + K_p W_p$$

Step 3: Compute NPV (Net Present Value)

Decision: If NPV is Positive, lessor should lease the asset.

LOS 4: Treatment of Depreciation

- Depreciation is always charged by the owner of the Asset.
- In case of Loan Option, depreciation is charged by borrower.
- Depreciation is a non-cash item, it should not be considered while calculating cash flows.
- Tax savings on depreciation should be taken as cash inflows.

$$\text{Tax Saving on Depreciation} = \text{Depreciation Amount} \times \text{Tax Rate}$$

Methods of Depreciation:

1. Straight- line Depreciation Method:

Straight-line depreciation allocates an equal amount of depreciation each year over the asset's useful life.

$$\text{Depreciation p.a.} = \frac{\text{Original Cost} - \text{Salvage Value/Residual Value}}{\text{Life of the asset}}$$

Note:

If question is silent, always use straight-line method of depreciation.

2. Written-down value Depreciation Method:-

$$\text{WDV Depreciation} = [\text{Cost} - \text{Accumulated Depreciation}] \times \% \text{ of Depreciation}$$

Note:

If Rate of Depreciation is given use WDV Method

- ❖ We recognize more depreciation expense in early years of the asset's life and less depreciation expense in the later years of life.

3. Sum of Years Digit Method of Depreciation:-**Example:**

Cost of Asset = 100
 Life = 5 Years
 Salvage Value = 10
 Calculate Depreciation.

Solution:

Amount to be depreciated = $100 - 10 \rightarrow 90$

Life = 5 years

Sum = $1+2+3+4+5=15$

Years	Depreciation
1	$90 \times 5 / 15 = 30$
2	$90 \times 4 / 15 = 24$
3	$90 \times 3 / 15 = 18$
4	$90 \times 2 / 15 = 12$
5	$90 \times 1 / 15 = 6$

LOS 5: Treatment of Salvage Value Adjusted for tax – (WDV Depreciation)**1. In Case of Profit**

$$= \text{Salvage Value} - \text{Tax Paid on Profit on Sale}$$

2. In Case of Loss

$$= \text{Salvage Value} + \text{Tax Saved on Loss on Sale}$$

Example A (In case of Profit):

Cost of Asset = 1,00,000
 WDV Dep. = 10%
 Life = 5 Years
 Tax@ = 50%
 Salvage Value = 70,000

Calculate Cash inflows & outflows for each year.

Solution:

Year	Cash flows
0	(1,00,000)
1	+ 5000

2	+ 4500
3	+ 4050
4	+ 3645
5	+ 3281 + (70,000 – 5476) = 67,805

1. Calculation of Depreciation:

Year	Opening Balance	WDV@10%	Closing Balance
1	100000	10000	90000
2	90000	9000	81000
3	81000	8100	72900
4	72900	7290	65610
5	65610	6561	59049

2. Calculation of Profit & Loss on Sale of Asset:

Original Cost	1,00,000
Less: Depreciation till date	<u>40,951</u>
WDV	59,049
Less: Salvage Value	<u>70,000</u>
Profit on sale	10,951

Tax Payment on Profit on Sale of Asset @ 50% 5,476
 Calculation of Salvage value Adjusted for tax = 70000-5476=64524

Example B (In case of Loss):**If Salvage Value is 35,000****Solution:**

Year	Cash Flows
0	(100000)
1	+5000
2	+4500
3	+4050
4	+3645
5	+3280.50 + (35000 + 12024.50) = 50305

3. Calculation of Profit & Loss on Sale of Asset:

Original Cost	1,00,000
Less: Depreciation till date	<u>40,951</u>
WDV	59,049
Less: Salvage Value	<u>35,000</u>
Loss on sale	24,049
Tax Saving on Loss on Sale of Asset @ 50%	12,024.50

LOS 6 : Treatment of Salvage Value Adjusted for tax – (SLM Depreciation)**Example:**

Cost of Asset 1,00,000
 SLM Depreciation
 Life 5 Years
 Tax @ 50%
 Salvage Value 20,000
 Calculate Cash inflows & outflows for each year.

Solution:

Year	Cash flows
0	(1,00,000)
1	+ 8000
2	+ 8000
3	+ 8000
4	+ 8000
5	+ 8000 + (20,000 ± 0) = 28,000

Working Note**1. Calculation of Depreciation:**

$$\text{Depreciation p.a} = \frac{1,00,000 - 20,000}{5} = 16,000 \text{ p.a}$$

2. Calculation of Profit & Loss on Sale of Asset:

Original Cost	1,00,000
Less: Depreciation till date	<u>80,000</u>
WDV	20,000
Less: Salvage Value	<u>20,000</u>
Profit on sale	0

Note:

When SLM method is used, Salvage Value should not be adjusted for tax purpose, we only considered SV as inflow unless there is a adjustment related to SV.

Confusion regarding SV

1. If question states that Profit/Loss on sale of assets should be ignored then no need to adjust SV for Tax purpose.
2. Use words like "Net SV" then no need to adjust SV for Tax purpose.
3. If SV is not given in the question then do not assume SV = 0, accordingly no adjustment of SV.

LOS 7: Treatment of Tax

- Cash inflows & Cash outflows should be taken Net of Tax provided cash inflows & outflows are part of the profit & loss account (Tax Saving or Tax Paid only on revenue items not on Capital items).
- Tax savings should be taken as cash inflows like tax savings on depreciation, tax savings due to loss on sale of asset.
- **Treatment of Tax when Cash inflow & Cash outflow arises from the Beginning of each year.**

Example:

Training expense incurred at the beginning of the Year 1 or in Year 0 ₹10, 000. Tax Rate@40%. Calculate Inflow & outflow for each year.

Solution:**Alternative 1 (Adjust Tax in year 0 itself):**

Year	Cash Flow
0	- 10,000 + 4,000 = (-) 6,000
1	Nil

Alternative 2: (Preferred by CA Institute) (Adjust Tax at year end 1):

Year	Cash Flow
0	-10,000
1	+ 4,000

Note:

There will be difference in answer under both alternatives.

LOS 8: Break-even lease rentals

Break-even lease rentals are those rentals at which:

$$\text{PV of outflow under Loan Option} = \text{PV of outflow under Lease Option}$$

LOS 9: IRR Technique / Implied Interest Cost of Lease for Lessor

- When discount rate is missing in the question, we use IRR technique.
- IRR is the Discount at which NPV is Zero.
- IRR is the discount rate at which PV of inflows = PV of Outflows

@NPV +ve

@NPV -ve

$$\text{IRR} = \text{Lower Rate} + \left[\frac{\text{Lower rate NPV}}{\text{Lower Rate NPV} - \text{Higher rate NPV}} \right] \times \text{Difference in Rate [HR - LR]}$$

Break Even Lease Rentals (From the point of view of LESSOR)**PV of Inflow = PV of Output**

PV of Lease Rentals Net of Tax

(+)

PV of Tax Savings on Depreciation = Cost of Asset

(+)

PV of SV Adjusted for Tax

(-)

PV of Expense Net of Tax

LOS 10 : Concept of Block of Assets

- Block of Assets means a group of assets falling within a particular class of assets.

- **No depreciation** shall be charged in the year in which asset is sold.
- Tax Benefit/Loss on Short Term Capital Loss/Gain shall be calculated on **previous year WDV**.

LOS 11: Different Plans under lease Rentals

Different plans are offered by lessor to lessee. Some of these are follows:

1. Equal Annual Lease Plans

In this plan, equal amount of lease rentals are paid every year.

2. Stepped-up lease plan

Under this plan lease rentals are increased by a particular percentage every year.

3. Deferred Payment Plan

Under this, lease rentals are deferred for some year (i.e. not paid for few years) and after that it will be paid according to the terms of the contract.

4. Ballooned Payment plan

Under this plan, low amount lease rentals are paid for few years

At the end of the lease term, a huge amount is paid which is known as **Ballooned Payment**.

LOS 12: Net Advantage of Leasing (NAL)

- NAL is the Net Advantage/ Net Benefit of Leasing over & above the loan/ purchase option.

$$\text{NAL} = \text{PV of Outflow under Loan Option} \\ (-) \\ \text{PV of Outflow under Lease Option}$$

- If NAL is positive → lease should be preferred, otherwise purchase (loan option) should be preferred.

LOS 13 : Treatment of Subsidy for charging Depreciation.

Alternative 1 (Preferred by CA Institute)

Claim Depreciation on the full cost of asset.

Alternative 2

Claim Depreciation on Net Amount of Asset

LOS 14: Evaluation of quotation from two or more Lessor

- When Quotations are received from two or more lessor, lessee should select the quotation which gives least outflows.
- When life of two proposals/quotes are not same , we will take decision based on equated annual annuity(EAA)

$$EAA = \frac{\text{PV of Outflow or PV of Inflow or NPV}}{\text{PVAF @ } r\%, n \text{ years}}$$

LOS 15: Calculation of Cost of Asset/ Amount of Loan**Example:**

Equate Annual Installment = ₹ 2,65,000

Life 5 years, Interest Rate = 14%.

Payment starts from the beginning of each year.

Calculate Cost of Asset?

Solution:

$$2,65,000 = \frac{\text{Cost of Asset}}{1 + \text{PVAF}(14\% (5-1)\text{years})}$$

$$\text{Cost of Asset} = 2,65,000 \times 3.9137 = 10,37,130$$

LOS 16: Sales & Lease back Agreement

- If you own an asset, you can sell it to a leasing company and take the asset back for use under a leasing arrangement. This is referred to as "Sales & Lease Back"
- The main advantage is that it releases cash from the sale of asset that can be put to alternate use without giving up the benefits that flow from the existing asset.

LOS 17: Confusing regarding Discount Rate**Lessee & Borrower**

K_d = Interest (1-Tax), even if cost of capital is separately given in the question.

Lessor

K_0 = Cost of Capital / Discount Rate / Desire Rate of Return / Target rate of return

Note:

K_0, K_d , discount rate & Desire rate of return given in the question are always Net of Tax.

Exception to these rules:

- If discount rate is separately given in the question.

E.g 1 : Borrow Vs. Lease

~~$$K_d = 12\%$$

$$K_0 = 15\%$$~~

Discount Rate @ 18%

- If PVF table is given in the question for single discount rate.

E.g 2 : Borrow Vs. Lease

~~$$K_d = 12\%$$

$$K_0 = 15\%$$~~

PVF Table @ 18%

Capital Budgeting

LOS No. 1: Introduction

- Capital Budgeting is the process of **Identifying & Evaluating** capital projects i.e. projects where the cash flows to the firm will be received over a period longer than a year.
- Any corporate decisions with an **IMPACT ON FUTURE EARNINGS** can be examined using capital budgeting framework.
- **Categories of Capital Budgeting Projects:**
 - (a) Replacement projects to maintain the business
 - (b) Replacement projects for cost reduction
 - (c) Expansion projects
 - (d) New product or market development
 - (e) Mandatory projects

Types of Capital Budgeting Proposals:

- (a) **Mutually Exclusive Proposals:** when acceptance of one proposal implies the automatic rejection of the other proposal.
- (b) **Complementary Proposals:** when the acceptance of one proposal implies the acceptance of other proposal complementary to it, rejection of one implies rejection of all complementary proposals.
- (c) **Independent Proposals:** when the acceptance/rejection of one proposal doesn't affect the acceptance/rejection of other proposal.

LOS No. 2: Net Present Value (NPV)

$$\text{NPV} = \text{PV of Cash Inflows} - \text{PV of Cash Outflows}$$

Decision: If NPV is

+ve	Accept the project- increase shareholder's wealth
-ve	Reject the project-decrease shareholder's wealth
Zero	Indifferent-No effect on shareholder's wealth

$$\text{NPV} = -\text{CF}_0 + \frac{\text{CF}_1}{(1+k)^1} + \frac{\text{CF}_2}{(1+k)^2} + \dots + \frac{\text{CF}_n}{(1+k)^n}$$

Where,

CF_0 = the initial investment outlay.

CF_t = after- tax cash flow at time t

K = required rate of return for project.

LOS No. 3: Profitability Index (PI)/ Benefit cost Ratio/ Desirability Factor/ Present Value Index

$$\text{PI} = \frac{\text{PV of Cash InFlows}}{\text{CF}_0 \text{ or Present value of Outflows}}$$

CF_0 = Initial Cash Out Flows

Note:

NPV = - CF₀ + PV of future Cash In Flows

CF₀ + NPV = PV of Future Cash In Flows

If NPV is given, then

Add Initial outlay in NPV to get, PV of Cash inflows.

Decision:

If NPV is Positive, the PI will be greater than one.

If NPV is Negative, the PI will be Less than one.

Rule:

If PI > 1,	Accept the project
PI < 1,	Reject the project
PI = 1,	Indifferent

LOS No. 4: Pay-Back Period Method (PBP)

The pay- back period (PBP) is the number of years it takes to recover the initial cost of an investment.

Case I: When Cash inflows are Constant/ equal

$$\text{Pay-back Period} = \frac{\text{Initial Investment/ outflow}}{\text{Annual Cash Inflow}}$$

Case II: When Cash inflows are unequal

$$\text{Pay-back Period} = \text{Full years until recovery} + \frac{\text{Unrecovered Cost}}{\text{Cash Flow during next Year}}$$

Decision:

Shorter the PBP, better the project.

Drawback:

PBP does not take into account the time value of money and cash flows beyond the payback period.

Benefit:

The main benefit of the pay-back period is that it is a good measure of project liquidity.

LOS No. 5: Discount pay-back period

- The discounted payback period uses the present value (PV) of project's estimated Cash flows.
- It is the number of years it takes a project to recover its initial investment in present value terms.
- Discounted pay-back period must be greater than simple pay-back period.

LOS No. 6: IRR Techniques (Internal Rate of Return)

- IRR is the discount rate that makes the PV of a project's estimated cash inflows equal to the PV of the project's estimated cash outflows.
- i.e. IRR is the discount rate that makes the following relationship:

$$\text{PV (Inflows)} = \text{PV (Outflows)}$$

→ IRR is also the discount rate for which the NPV of a project is equal to ZERO.

$$\rightarrow \text{IRR} = \text{Lower Rate} + \frac{\text{Lower Rate NPV}}{\text{Lower Rate NPV} - \text{Higher Rate NPV}} \times \text{Difference in Rate (HR-LR)}$$

How to find the starting rate for calculation of IRR:

Step 1: Calculate Fake Pay-back period:

$$\text{Fake Pay-back Period} = \frac{\text{Initial Investment}}{\text{Average Annual Cash Flow}}$$

Step 2: Locate the above figure in Present Value Annuity Factor Table and take this discount rate to start the calculation of IRR.

Accept/Reject Criteria:

- | | |
|-----------------------|---------------------|
| IRR > Cost of Capital | Accept the Proposal |
| IRR = Cost of Capital | Indifferent |
| IRR < Cost of Capital | Reject the Proposal |

LOS No. 7: Accounting Rate of Return

$$\text{ARR} = \frac{\text{Average Net Profit}}{\text{Initial Investment}}$$

Note:

$$\text{Average Net Profit} = \frac{\text{NP}_1 + \text{NP}_2 + \text{NP}_3 + \dots + \text{NP}_n}{n}$$

1. It ignores time value of money.
2. It takes into account accounting profits rather than cash flows.

LOS No. 8: Net Profitability Index or Net PI

$$\text{Net PI} = \frac{\text{NPV}}{\text{Initial Investment / Present Value of Outflows}}$$

Decision: Higher the Better.

LOS No. 9 : Project NPV/ Project IRR

	Equity Approach	Total Fund Approach / Overall Project Approach
Discount Rate	K_e	K_0
Initial Outflow	Equity Share Capital (Fund)	Equity – Share Capital (Fund) + Debenture + Long-term Loan + Preference Share Capital Or Total Cost of Project

Operating Cash Inflows	Cash Inflow available for equity	Cash Inflow available for overall project
Terminal Cash flows	SV adjusted for Tax Release of Working Capital	SV adjusted for Tax Release of Working Capital
NPV	NPV that a project earns for the equity share holders	NPV that a project earns for the company as a whole.

Calculation of Project Cash Flows

Sale Price Per Unit	xxx
- Variable Cost Per Unit	xxx
Contribution Per Unit	xxx
X No. of Unit	xxx
Total Contribution	xxx
- Fixed Cost	xxx
EBDIT	xxx
- Depreciation	xxx
EBIT	
- Tax	xxx
NOPAT	
Add : Depreciation	<u>xxx</u>
CFAT	<u>xxx</u>

Note 1 : Treatment of Depreciation

- $[EBDIT - \text{Depreciation}] [1 - \text{Tax Rate}] + \text{Depreciation}$
Or
- $EBDIT (1 - \text{Tax Rate}) + \text{Tax saving on Depreciation}$

Note 2 : Treatment of Interest Cost / Finance Cost

- Finance Cost are already reflected in the Projects required rate of return / WACC / K_0
- This shows that Interest on Long Term Loans as well as its Tax Saving is already considered by K_0

Note 3 : Treatment of Working Capital

- | | | Time |
|-----------------------------------|---------|---------------------|
| • Introduction of Working Capital | Outflow | Year 0 |
| • Release of Working Capital | Inflow | End of project Life |

Working Capital should never be adjusted for tax as it is a balance sheet item. Working capital is also not subject to depreciation.

Note 4 : Treatment of Tax

If we have loss in a particular year, there are two adjustments

1. **Set-off** : assumed the firm as other profitable business, Loss in a year generate tax savings in that year.
2. **Carry Forward** : The company has an individual business or a new business having no other operations, loss in a year will be carried forward to future years for the purpose of Set-off.

Note 5 : Key Points to Remember

1. **Decisions are based on cash flows, not accounting income:**

- ❖ Consider INCREMENTAL CASH FLOWS, the change in cash flows that will occur if the project is undertaken.
- 2. **Sunk costs should not be included in the analysis.**
 - ❖ These costs are not effected by the accept/reject decisions. Eg. Consulting fees paid to a marketing research firm to estimate demand for a new product prior to a decision on the project.
- 3. **Externities / Cannibalization**
 - ❖ When considering the full implication of a new project, loss in sales of existing products should be taken into account & also consider positive effects on sale of a firm's other product line.
- 4. **Cash flows are based on Opportunity Costs.**
 - ❖ Opportunity costs should be included in projects costs.
- 5. **The timing of cash flows is important.**
 - ❖ Cash flows received earlier are worth more than cash flows to be received later.
- 6. **Cash flows are analyzed on an after-tax basis.**

Calculation of Equity Cash Flows

EBITDA	xxx
- Depreciation & Amortization	xxx
EBIT	
- Interest	xxx
EBT	
- Tax	xxx
PAT	xxx
Add : Depreciation	xxx
Less: Principal Repayment	xxx
EQUITY CASH FLOWS	xxx



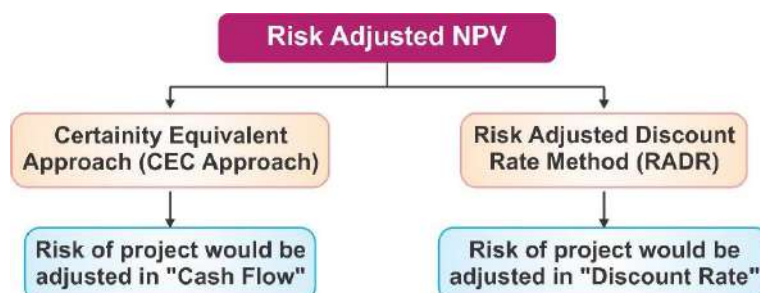
Modified NPV/ IRR

- When Cost of Capital & Re-investment rate are separately given, then we calculate Modified NPV.
- **Modified IRR:** It is the discount rate at which Modified NPV is Zero.

i.e. Modified NPV = $\frac{\text{Terminal Value}}{(1 + K_0)^n}$ - PV of Cash Outflow

'or' PV of cash outflow = $\frac{\text{Terminal Value}}{(1 + K_0)^n}$

LOS No. 10: Calculation of Risk Adjusted NPV



Risk-Adjusted Discount Rate Method (RADR)

$$(1 + \text{RADR}) = (1 + \text{Risk-free rate}) (1 + \text{Risk Premium})$$

Note:

- Under this method, Project should be discounted using risk-adjusted discount rate rather than risk-free discount rate.
- Project having higher risk should be discounted with higher rate.
- Higher the risk of the project, higher should be the discount rate.
- NPV calculated by using RADR is known as "Risk Adjusted NPV".
- CV is a measure of risk, higher the CV, higher the risk.
- Imagine the firm to be market portfolio, K_o can be treated as R_m

$$\text{RADR} = R_F + \text{Risk Index} (K_o - R_F)$$

Certainty Equivalent Co-efficient (CEC) Method

It involves discounting of certain Cash Flows instead of Total Cash Flows.

Steps involved:

Step 1: Calculate all cash flows arising from the project.

Step 2: Calculate certain cash flow by using CEC (Certainty Equivalent Co-efficient)

$$\text{Certain Cash Flow} = \text{Cash Flow} \times \text{CEC}$$

Step 3: Compute NPV by taking certain risk-free Cash Flow and risk-free discount rate.

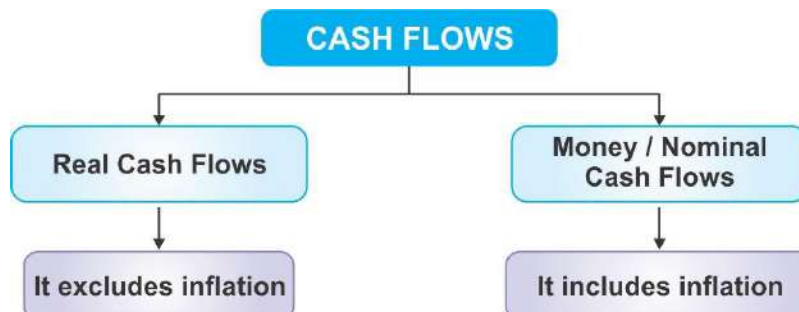
Note:

- ❖ Higher the CEC, lower the risk and vice-versa.
- ❖ CEC of cash flow arising in year 0 will always be One.

LOS No. 11: Inflation under Capital Budgeting



1. Cash Flow:



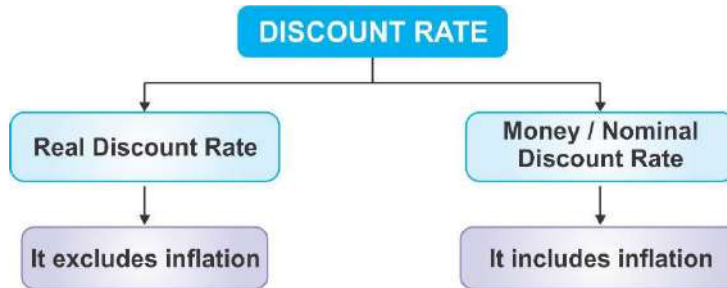
Conversion of Real Cash Flow into Money Cash Flow & Vice-versa

$$\text{Money Cash Flow} = \text{Real Cash Flow} (1 + \text{Inflation Rate})^n$$

Or

$$\text{Real Cash Flow} = \frac{\text{Money Cash Flow}}{(1 + \text{Inflation Rate})^n}$$

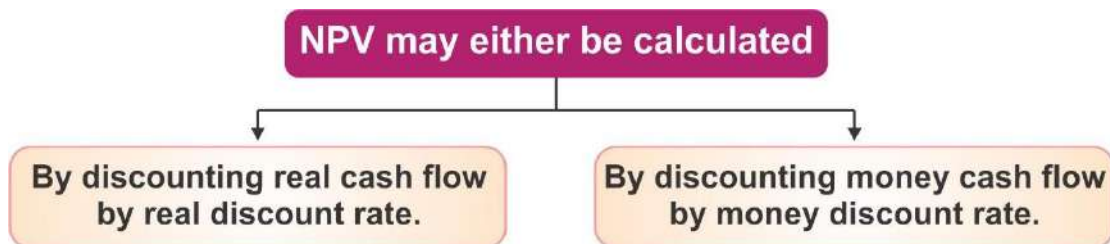
2. Discount Rate:



Conversion of Real Discount Rate into Money Discount Rate & Vice-versa

$$(1 + \text{Money Discount Rate}) = (1 + \text{Real Discount Rate}) (1 + \text{Inflation Rate})$$

3. NPV :



Note:

- ❖ Answer in both the case will be same.
- ❖ Depreciation is not affected by inflation rate as depreciation is changed on the book value of the asset & not market value.

LOS No. 12: Replacement Decision

“Whether to repair existing machine”

Or

“Whether to replace the existing machine and buy new machine”

Case 1 : Life of new machine = Remaining Life of Old Machine

(We can apply incremental principle i.e. New – Old)

Initial Investment = Cost of New Machine – SV of Old Machine

Operating CF's = CFAT from New Machine – CFAT from Old Machine

Terminal CF's = SV from New Machine – SV from Old Machine

Case 2 : Life of new machine ≠ Remaining Life of Old Machine

We can't apply incremental principle

Use equated Annual Annuity Approach (EAA)

Steps Involved:

Step 1: Calculate NPV or PV of cash inflow or PV of cash outflow of each project.

Step 2: Calculate equated annual amount by using this formulae:

$$= \frac{\text{NPV or PV of cash out flow or PV value of cash Inflow}}{\text{PVAF (k\%,n years)}}$$

LOS No. 13: Probability Distribution Approach**Expected NPV/ Expected Cash Flow / Expected Value**

$$\sum NPV \times Probability$$

Standard Deviation:

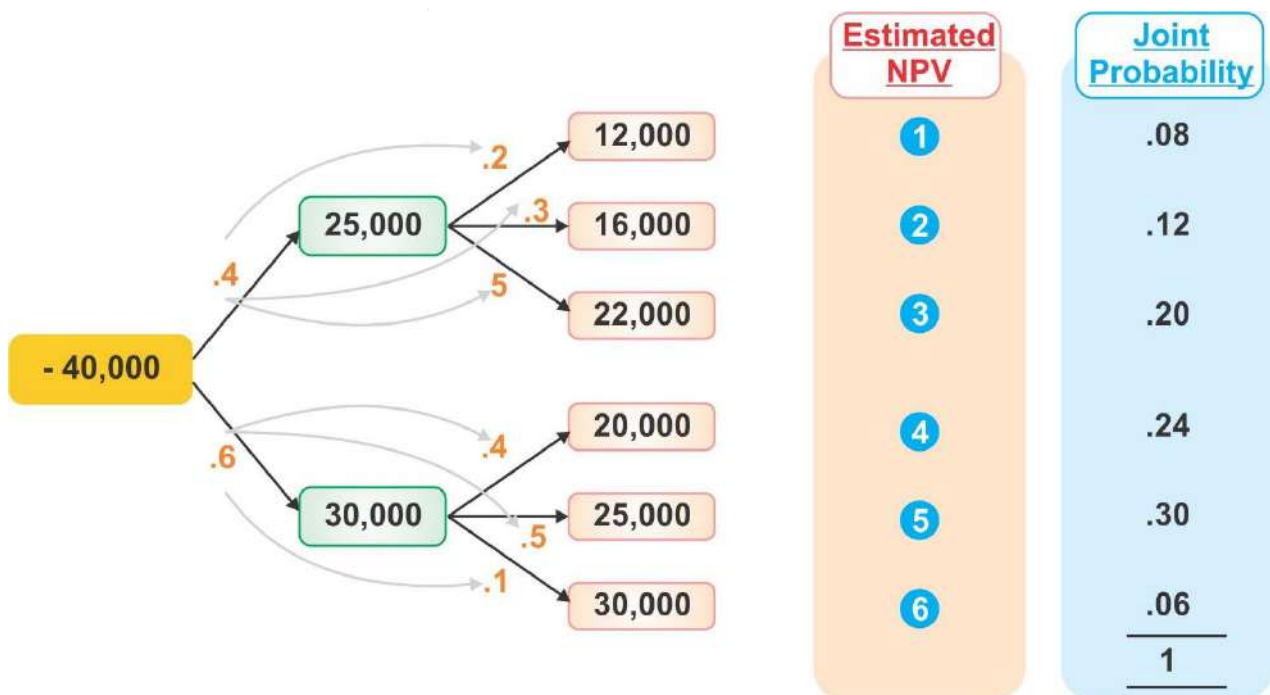
$$\sigma = \sqrt{\sum [probability \times (Given\ NPV - Expected\ NPV)^2]}$$

- Higher the S.D, Higher the risk & Vice-versa.

Co-efficient of Variation (CV):

$$CV = \frac{\text{Standard Deviation}}{\text{Expected NPV}}$$

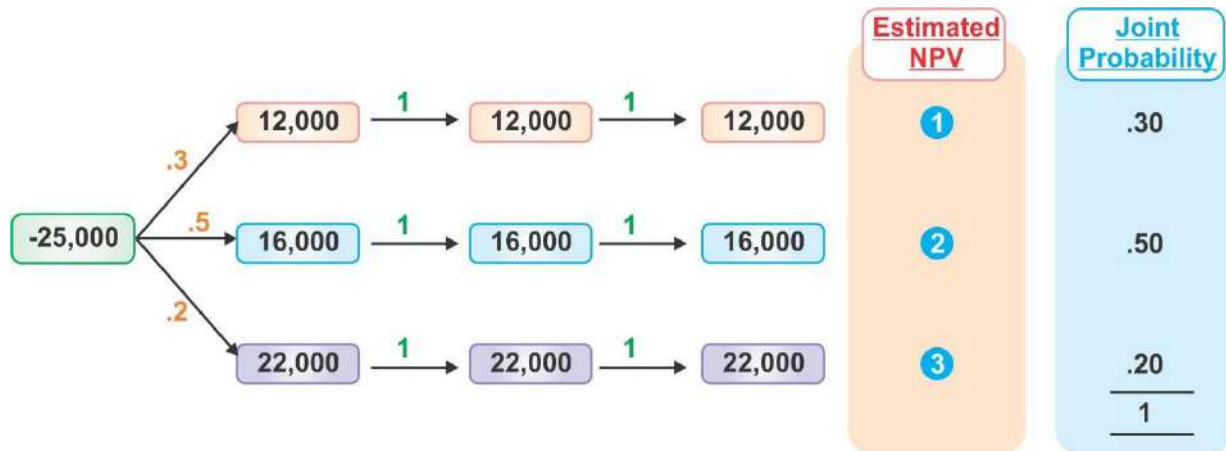
- Higher the CV, higher the risk & vice-versa

LOS No. 14: Decision Tree Approach & Joint Probability**Type 1 : Moderately Correlated Cash Flows**

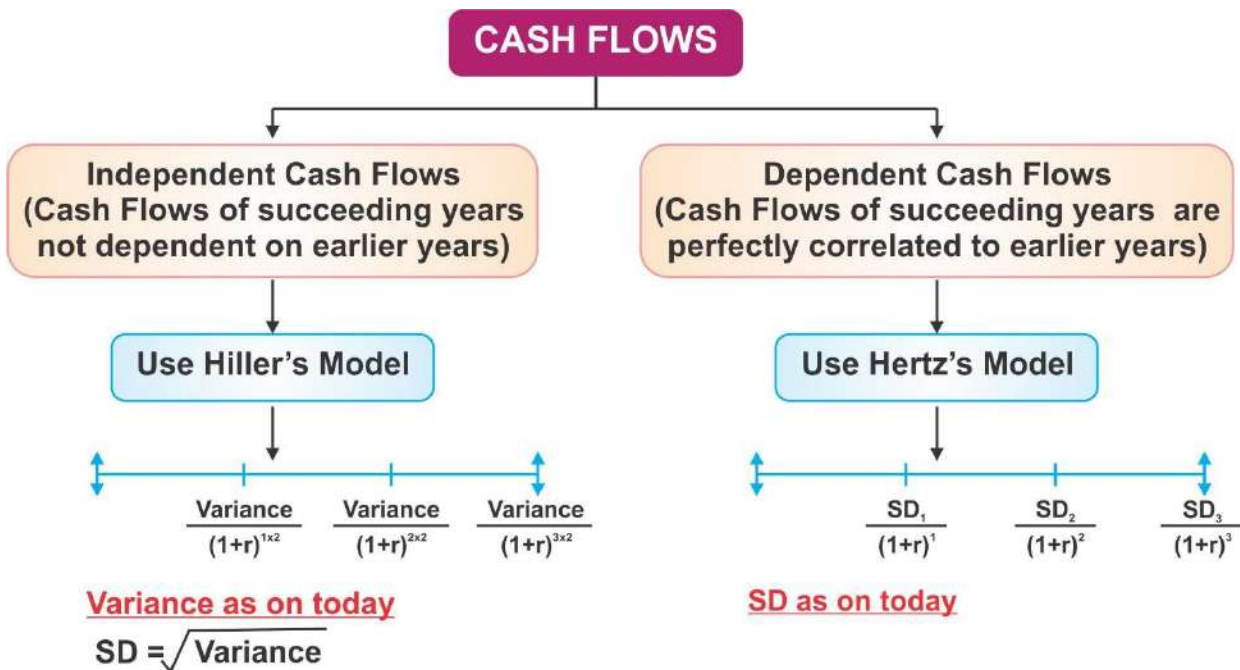
- Decision Tree is a graphical representation of two or more than 2 years cash flows, which are dependent to each other.
- Joint probability is the product of two or more than two dependent probabilities.
- The total of joint probabilities is always equal to 1.
- Joint probability is applicable in case of dependent cash flows.

Steps Involved:**Step 1:** Identify the various paths or outcomes**Step 2:** Compute joint probability.**Step 3:** Compute NPV of each path.**Step 4:** Compute Expected NPV.

Type 2 : Perfectly Correlated Cash Flows



Type 3 : Hiller's and Hertz's Model



LOS No. 15: Scenario Analysis

- Scenario Analysis is an analysis of the NPV of a project under a series of specific scenarios (worst, most likely and best scenario) based on macro-economics, industry and firm-specific facto
- Under this, all inputs are set at their most optimistic or pessimistic or most likely levels and NPV is computed.
- Decision is based on the NPV under all scenarios.

LOS No. 16: Sensitivity Analysis

- Also known as "What if" Analysis.
- Sensitivity Analysis is one of the methods of analyzing the risk surrounding the capital expenditure Decision and enables an assessment to be made of how responsive the project's NPV is to changes in those variables based on which NPV is computed.

- Sensitivity Analysis is a tool in the hand of firms to **analyze change in the project's NPV for a given change in one of the variables.**
- Under this analysis we try to measure risk of each factor taking NPV=0.
- Key factors which are used to calculate NPV are as follows:

	Inverse Effect
Cash Inflows	Decrease
Cash Outflows	Increase
Discount Rate	Increase
Life of the project	Decrease

➤ **Decision Rule**

- ◆ Management should pay maximum attention towards the factor where minimum percentage of adverse changes causes maximum adverse effect.

Example:

- ◆ If NPV is to become Zero with 5% change in initial investment relative to 10% change in cash inflows, project is said to be more sensitive to initial investment than to cash inflows.

Note:

Sensitivity Analysis is calculated for each factor separately, keeping other factors constant.

Method 1 : Margin of Safety Approach (MOS)

Set NPV = 0 & Calculate the Break Even Values and Margin of Safety for Each Factor

$$\text{Sensitivity (\%)} = \frac{\text{Change}}{\text{Base}} \times 100$$

Decision : Most critical / Sensitive Factor is that Factor for which MOS is least.

Method 2 : Shock Approach

Shock each Risk Factor in the adverse direction like 10%/ 20% & Find out the Revised NPV or %age fall in NPV

$$\% \text{ Fall In NPV} = \frac{\text{Revised NPV} - \text{Original NPV}}{\text{Original NPV}} \times 100$$

Decision : Most critical / Sensitive Factor is that Factor for which results in Maximum Fall in NPV.

LOS No. 17: Capital Rationing

- Capital rationing is the situation under which company is not able to undertake all +ve NPV projects due to lack of funds.
- Firm must prioritize its capital expenditure with the goal of achieving the maximum increase in value for shareholders.
- If the firm has unlimited access to capital, the firm can undertake all projects with +ve NPV.

Divisible Projects

Those projects which can be taken in parts

E.g. Construction of Flats.

Indivisible Projects

Those projects which cannot be taken in parts

E.g. Construction of Ship.

Case I: Divisible Project**Steps Involved:****Step 1:** Calculate NPV of each project.**Step 2:** Identify whether capital rationing exists.**Step 3:** Calculate Net Profitability Index or Profitability Index (PI) for each project.**Step 4:** Rank the project**Step 5:** Allocate money according to rank.**Case II: Indivisible Project****Steps Involved:****Step 1:** Calculate NPV of each project.**Step 2:** Identify whether capital rationing exists.**Step 3:** Take possible combinations of projects taking into consideration limitation of funds.**Step 4:** Select that combination which gives highest NPV.**LOS No. 18: Overall Beta/ Asset Beta/ Project Beta/ Firm Beta****Situation 1 :**

100 % Equity Firm → Unlevered Firm

$$\beta_{\text{Equity}} = \beta_{\text{Assets}} = \beta_{\text{Overall}}$$

Situation 2 :

Debt + Equity Firm → Levered Firm

$$\beta_{\text{Levered}} = \beta_{\text{Unlevered}} = \beta_{\text{Overall}} = \beta_{\text{Assets}}$$

- Overall Beta of the companies belonging to the same industry/sector, always remain same.
- Equity Beta and debt Beta may change with the change in Capital structure.
- Overall Beta of a project can't be changed with the change in capital structure of a particular company.
- According to MM, the change in capital structure doesn't change the overall beta.
- Debt is always assume to be risk free, so. Debt Beta = 0.

$$\text{Overall Beta} = \text{equity Beta} \times \frac{\text{Equity}}{\text{Equity} + \text{Debt} (1 - \text{tax})} + \text{Debt Beta} \times \frac{\text{Debt} (1 - \text{tax})}{\text{Equity} + \text{Debt} (1 - \text{tax})}$$

Overall Cost of Capital/ Discount Rate

Cost of Capital (K_o) = $K_e W_e + K_d W_d$ $K_e = R_f + \beta_{\text{equity}} (R_m - R_f)$ Or $K_d = \text{Interest} (1 - \text{tax rate})$ 	OR	$K_o = R_f + \beta_{\text{Overall}} (R_m - R_f)$ (Only applicable when tax rate is missing)
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Note:

- ❖ If interest rate is not given, it is assumed to be equal to risk-free rate.
- ❖ If Beta Debt is not given, it is assumed to be equal to Zero
- ❖ If debt = 0

Overall Beta = Equity Beta

i.e. for 100% equity firm overall beta & equity beta is same

Estimating the project Discount Rate (Pure Play Technique)

CAPM can be used to arrive at the project discount rate by taking the following steps:

1. Estimate the project beta.
2. Putting the value of Beta computed above into the Capital Asset Pricing Model (CAPM) to arrive at the cost of equity.
3. Estimate the cost of debt.
4. Calculate the WACC for the project.

Proxy Beta (If more than one comparable co. data is given)

- Sometimes overall beta of similar companies belonging to same sector may be slightly different.
- In such case we use proxy beta concept by taking average of all the given companies.

LOS No. 19: Backward Decision Tree

- ❖ It is a graphical presentation of a decision making situation. We have branches coming out of nodes.





Decision Nodes → From which this alternative will come out.



Choice Nodes → Certain outcome like High Demand or Low Demand or success or failure will come out.

- ❖ The tree is drawn from left to right. However, calculation can be done from right to left.

At Every , Calculate expected value

At Every , Move towards best alternative.

Miscellaneous Concepts

Study Session 16

LOS No. 3: Effective Yield under Money Market Operations

$$\text{Effective Rate of Interest} = \frac{\text{FV} - \text{Issue Price}}{\text{Issue Price}} \times \frac{12}{\text{Required Period}} \times 100$$

Cost of Funds:

Effective rate of Interest p.a
 + Brokerage p.a
 + Rating Charges p.a
 + Stamp Duty p.a
 = Total cost of Funds p.a

LOS No. 4: Factoring

- Factoring is a new concept in financing of accounts receivables. This refers to out right sale of accounts receivables to a factor or a financial agency.
- A factor is a firm that acquires the receivables of other firms. The factoring agency bears the right of collection and services the accounts for a fee.
- Types of Factoring :

Non-Recourse Factoring & Recourse Factoring

- a) **Non-Recourse Factoring:** Normally, factoring is the arrangement on a non-recourse basis where in the event of default the loss is borne by the factor. i.e if there are bad debts, it will be borne by the factor.
- b) **Recourse Factoring:** In this type of factoring. the risk of bad debt is borne by the client and not factor.

Type 1 : Cost Benefit Analysis

a) Benefits of Factoring

- a) Reduction of Bad Debts
- b) Reduction in Admin cost
- c) Reduction in Debtors collection period which will reduce blockage of funds and will save our opportunity cost of interest (Early Recovery)
- d) If company is dependent on Over Draft then it can save interest, if company receives advance from Factor.

b) Cost of Factoring

- a) Commission / brokerage
- b) Interest paid to Factor if advances taken

Net Benefit of Factoring

Decision :

If net benefit if positive company should go for factoring arrangement.

$$\text{Debtors collection period} = \frac{\text{Debtors}}{\text{Average daily credit sales}}$$

Type 2 : Effective Cost of Factoring (%age)

$$\text{Effective Cost of Factory} = \frac{\text{Net Cos of Factoring}}{\text{Net Advance Received}} \times 100$$

a) Net Advance received from factor

Annual Credit Sale × DCP = Debtors amount received in advance	XXX
- reserve required	XXX
- commission charged	XXX
Amount of advance	XXX
- Interest on amount of advance	XXX
Net advance received from factor	XXX

b) Net cost of factoring

Factor commission	XXX
+ interest cost	XXX
- Bad Debt saved	XXX
- admin cost saved	XXX
Net cost of factoring	XXX

LOS No. 6: Right Shares

Right Shares are those shares which are issued to existing shareholders at a price which is normally less than Current Market Price.

Choice before Shareholder in respect of Right Issue	Effect on Shareholder's wealth
1. Exercise his rights and subscribe for Right shares.	No change in wealth
2. Do not exercise	Decrease in Wealth
3. Sell the rights in the market.	No change in wealth
4. Exercise his right for few shares and sell the balance rights in the market.	No change in wealth

Theoretical Post Right (Ex-Right) Price per share =

$$\frac{\text{MPS Cum Right} \times \text{Existing No. of Shares} + \text{Right Share Price / Offer Price} \times \text{No. of Right Share issued}}{\text{Existing No. of Equity Shares} + \text{New No. of Shares}}$$

LOS No. 7: Calculation of EMI(Equated Monthly Installment)

$$\text{EMI, if installment is paid at the end of each month} = \frac{\text{Amount of loan}}{\text{PVAF} \left[\frac{r\%}{12}, n \times 12 \right]}$$

EMI, if installment is paid at the beginning of each month = $\frac{\text{Amount of loan}}{1 + \text{PVA} \left[\frac{r\%}{12}, (n \times 12 - 1) \right]}$

LOS No. 8: Consumer Finance

Calculation of EMI = $\frac{P(1+nf)}{N}$

P = Loan Amount

n = No. of Years

f = Flat rate of interest

N = No. of Installments

Effective Annual Cost

a) At the end of each month = $2f \frac{N}{N+1}$

b) At the beginning of each month = $2f \frac{N}{N-1}$

LOS No. 10: Venture Capital Investing

- Venture Capital Investments are private, non-exchange-traded equity investments in a Business Venture.
- Investments are usually made through limited partnerships, with investors anticipating relatively high returns in exchange for the illiquidity and high-risk profile of a venture capital investments.

Stages of Venture Capital Investing:

Seed Stage:

Investors are providing Capital in the early stage of the business and may help fund research and development of product ideas.

Early Stage:

Start-up Financing refers to Capital use to complete Product Development and fund initial marketing Efforts.

First-Stage Financing refers to funding to commercial production and sales of the product.

Later Stage: Major Expansion of the Company.

Note:

1. Conditional probability of failure i.e. 22% in 3rd Year refers to the probability of failing in the 3rd year provided success in the 1st and 2nd Year.
2. Joint probability of failure cannot be calculated as joint probability of success because if failure in 1st Year cannot go in 2nd Year.

LOS No. 11: Moving Averages

- Two types of moving Average are:
AMA (Arithmetic Moving Average)
EMA (Exponential Moving Average)

AMA**Example:**

Day 1	Closing Price
1	40
2	45
3	39
4	42
5	48
6	43
7	52
8	47
9	45
10	38

Calculate 5 day's AMA?

Solution:

Day1	Closing Price	5 Days AMA
1	40	-
2	45	-
3	39	-
4	42	-
5	48	42.80
6	43	43.40
7	52	44.80
8	47	46.40
9	45	47
10	38	45

EMA

$$\text{EMA today} = \text{EMA}_{\text{Yesterday}} + a \times [\text{Price today} - \text{EMA}_{\text{Yesterday}}]$$

Note:

a = Exponent/ Multiplier/ Smoothing Constant.

'a' will always be given in question, however 'a' can also be calculated by using following relation:

$$a = \frac{2}{1 + \text{Period}}$$

LOS No. 12: Index Formation**Market Capitalization Weighting:**

A market Capitalization weighted index is calculated by summing the total value [Current stock price times the no. of shares outstanding) of all the stocks in the index.

- This sum is then divided by a similar sum calculated during the selected base period.
- The ratio is then multiplied by the indexer's base value (typically 100)

Current Index Value

$$= \frac{\text{Current Total Market Value of Index stock}}{\text{Base year total Market value of index stock}} \times \text{Base year index value}$$

Example:

If the total market value of the index portfolio on Dec. 31st and Jan 31st are \$ 80 million, and \$ 95 million, respectively, the index value at the end of January is

$$= \frac{\$ 95 \text{ million}}{\$ 80 \text{ million}} \times 100 = 118.75$$

Thus,

$$\text{Market capitalization – Weighted index percentage return is} = \frac{118.75 - 100}{100} \times 100 = 18.75\%$$

LOS No. 13 : MM Approach (IRRELEVANCE THEORY)

Dividends do not play any role in determination of market value. Market value is rather affected by earnings and investment.

Formulae:

$$nP_0 = \frac{(n+m) \times P_1 + E_1 - I_1}{(1 + K_e)^1}$$

n = Existing number of equity shares at the beginning of the year

m = New number of equity shares, issued at year end market price

P₀ = Current market price as on today

P₁ = Market price per share at the end of year one

E₁ = Total earning at the end of year one

I₁ = Total investment at the end of year one

K_e = Cost of equity

nP₀ = Market value of the company as on today

n+m = Total no of equity share at the end (old + new share)

(n + m)P₁ = Total market value of the company at the end.

Amount raised by issue of new equity shares = Investment – [Earning – Dividend]

Assumption:

Funds can raise only by equity & retained earnings.

Note:

- The Market Price of a share = PV of dividend paid at end + PV of market price at the end at the beginning of a period

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

Calculate P₁ from this formulae.

- **New number of equity share**

$$m = \frac{I_1 - (E_1 - nD_1)}{P_1} \quad \text{or} \quad m = \frac{\text{Investment}_1 - (\text{Earnings}_1 - n \times \text{DPS}_1)}{\text{Market Price at the End}(P_1)}$$

Los No. 15: Chop-Shop Method

➤ This approach attempts to identify multi-industry companies that are undervalued and would have more value if separated from each other. In other words as per this approach an attempt is made to buy assets below their replacement value.

➤ **This approach involves following three steps:**

Step 1: Identify the firm's various business segments and calculate the average capitalization ratios for firms in those industries.

Step 2: Calculate a "theoretical" market value based upon each of the average capitalization ratios.

Step 3: Average the "theoretical" market values to determine the "chop-shop" value of the firm.

Example:

Capital/ Sales Ratio = 0.75
 Sales = 15,00,000
 Calculate Capitalized Value?

Solution:

$$\frac{\text{Capital}}{\text{Sales}} = 0.75$$

$$\begin{aligned} \text{Capitalized Value} &= \text{Sales} \times 0.75 \\ &= 15,00,000 \times 0.75 \Rightarrow 11,25,000 \end{aligned}$$

