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for AFM preparation,
then it's definitely
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-: Author :-

CA, CFA (USA),
CPA (USA)
PRAVEEN KHATOD
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Index & Past Trend Analysis

● Colour means MCQ ● Colour means Practical Question ● Colour means Theory Question

Page No.	Chapter Name	Average Marks	Sep 2025	May 2025	Nov 2024	May 2024	Nov 2023	May 2023	Nov 2022	May 2022
3	Mergers, Acquisition & Restructuring	9	6	4	6	10	8 + 10 (Right Issue)	8	8	8
34	Security Valuation & Business Valuation	15	19	17	10+8	18	8	18	8	16
83	Start up Finance	6	4	4	4	4	8	8	8	4
90	Portfolio Management	16	6	10+6	14	14	16	16	32	16
144	Risk Management	3	4	-	-	6	4	5	4	4
149	Mutual Funds	10	6+11	6+7	6	8	8	8+4	-	16
169	Management of Bonds Portfolio	6	6	4	8	6	-	9	16	-
201	Derivatives Analysis & Valuation	12	6+4	6+7	6+10	12	16+2	8+4	8	8
245	Technical Analysis	3	4	4	-	6	4	-	-	8
252	Foreign Exchange Exposure & Risk Management	9 } 17	6+11	8+4+4	8	0	16	6	8+4	-
312	International Financial Management	8 }	7	6	6	8	-	7	8	16+4
326	Advanced Capital Budgeting	8	6	6	12	8	NA	NA	NA	NA
373	Interest Rate Risk Management	11	4	7	16	10	14+2	8+4	8	8+4
400	Securitization	4	4	4	-	4	4	4	4	4
406	Financial Policy & Corporate Strategy	5	4	4	4	4	4	4	8	4
413	Theory	Marks already written against respective chapters								
	Total		30+68+20=118	30+68+20=118	30+80+8=118	98+20=118	96+28=124	93+28=121	96+28=124	96+24=120

Applicable Attempt: May 2026 & Sep 2026

AFM_Ver9

- Two Tips to save some time on the Last Day Revision:
  1. At some places we have also given Derivations & Proofs for initial conceptual understanding. Some of these can be skipped on the last day revision. Please exercise your discretion.
  2. Make an Audio podcast for ~20 to 30 questions in your own voice for such questions that you feel are easy & doesn't require reading & solving entire Q on the last day
- LDR Time ⏰ mentioned for each Topic in this Booklet is for 'Concept + Questions' of that Topic
- Everywhere in this Colorful Book, Text has been color-coded, Key words have been differentiated with color scheme, Concepts have been connected by matching colors to achieve clearer understanding of such Concepts and to increase your revision speed by 2x.
- Every effort has been made to make this Revision Booklet 'Comprehensive yet Concise'. This Book is the result of reviews, feedback & experiences of 1,00,000+ students. Any suggestion regarding improvement of this Booklet for the benefit of future students is most welcome and be sent to Praveen Khatod Sir directly on Whatsapp +91 80856 08870

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Basics of Financial Management

EPS

$= \frac{EAES}{n}$ or $\frac{EAT*}{n}$ *If Pref shares doesn't exist

Dividend % vs Dividend Yield % vs Dividend Payout Ratio

$= \frac{DPS}{Face\ value}$ $= \frac{DPS}{MP}$ $= \frac{DPS}{EPS}$

Retention Ratio

$= \frac{EPS - DPS}{EPS}$ or 1 - DPR

PE Ratio (Price Earnings Ratio)

$= \frac{MP}{EPS}$; Accordingly, MP = PER x EPS

Earnings Yield %

$= \frac{EPS}{MP}$

Observe that PER and Earnings Yield% have inverse relationship

Interpretation of PE Ratio

- ✓ A Co. having higher goodwill, brand name & reputation enjoys higher PE Ratio eg HUL , Nestle etc.
- ✓ A Co. perceived less risky by investors will command higher PE Ratio.
- ✓ A Co. whose future growth expectations are higher will have higher PE Ratio.
- ✓ All things being constant, a Co. whose PE Ratio is higher is Overvalued and a Co. whose PE Ratio is lower is Undervalued.

Market Capitalization or Market Value

= MP x No. of Shares {Formula 1}

÷ EPS x

= PER x EAES or EAT* {Formula 2}

Practice Question

PER = 15 times | EPS = ₹ 8 | n = 10 Lakh sh

Calculate M Cap ?

M. Cap = MP x n = ₹ 120 x 10 lakh shares

or

M. Cap = PER x EAES = 15 times x ₹ 80 lakhs

= ₹ 1200 lakhs

Cost of Equity [K_e]

K_e (Using CAPM) = $R_f + \beta (R_m - R_f)$

Equity Shareholders Fund or Book Value or Networth

Using Liabilities Side		Using Assets Side	
Equity Share Capital	xxx	Total Assets excluding Fictitious Assets	xxx
Add: Reserves & Surplus	xxx	Less: Outside Liabilities	xxx
Less: Fictitious Assets		Total BV	xxx
e.g. Preliminary Expenses	xxx		
Total BV	xxx		

Deferred tax asset is treated just like other genuine assets. DTA is not a fictitious asset.

BVPS

$= \frac{\text{Total BV or Eq Shhl Fund}}{\text{No. of shares}}$

Return on Equity

$ROE = \frac{EAES}{\text{Equity Shhl fund}} \times 100$ (÷n) or $\frac{EPS}{BVPS} \times 100$ (÷n)

Growth rate or Sustainable growth rate

g = RR x ROE

Basics of Time value of money

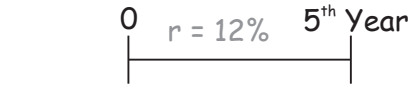
A. Present Value of a Single Sum

$PV = FV \times PVF_{(@\ r\ \%,\ nth\ Year)}$ or $PV = A \times \left(\frac{1}{1+r}\right)^n$

= ₹ 50000 x $PVF_{(@\ 12\%,\ 5th\ Year)}$
= ₹ 50,000 x 0.5674
= ₹ 28371

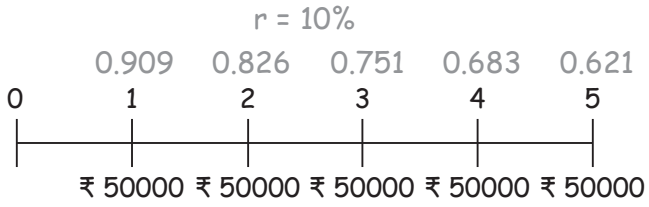
B. Future Value of a Single Sum

$FV = PV \times FVF_{(@\ r\ \%,\ nth\ Year)}$ or $FV = PV \times (1+r)^n$



C. Annuity: A series of Cashflows having (i) Same Amount (ii) Same Time interval

(i) PV of an Annuity in Arrears i.e at the end



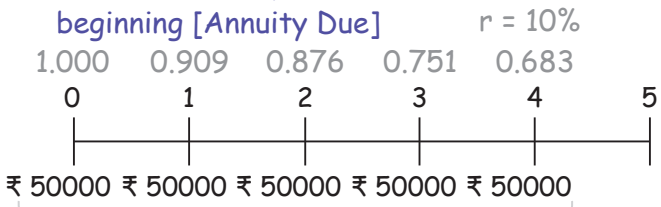
₹ 189539

PVA = Annuity x $PVAF_{(@\ r\%,\ n\ Yrs)}$
amount
= ₹ 50000 x 3.791
= ₹ 189539

$PVA = A \times \frac{1-\left(\frac{1}{1+r}\right)^n}{r}$

$= 50000 \times \frac{1-\left(\frac{1}{1.10}\right)^5}{0.10}$

(ii) PV of an Annuity in advance i.e. at the beginning [Annuity Due]

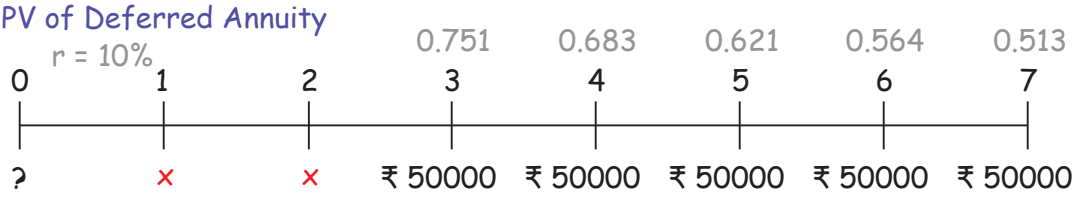


₹ 208450

PV of an Annuity in advance
= Annuity x PVAF in advance $_{(@\ r\%,\ n\ Years)}$
= ₹ 50000 x 4.169
= ₹ 208450

$\sum PVF_{1\ to\ 4\ yrs} + 1$ (for $PVF_{0}^{th}{}_{yr}$)

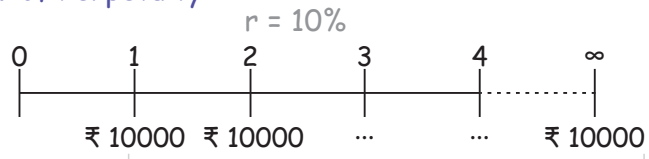
(iii) PV of Deferred Annuity



PVDA = Annuity amt x PVDAF $_{(@\ r\ \%,\ n\ Years)}$
= 50000 x 3.1329
= ₹ 156644

Simply Skip PVF of Year 1 & 2 and now Sum-up PVF_3 to PVF_7

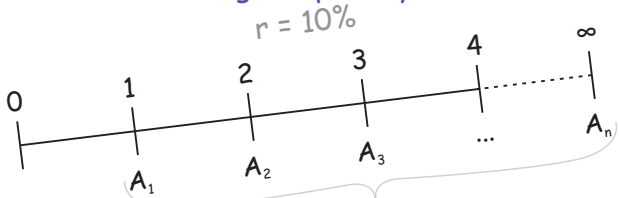
D. PV of Perpetuity



$PVP_0 = \frac{A_{1\ to\ \infty}}{r}$

$= \frac{10000}{0.10} = ₹\ 100000$

E. PV of Growing Perpetuity



$PVGP_0 = \frac{A_1}{r-g}$ | $P_0 = \frac{D_1}{K_e - g}$

Tutorial Note: Observe that in all the annuity & perpetuity formulas when we put amount from year 1 to n, then we get PV at yr 0. On the same analogy, if we put amount from yr 5 to n, then we'll get PV at the end of yr 4.

Mergers, Acquisition & Restructuring

LDR 1 ½ Hrs
LMR 10 Mins

Deal Done

Pre-deal analysis is covered in AFM

Post-deal accounting is covered in Accounts / FR

A

Is M&A deal going to be beneficial ?

Find out the benefit to the shareholders based on given swap ratio/ cash deal

- in terms of Earnings
- in terms of Market value

B

What should be the Share Exchange Ratio ?

Swap Ratio Calculation

- Swap Ratio i.e. Equitable Swap Ratio
- Maximum Swap Ratio
- Minimum Swap Ratio

C

How to survive a Loss-making company ?

Restructuring

Basic Concepts

Swap Ratio/ Exchange Ratio & Total Number of Shares Outstanding after Merger

Eg. Acquiror no. of shares = 400000
Target no. of shares = 300000
Swap ratio (SR) is 3:4
Calc total no. of shares outstanding after merger?

Select Answer	800000	700000	625000	600000

Hint: No. of Shares issued to target (Δn) $= 300000 \times \frac{3}{4} =$ **225000**

$\therefore$ Total no. of sh O/s $= n + \Delta n = 400000 + 225000 =$ **625000**

Swap Ratio means "How many shares of Acquiror will be issued against every 1 share of Target Company"

Don't read Swap Ratio of 3:4 as "3 is to 4"
Correct Approach is to read ":" symbol as "for", hence Swap Ratio is "3 for 4" meaning 3 new shares of Acquiror will be issued for every 4 shares of Target

Synergy

means "Excess amount over and above the simple summation of the two numbers." Synergy could be either in Earnings or in Market Value or Both.

Synergy in Earnings = $E_{AT} - (E_A + E_T)$ | Synergy in Market Value = $V_{AT} - (V_A + V_T)$

here, A means Acquiror , T means Target & AT means Merged firm

Post-merger EPS / Combined EPS / EPS after Merger

	If Shares Offer	If Cash Offer
Post Merger EPS	$= \frac{EAT_A + EAT_T + \text{Synergy in earnings}}{n + \Delta n \text{ or } n_A + (n_T \times SR)}$ here, n means No. of shares of Acquirer Δn means No. of shares issued to Tgt SR means swap ratio	$= \frac{\left(EAT_A + EAT_T + \text{Syn in Earnings}\right) - \left(\text{After tax Intt Rate\% or Opp Cost \% x Cash Paid}\right)}{n}$

Post Merger MP & Market Capitalization

	If Shares Offer	If Cash Offer
IF Post-merger PER is given (or assumed to be the same as Acquiror)	Post Merger PER x Post Merger EPS or $\frac{\text{Post-merger PER} \times \left(EAT_A + EAT_T + \text{Synergy in Earnings}\right)}{n + \Delta n}$	Post Merger PER x Post Merger EPS or $\frac{\text{Post-merger PER} \times \left[\left(EAT_A + EAT_T + \text{Syn in Earnings}\right) - \left(\text{After tax Intt Rate\% or Opp Cost\% x Cash Paid}\right)\right]}{n}$
If Synergy in MV is given (or calculatable separately)	$\frac{MV_A + MV_T + \text{Synergy in Market Value}}{n + \Delta n}$	$\frac{MV_A + MV_T + \text{Synergy in Market Value} - \text{Cash Paid}}{n}$

Format to calculate Benefit to the Shareholders

Q. Find Impact on EPS/ MP of Acq & Tgt | Whether Shhl will be better off or worse off than before

Trick Compare Pre merger EPS or MP vs. Post merger EPS or MP

	Acquiror	Target
Post-merger EPS or MP	₹	-
Adjusted/ Equivalent EPS/MP or Cash Offer Price [Post merger EPS x Swap Ratio or Post merger MP x Swap Ratio]	-	₹
Less: Pre-merger EPS or MP	(₹)	(₹)
G/ (L) per share	₹	₹
x No. of Shares	Existing No. of Acq Sh	Existing No. of Tgt Sh
Total G/(L) to the Shhl	₹₹	₹₹

Swap Ratio formula

$$\text{Swap ratio} = \frac{\text{Relevant factor of Target firm}}{\text{Relevant factor of Acquiror firm}}$$

here, Relevant factor means any factor (say EPS, MP, BVPS etc.) that needs to be maintained or a factor based on which swap ratio needs to be calculated

Caution Notes

1. Do not make the mistake of using Total data (eg. Total earnings, Total M. cap, Total Book Value etc.) in SR formula. Always use per share data (eg. EPS, MP, BVPS) in Swap Ratio Formula
2. When SR is based on some negative parameters / ratios (where lower number of such ratios are considered better over higher numbers eg. gross NPA ratio, Debt Equity ratio etc. are lower the better) then formula to calc SR switches between Numerator $\rightleftharpoons$ Denominator

In such cases, $\text{Swap ratio} = \frac{\text{Relevant factor of Acquiror firm}}{\text{Relevant factor of Target firm}}$

Tutorial Note

1. SR may be calc based on more than one factor EPS, MP & BVPS and then weights are applied to calc final SR (Weighted Avg Swap Ratio)
2. If 'Amount of Consideration' to be discharged to shareholders of Target Co. is given in Q, then

$$\text{No. of Equity shares to be issued to shareholders of Target Company} = \frac{\text{Amount of Consideration}}{MP_A \text{ i.e. Pre merger MP of Acquirer Company}}$$

$$\text{Swap Ratio} = \frac{\text{No. of Equity Shares issued to Target}}{\text{No. of Existing Equity shares of Target}}$$

Maximum Swap Ratio (always from the point of view of Acquiror)

Concept: 100% of Synergy gains shall accrue to the Target. Hence, Post-merger EPS or MP should be set equal to Acquiror's Pre-merger EPS or MP.

Particulars		Amount
Post-merger Total Earnings or Total Market Cap	A	xxx
Required post merger EPS or MP	B	EPS_A or MP_A
Total no. of sh o/s after merger	C = A/B	xxx
Less: Total No. of sh of Acq.	D	N_A
Total No. of sh to be issued to tgt	E = C - D	xxx
÷ Existing no. of shares of target	F	N_T
∴ Max swap ratio	G = E/F	xxx

It is set equal to Pre-merger EPS or MP of Acquiror

or

Based on Earnings

$$\text{Max Swap Ratio} = \frac{\text{Revised } EPS_T \text{ (including whole Synergy in earnings)}}{EPS_A}$$

or

Based on Market Value

$$\text{Max Swap Ratio} = \frac{\text{Revised } MP_T \text{ (including whole Synergy in market value)}}{MP_A}$$

Minimum Swap Ratio (Always from the point of view of Target)

Concept: 100% of Synergy gains shall accrue to the Acquiror. Hence, Required Post merger EPS or MP should include full amount of synergy accruing to the Acquiror only

Based on Earnings

$$\text{Min Swap Ratio} = \frac{EPS_T}{\text{Revised } EPS_A \text{ (including whole Synergy in earnings)}}$$

Based on Market Value

$$\text{Min Swap Ratio} = \frac{MP_T}{\text{Revised } MP_A \text{ (including whole Synergy in market value)}}$$

Comprehensive Example

	Alpha (Acq)	Beta (Tgt)
EAT or EAES	₹ 100000	₹ 40000
n	10000 sh	8000 sh
EPS	₹ 10	₹ 5
PE Ratio	10 times	8 times
MP (PER x EPS)	₹ 100	₹ 40

We'll address, following Situations & cases:
Situation 1: Caln in terms of Earnings
Case 1 When No Synergy in Earnings
Case 2 When Synergy in Earnings

Situation 2: Caln in terms of Market Value
Case 3 When Shares Offer
Case 4 When Cash Offer

Situation 1 Caln in terms of Earnings

Case 1 When No Synergy in Earnings

Benefit to shareholders

1. Calculate gain/(loss) to the shhl of both the firms in terms of earnings if SR is 0.4:1

Swap Ratio Calculation

2. Calculate
   (a) Swap Ratio based on EPS or SR if Companies wish to maintain their EPS
   (b) Maximum SR
   (c) Minimum SR

Solution: Benefit to shareholders

$$\text{Post-merger EPS} = \frac{EAT_A + EAT_T + \text{Synergy in earnings}}{n + \Delta n}$$

$$\text{Post-merger EPS} = \frac{₹\ 100000 + 40000}{10000 + 3200\ \text{Shares}} = ₹\ 10.606$$

8000x0.4 sh

Statement showing G/(L) to the shhl

Particulars	Alpha	Beta
Post-merger EPS / Adjusted or Equiv EPS [Post Merger EPS x SR]	10.606	4.24 [10.606x0.40]
Less: Pre-merger EPS	10	5
G/(L) per share	0.606	(0.76)
x No. of shares	10000	8000
Total gain/(loss)	₹6060	(₹6082)

Swap Ratio Calculation

(a) Swap ratio i.e. Equitable / justifiable swap ratio based on EPS

$$= \frac{EPS_T}{EPS_A} = \frac{5}{10} = 0.50$$

(b) Max SR = 0.50*

(c) Minimum SR = 0.50*

*Same number as result from Swap Ratio formula since there is No Synergy. But in Exams use the 'Format to calculate Max/ Min Swap Ratio' to find Swap Ratio. Check Format in case 2 below

Case 2 When Synergy in Earnings

Benefit to shareholders

1. Calc gain/(loss) to the shhl of both the firms in terms of earnings if SR is 0.4:1 & synergy in earnings ₹ 20000

Swap Ratio Calculation

2. Calculate (a) Swap Ratio based on EPS or SR if Companies wish to maintain their EPS
   (b) Maximum SR (c) Minimum SR

Solution: Benefit to shareholders

$$\text{Post-merger EPS} = \frac{₹\ 100000 + 40000 + 20000}{10000 + 3200\ \text{Shares}} = ₹\ 12.12$$

Statement showing G/(L) to the sh hl

Particulars	Alpha	Beta
Post-merger EPS / Adjusted or Equiv EPS	12.12	4.84 [12.12x0.40]
Less: Pre-merger EPS	10	5
G/(L) per share	2.12	(0.16)
x No. of shares	10000	8000
Total gain/(loss)	21200	(1280)

Tallies with Synergy of ₹ 20000

Swap Ratios Calculation

(a) Swap ratio i.e. Equitable / justifiable swap ratio based on EPS

$$= \frac{EPS_T}{EPS_A} = \frac{5}{10} = 0.50$$

(b) Caln of Maximum swap ratio

Particulars	Amount
Post-merger combined EAT	160000
÷ Required post merger EPS	10
To calc Max SR, Required EPS is set same as Pre merger EPS of Acquiror	
Total no. of sh o/s after merger	16000 shares
Less: No. of sh of Acq.	10000 shares
No. of sh to be issued to tgt	6000 shares
÷ Existing no. of shares	8000 shares
∴ Max swap ratio	0.75 [6000/8000]

$$\text{Or Max Swap Ratio} = \frac{\text{Revised } EPS_T \text{ (including whole Synergy in earnings)}}{EPS_A}$$

$$= \frac{(40,000 + 20,000)/8000\ \text{Shares i.e. } ₹\ 7.5}{₹\ 10}$$

$$= 0.75$$

(c) Calc of Minimum Swap ratio

Particulars	Amount
Combined earnings	160000
÷ Required post merger EPS	12
To calc Min SR, Add all synergy gains in earnings to Acquiror's EPS (100000+20000)/10000 sh	
Total no. of sh o/s after merger	13333 shares
Less: No. of sh of Acq.	10000 shares
No. of sh to be issued to tgt	3333 shares
÷ Existing no. of sh of tgt	8000 shares
∴ Min swap ratio	0.4167 [3333/8000]

$$\text{Or Min Swap Ratio} = \frac{EPS_T}{\text{Revised } EPS_A \text{ (including whole Synergy in earnings)}}$$

$$= \frac{₹\ 5}{(1,00,000 + 20,000)/10,000\ \text{Sh i.e. } ₹\ 12}$$

$$= 0.4167$$

Situation 2 Caln in terms of Market Value

Case 3 When Shares Offer

Benefit to shareholders

1. Calculate gain/(loss) to the shhl of both the cos. in term of MV if SR is 0.4:1

Swap Ratio Calculation

2. Calculate
   (a) SR based on MP or SR if Company wish to maintain the MP
   (b) Max SR (c) Minimum SR

Solve: Benefit to shareholders

$$\text{Post-merger MP} = \frac{\text{PER} \times \text{Combined EAT}}{n + \Delta n} = \frac{10 \text{ Times} \times (100000 + 40000)}{10000 + (8000 \times 0.40)} = \frac{₹\ 14{,}00{,}000}{10000 + 3200} = ₹\ 106.06$$

St sh G/(L) to the shhl

Particulars	Alpha	Beta
Post-merger MP /Adjusted or equiv MP [Post - merger MP x SR]	₹ 106.06	₹ 42.42 [106.06 x 0.4]
Less: Pre-merger MP	₹ 100	₹ 40
G/(L) per share	₹ 6.06	2.42
x No. of shares	10000	8000
Total G/(L)	₹ 60600	₹ 19360

₹ 79960 ~ ₹ 80000

Tallies with Overall Syn in market value = (10 - 8times) x ₹ 40000

Or

	Acquiror	Target
Overall Market Cap	₹ 1400000	
Proportionate% Shhl	75.76% [10000/13200]	24.24% [3200/13200]
Proportionate Post-merger MV	₹ 1060600	₹ 339360
Less: Pre-merger MV	₹ 1000000	₹ 320000
G/ (L) to the Shhl	₹ 60600	₹ 19360

₹ 79960 ~ ₹ 80000

Swap Ratios Calculation

(a) Calc of SR based on MP

$$= \frac{\text{MP of Tgt}}{\text{MP of Acq}} = \frac{₹\ 40}{₹\ 100} = 0.40 : 1$$

(b) Cal of Maximum SR

Post merger M Cap	₹ 14,00,000
÷ Reqd Post merger MP	₹ 100
Total No. of Sh o/s after merger	14000 sh
Less: No. of Sh of Acq	10000 sh
No. of Sh to be issued to Tgt	4000 sh
÷ Existing No. of sh of Tgt	8000 sh
∴ Max swap ratio	0.50 or 0.50:1

Required MP is Set equal to Premerger MP of Acq. So that Gain to Acq is '0' & All Synergy Gains accrue to the Target

Or

$$\text{Max Swap Ratio} = \frac{\text{Revised } MP_T \text{ (including whole Synergy in market value)}}{MP_A} = \frac{₹\ 40 + (₹\ 80{,}000 / 8000 \text{ Shares}) \text{ i.e. } ₹\ 50}{₹\ 100} = 0.50$$

(c) Cal of Minimum SR

Post-merger M Cap	₹ 14,00,000
÷ Reqd post-merger MP	₹ 108
Total No. of share o/s after merger	12963 shares
Less: No. of shares of Acq	10000 shares
No. of sh to be issued to Tgt	2963 shares
÷ Existing No. of shares of Tgt	8000 shares
∴ Min Swap Ratio	0.37

All synergy gains in terms of MV added to Acquiror

$\left(\frac{₹ 10 \text{ Lakhs} + ₹ 80000 \text{ Synergy}}{10000 \text{ Sh}}\right)$

Or

$$\text{Min Swap Ratio} = \frac{MP_T}{\text{Revised } MP_A \text{ (including whole Synergy in market value)}} = \frac{₹ 40}{₹ 100 + (₹ 80{,}000 / 10{,}000 \text{ Shares) i.e. } ₹ 108} = 0.37$$

Case 4 When Cash Offer

Benefit to shareholders

1. Calculate gain/(loss) to the shhl of both the cos. in term of MV if Cash offer of ₹ 45 per share is given

Swap Ratio Calculation

2. Calculate
   (a) SR - NOT Applicable since Cash Offer
   (b) Max Cash Offer Price (c) Minimum Cash Offer Price

Solve:

Calculation of G/(L) to the shareholders

$$\text{Post-merger MP} = \frac{(\text{PER} \times \text{Combined Earnings}) - \text{Cash Paid to Tgt}}{n} = \frac{(10 \text{ Times} \times ₹ 140000) - (₹ 45 \text{ per share} \times 8000 \text{ share of Tgt})}{10000 \text{ sh}} = ₹ 104$$

St sh G/(L) to the sh hl

Particulars	Alpha	Beta
Post Merger MP/ Cash offer price	₹ 104	₹ 45
Less: Pre - merger MP	₹ 100	₹ 40
G/(L) Per Share	₹ 4	₹ 5
No. of shares	10000	8000
Total G/(L)	₹ 40000	₹ 40000

₹ 80000

Tallies with Overall Syn in market value = (10 - 8times) x ₹ 40000

Swap Ratios Calculation

(a) NOT Applicable

$$\text{(b) Max Cash offer price} = \frac{\text{Premerger } V_T + \text{Synergy in MV}}{\text{No. of Sh of Tgt}} = \frac{320000 + 80000}{8000 \text{ share}} = ₹ 50 \text{ per share}$$

$$\text{(c) Min Cash offer price} = \frac{\text{Premerger } V_T}{\text{No. of Sh of Tgt}} = \frac{320000}{8000 \text{ share}} = ₹ 40 \text{ per share}$$

General Points to Remember

1. Students are under general impression that data in the 1st column belongs to Acquiror & in the 2nd column belongs to the Target. But Q may prank you by writing Target Company data in 1st column & Acquiror data in 2nd column.

2. Should G/(L) to the sh hl be calculated in terms of MV or Earnings ?
G/(L) in terms of MV is always preferred over earnings. Hence if info about (i) PER or (ii) Synergy in MV is available in Question then Calculate G/(L) in terms of MV. Else Calc G/(L) in terms of Earnings

3. If SR needs to be calculated & Q doesn't provide the basis to calculate SR, then use MP as the basis to calculate SR. [MP_T / MP_A]

4. If Question doesn't provide as to what would be the post-merger PE Ratio then default assumption is that "PE Ratio of Acquiror will remain maintained even after merger"
hence, $PER_{AT} = PER_A$ {aka Bootstrap effect}

5. If PER of Acq is 10 times & Tgt is 5 times and Q says "after merger PE ratio will be adversely affected by 10%" then Post merger PE ratio will be taken as 9 times

6. If Question has written 'ignore synergy' next to Premerger PE ratio info Eg. "PE ratio (ignore synergy) then there will be no synergy coming through PE ratio. If no other kind of synergy info is provided by Q then $V_{AT} = V_A + V_T$.

7. If Q language reads as "Considering MP of Target reflects its true value" then don't make the mistake of applying PER of Acquiror to the earnings of Target. Instead, post merger market cap would be the simple summation of pre merger MV of acquiror + Pre merger MV of target. i.e. $V_{AT} = V_A + V_T$

8. Alternative Terminologies

Gain to Acquiror	aka →	NPV of Acquisition
Gain to Target	aka →	Cost of merger or True cost of merger or Net cost of acquisition
Synergy	aka →	Total gain from merger or Gain from Merger or Gain from acquisition
Max Swap Ratio	aka →	Max Exchange Ratio Acquiror can offer without dilution of EPS/ MP

9. Value of Acquisition
It means gross increase in Value of acquiror after the acquisition of target
= Post-merger M. Cap of Merged Firm *less* Pre-merger M. Cap of Acquiror
i.e. V_{AT} i.e. V_A

10. Value of Original Shareholders
It means Market Capitalisation as if No Synergy in Market Value

(a) Value *Per share* of Original Shareholder

$$= \frac{\text{Premerger Market Cap of Acquiror + Premerger Market Cap of Target}}{\text{Total No. of Shares O/s after merger}}$$

Synergy is NOTconsidered

(b) Value of Original Shareholders *in Total*
Acquiror firm Shareholders = No. of Shares of Acquiror x Value Per share as calc above
Target firm Shareholders = No. of Shares issued to Target x Value Per share as calc above

11. Purchase Price Premium Offered or % Premium offered $= \frac{\text{Offer price - Pre merger MP of Tgt}}{\text{Pre merger MP of Tgt}} \times 100$

Example:

	Acq	Tgt
Pre merger MP	₹ 100	₹ 20

↓ 50% Premium offered by Acq to Tgt

∴ ₹ 30 is Offer Price

$\therefore$ Swap Ratio $= \frac{\text{Offer price}}{\text{Premerger MP of Acquiror}} = \frac{30^*}{100} = 0.30$ i.e. 0.30 : 1

*In case of Premium Offered, Offer Price is used to calculate SR [Don't use Premerger MP of Tgt]

12. If Q provides Pre-tax Profits then remember to After-tax such Profits before calculating EPS.

13. If Q asks "Effect on EPS or Effect on Share Price" then write answer in both ways -
   (i) Δ in ₹ terms and
   (ii) Δ in % terms.

14. Various ways to find Synergy in Market Value

Using Market Capitalization Formula

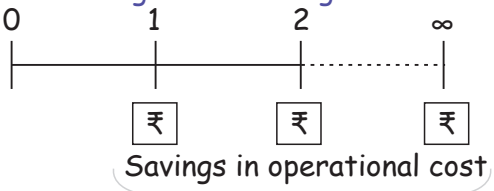
M. Cap = PER x Combined earnings

Increase in M. Cap vs Pre-merger M. cap could be either due to PE ratio or due to increase in Earnings or both

Syn in MV is given in the Q

Absolute amount of Synergy or Synergy % given

Capitalized value of operational cost savings due to merger



PV of such Savings is Syn in market value $= \frac{\text{Savings i.e. Synergy in earnings}}{\text{Capitalization rate}}$ [Just like $PVP = \frac{A}{r}$]

If Tax rate is given in the Q, then "After tax Savings" should be considered to calculate Synergy in MV

Due to Increase in 'growth rates'

Refer below Example

In all above 3 cases, Postmerger M. Cap = $V_A + V_T$ + Synergy in MV

Caution note Above 4 methods of finding synergy & Calculating Post-merger M. Cap are mutually exclusive. Hence, if you apply one of the way then don't even think about rest of the ways. Else it will amount to double counting of Synergy.

Example: Syn in MV due to Increase in growth rate

	Tata Steel (Acq)	Sunflag Iron & steel (Tgt)
No. of shares	10000	5000
D_0	₹ 100	₹ 50
K_e	15%	15%
g	10%	4%

If growth rate of Tgt is expected to accelerate to 8% after acquisition, Calc g/(l) to the shareholders of both the firms. Proposed swap ratio is 0.25 : 1.

Solve:	Tata Steel	Sunflag (Pre Merger)	Sunflag (Post Merger)
D_0	₹ 100	₹ 50	-
x No. of shares	10000 shares	5000 shares	-
Total Dividend$_0$	₹ 10,00,000	₹ 2,50,000	₹ 2,50,000 [Same as Total D_0 pre merger]
Premerger & Postmerger MV	₹ 220 lakhs $\left[\frac{₹\ 10,00,000 \times 1.10}{0.15 - 0.10}\right]$	₹ 2363600 $\left[\frac{₹\ 250000 \times 1.04}{0.15 - 0.04}\right]$	₹ 3857150 $\left[\frac{₹\ 250000 \times 1.08}{0.15 - 0.08}\right]$

Syn in MV ₹ 1493550

Post-merger MV = ₹ 220 lakhs + ₹ 2363600 + ₹ 1493550
or ₹ 220 lakhs + ₹ 3857150
= ₹ 258.5715 lakhs

Post-merger MP = $\frac{₹\ 258.5715 \text{ lakhs}}{10000 + 1250 \text{ Shares}}$
= ₹ 2298.41

St sh g/(l) to the sh hl

	Tata Steel	Sunflag
Post - merger MP / Adjusted MP or Equiv MP	2298.41	574.60 [2298.41 x 0.25]
Less: Premerger MP	2200	472.72
G/(L) per sh	98.41	101.88
x No. of Sh	10000	5000
Total G/(L)	984100	509400

Overall Synergy 1493500 It tallies with overall synergy calc above

15. Types of Market Capitalization

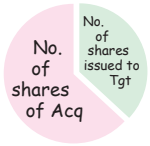
Total M. Cap = MP x Total no. of shares o/s

Free Float M.cap = MP x No. shares held by Non-promoters*

*hence free float M. cap excludes sh. held by Promoters & Govt

16. Shareholding% of Acq & Tgt after Merger

% Shhl of Acq Firm = $\frac{\text{No. of Shares of Acquiror}}{\text{Total No. of Shares O/s after Merger}}$



% Shhl of Tgt Firm = $\frac{\text{No. of Shares issued to Target}}{\text{Total No. of Shares O/s after Merger}}$

17. Promoter holding %

Promoter's Holding % = $\frac{\text{No. of Shares held by Promoters in a Company}}{\text{Total No. of Shares O/s in a Company}}$

Promoter's Holding % in Merged Firm = $\frac{\text{No. of Shares held by Promoters of Acquiror} + \text{No. of Shares issued to Promoters of Target}}{\text{Total No. of Shares O/s in Merged Firm}}$

18. In reverse calc, Turnover could be calc using either 'Inventory turnover ratio' or 'Debtors turnover ratio'. However, if both are given in a Q then prefer Inventory turnover ratio to calc turnover {Reason → Debtor turnover ratio will give only Credit sales. But Inventory turnover ratio will give COGS for Total sales, now using GP ratio Total sales can be found}

19. **Purchase Consideration or Cost of Acquisition**

means 'Net Payment made by Acquiring Co. to Target Co.'

Calculation of PC/ COA

= Market Value of Equity Shares issued by Acquiror to Target	XXX
(+) Debentures, Preference shares Capital issued by Acquiror to Target	XXX
(+) Current Liability paid or taken over by Acquirer	XXX
(+) Any other expenses incurred	XXX
(-) Sale of Assets not required by Acquiror [Debtors & Inventory]	XXX
(-) Cash in hand & Bank	XXX
Cost of Acquisition / Purchase Consideration	XXX

20. **When to deduct & when NOT to deduct Cash & bank balance while calculating "Cost to Acq." ?**

If Q mentions about realization of stock & debtors	If Q doesn't mentions about realization of stock & debtors
then Deduct Cash & Bank bal as inflow while calculating Cost of Acq.	then Don't Deduct Cash & Bank

21. **Financial Feasibility of Acquisition**

PV of cash inflows from target company's operations after acquisition	XX
(-) Purchase consideration paid to acquire the target company	(XX)
NPV	XX/(XX)

If NPV is positive Acquisition is advantageous

If NPV is negative Acquisition is not advantageous

22.

Components of MP

MP = PER x EPS

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

$$\text{EPS} = \frac{\text{EAES}}{\text{n}}$$

EPS = BVPS x ROE

$$\text{BVPS} = \frac{\text{Equity Shareholders' Fund}}{\text{n}}$$

$$\text{ROE} = \frac{\text{EAES}}{\text{Equity Shareholders' Fund}} \text{ or } \frac{\text{EPS}}{\text{BVPS}}$$

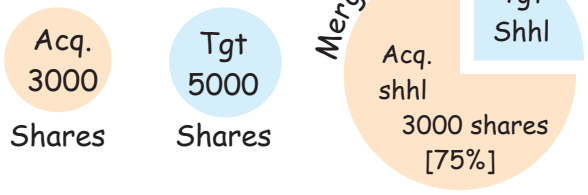
23. **Alternative language hinting how to calc No. of share to be issued to Tgt**

Premerger No. of share of Acq = 3000

Premerger No. of share of Tgt = 5000

If Acq. is considering allowing target co. a 25 % holding in the merged firm then calc SR ?

Solve: Since target will hold 25%, therefore, Acquirer's 3000 shares are equivalent to 75% holdoing.



1000 shares will be issued [25%]

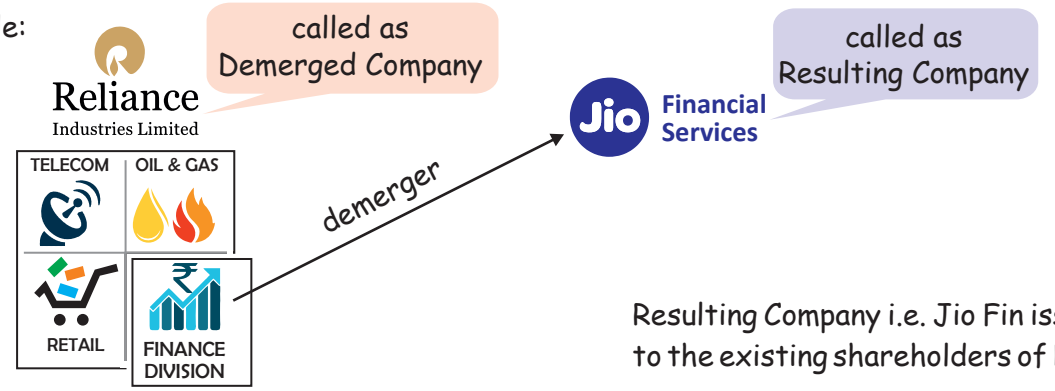
i.e. $\frac{3000}{75\%} \times 25\%$

$$\therefore \text{Swap Ratio} = \frac{1000 \text{ shares}}{5000 \text{ shares}} = 0.20$$

DEMERGER

a part or a division of a Company is sold to another Company.

Example:



Resulting Company i.e. Jio Fin issues its Equity shares to the existing shareholders of Demerged Company

No. of Equity shares O/s in Demerged Company i.e. No. of shares of RIL will remain same after Demerger.

RESTRUCTURING

B/S

What happens in Restructuring ?	Liabilities	Amount	Assets	Amount	What happens in Restructuring ?
Reduction in Face Value	Eq Sh Cap	₹	FA	₹	Revaluation of Assets
(1) Reduction in Intt Rate %	Loan/Debt	₹	CA	₹	
(2) Convert some claims into Equity (3) Forgo some claims	Creditors	₹	P&L A/c (loss)	₹	The net impact of all the restructuring adjustment would lead to disappearing of P&L A/C Dr bal

Before we prepare New B/S after restructuring, we have to first prepare a statement showing:-

1. Benefits of restructuring

(i)	Liabilities Reduction (eg Reduction in Eq/ Debt, Forgo Debt/ Creditor claims)	
(ii)	Assets Revaluation - Increase in Value	
	Total benefit	xxx

2. Utilization of benefit

(i)	Write Off P&L A/c Debit bal	
(ii)	Write Off Fictitious Assets (eg. Preliminary Exps, Cost of Debenture issue)	
(iii)	Creation of provisions (eg. Prov. for bad debts)	
(iv)	Decrease in value of assets	
	Total utilization	xxx

Should Tally

Tutorial Note: If Total Benefits > Total Utilization, then such additional amount is shown as "Capital Reserve" in the new Balance sheet

Miscellaneous - Rights Issue

MP = ₹ 2000
n = 150 cr. shares

Kotak Mahindra bank

Sh. holder

KMB brings right issue in the ratio of 3:8 at subscription price of ₹ 1600.

(i) Calculate Theoretical post - right price per share (aka Theoretical Ex-Right Price (TERP))

$$\text{Theoretical Post-Rights price per share} = \frac{nP_0 + S}{n + n_1}$$

here,
n = No. of existing equity shares
P_0 = Price of shares pre-right issue
S = Subscription amount raised from right issue
n_1 = No. of new shares offered [150 cr x 3/8 = 56.25 cr shares]

Tutorial Note: If future earnings / cashflows from the use of such rights issue proceeds is given in the Q, then we would prefer to add the PV of such earnings/ cashflows instead of adding rights issue proceeds.

$$= \frac{₹\ 2000 \times 150 \text{ cr. sh} + ₹\ 1600 \times 56.25 \text{ cr.sh.}}{150\text{cr.} + 56.25\text{cr.}} \quad \text{or} \quad \frac{₹\ 2000 \times 8\text{sh} + ₹\ 1600 \times 3\text{sh}}{8 + 3\text{sh}}$$

= ₹ 1890.91

(ii) Calculate Theoretical Value of Rights alone

Value of right = Theoretical post right per share- Right issue price
= ₹ 1890.91 - 1600
= ₹ 290.91 per right share (means if we renounce right then this is the fair price)

or

$$= ₹\ 290.91 \times \frac{3}{8}$$

= ₹ 109.09 per original share held

(iii) Let us assume a share holder is holding 800 shares in KMB. Find impact on his wealth

Trick : Simply compare Net worth before Rights issue vs Net worth after Rights issue

Case (a) If he subscribes the rights offer

Solve :

Shareholder wealth - Before Rights	
No. of shares	800 sh.
Pre - Rights MP	₹ 2000
Value of shares	₹ 16,00,000

Shareholder wealth - Post Right Issue	
Post Right MP	₹ 1890.91
No. of shares [800 sh. + 300 sh.]	1100 sh.
	₹ 20,80,000
Less: Cash paid for Rights subscription [300 sh. x ₹ 1600]	₹ 4,80,000
Net Wealth	₹ 16,00,000

It can be observed that there is no impact on share holder's wealth if he subscribes the right issue.

Case (b) If he renounces rights in somebody else's favour.
Solve :

Shareholder wealth - Before Rights	
No. of shares	800 sh.
Pre Rights MP	₹ 2000
Value of Shares	₹ 16,00,000

Shareholder wealth - Post Right Issue	
No. of shares	800 sh.
Post Right MP	₹ 1890.91
Value of shares	₹ 15,12,728
Add: Cash received on right renunciation [300sh. x ₹ 290.91] or [800sh. x ₹ 109.09]	₹ 87,272
Net Wealth	₹ 16,00,000

It can be observed that there is again no impact on share holder's wealth.

Case (c) If he ignores the rights issue & doesn't take any action ?
Solve:

Shareholder wealth - Before Rights	
No. of shares	800 sh.
Pre Rights MP	₹ 2000
Value of shares	₹ 16,00,000

Shareholder wealth - Post Right Issue	
No. of shares	800 sh.
Post - Rights MP	₹ 1890.91
Value of shares/ Net wealth	₹ 15,12,728

Loss of wealth ₹ 87,272 (₹ 16,00,000 - ₹ 15,12,728)

Shareholder's wealth reduced by ₹ 87,272 if he ignores & doesn't take any action over right issue.

(d) In the above case, if Co. wishes that the ex-rights value of share shall not fall below ₹ 1900 (or 5% of MP), find the subscription price for one rights shares.

Solve: Let x be the price at which right share to be issued then

$$1900 = \frac{₹\ 2000 \times 8\ sh + ₹\ X \times 3\ sh}{8 + 3\ sh} \quad \text{or} \quad 1900 = \frac{₹\ 2000 + (X \times 3/8)}{1 + 3/8}$$

$\therefore X = ₹\ 1633.33$ $\quad\quad$ $\therefore X = ₹\ 1633.33$

(e) If Co. is willing to offer rights share @ ₹ 1600 and is also desirous that the fall in ex - rights price of the shares be restricted to 5% of CMP, calc no. of new eq. shares to be offered as rights & rights issue ratio ?

Solve: Let R be the ratio in which right shares to be issued

$$1900 = \frac{2000 \times 1 + 1600 \times R}{1 + R}$$

$\therefore R = 1/3$ or $0.33:1$

Hence, Co. will issue 1 right sh for every 3 sh held

Question 1

2 Questions Merged | Study Material, (12M) Exam N08, M15, Jan21, RTP M25, MTP M25

BA Ltd, and DA Ltd. both the companies operate in the same industry. The Financial statements of both the companies for the current financial year are as follows:

Balance Sheet ₹

Particulars	BA Ltd.	DA Ltd.
Current Assets	14,00,000	10,00,000
Fixed Assets (Net)	10,00,000	5,00,000
Total (₹)	**24,00,000**	**15,00,000**
Equity capital (₹ 10 each)	10,00,000	8,00,000
Retained earnings	2,00,000	-
14% long-term debt	5,00,000	3,00,000
Current liabilities	7,00,000	4,00,000
Total (₹)	**24,00,000**	**15,00,000**

Income Statement ₹

	BA Ltd.	DA Ltd.
Net sales	34,50,000	17,00,000
Cost of Goods sold	27,60,000	13,00,000
Gross profit	6,90,000	3,40,000
Operating expenses	2,00,000	1,00,000
Interest	70,000	42,000
Earnings before taxes	4,20,000	1,98,000
Taxes at 50%	2,10,000	99,000
Earnings after taxes (EAT)	**2,10,000**	**99,000**
Additional information:		
No. of Equity shares	1,00,000	80,000
Dividend payment ratio	40%	60%
Market price per share	₹ 40	₹ 15

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Assume that both companies are in the process of negotiating a merger through an exchange of equity shares. You have been asked to assist in establishing equitable exchange terms and are required to:

(i) Decompose the share price of both the companies into EPS and P/E components; and also segregate their EPS figures into Return on Equity (ROE) and book value/intrinsic value per share components.

(ii) Estimate future EPS growth rates for each company.

(iii) Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be ₹ 20 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratios that can be offered by BA Ltd. to the shareholders of DA Ltd. Based on your analysis in part (i) and (ii), would you expect the negotiated terms to be closer to the upper, or the lower exchange ratio limits and why?

(iv) Calculate the post-merger EPS based on an exchange ratio of 0.4:1 being offered by BA Ltd. Indicate the immediate EPS accretion or dilution, if any, that will occur for each group of shareholders.

(v) Based on a 0.4:1 exchange ratio and assuming that BA Ltd.'s pre-merger P/E ratio will continue after the merger, estimate the post-merger market price. Also show the resulting accretion or dilution in pre-merger market prices.

(vi) Comment on the decision taken by BA Ltd.

(vii) Calculate value of original shareholders assuming swap ratio is 0.4:1

Solution: Market price per share (MPS) = EPS X P/E ratio or P/E ratio = MPS/EPS

(i) Determination of EPS, P/E ratio, ROE and BVPS of BA Ltd. and DA Ltd.

	BA Ltd.	DA Ltd.
Earnings After Tax	₹ 2,10,000	₹ 99,000
No. of Shares	100000	80000
EPS	₹ 2.10	₹ 1.2375
Market price per share	40	15
P/E Ratio	19.05	12.12
Equity Funds	₹ 12,00,000	₹ 8,00,000
BVPS	12	10
ROE	17.50%	12.37%

(ii) Estimation of growth rates in EPS for BA Ltd. and DA Ltd.

		BA Ltd.	DA Ltd.
Retention Ratio	(1-D/P ratio)	0.6	0.4
Growth Rate	(ROE × Retention Ratio)	10.50%	4.95%

(iii) Justifiable equity shares exchange ratio

(a) Intrinsic value based = ₹ 20 / ₹ 40 = 0.5:1 (upper limit)

(b) Market price based = MPS_{DA}/MPS_{BA} = ₹ 15 / ₹ 40 = 0.375:1 (lower limit)

Since, BA Ltd. has a higher EPS, ROE, P/E ratio and even higher EPS growth expectations, the negotiable terms would be expected to be closer to the lower limit, based on the existing share prices.

(iv) Calculation of Post merger EPS and its effects

Particulars	BA Ltd.	DA Ltd.	Combined
EAT	2,10,000	99,000	3,09,000
Share outstanding	100000	80000	132000
Pre-merger EPS	2.1	1.2375	2.341
Post-merger/ Adjusted EPS	2.341	0.9364 [2.341x0.40]	
EPS Accretion (Dilution)	0.241	(0.3011)	

(v) Estimation of Post merger Market price and other effects

Particulars	BA Ltd.	DA Ltd.	Combined
EPS	2.1	1.2375	2.341
P/E Ratio	19.05	12.12	19.05
Pre-merger MPS	40	15	44.6
Post-merger/ Adjusted MPS	44.6	17.84 [44.6 x 0.40]	
MPS Accretion	4.6	2.84	

(vi) Since P_{AB} (i.e. ₹ 44.6) > P_A (i.e. ₹ 40), therefore, decision to acquire DA Ltd. is value accretive and hence a sound decision taken by BA Ltd.

(vii) Market value of company

BA Ltd. = ₹ 40 x 100000 = ₹ 40 lakhs
DA Ltd. = ₹ 15 x 80000 = ₹ 12 lakhs
Combined = ₹ 40 + ₹ 12 = ₹ 52 lakhs

After Merger	BA Ltd.	DA Ltd.
No. of Shares	100000	80000 x 0.40 = 32000
Combined		132000
% of Combined Equity Owned	$\frac{100}{132}$ x 100 = 75.76%	$\frac{32}{132}$ x 100 = 24.24%

∴ **Value of Original Shareholders**

BA Ltd.
₹ 52 lakhs x 75.76%
= ₹ 39.40 lakhs

DA Ltd.
₹ 52 lakhs x 24.24%
= ₹ 12.60 lakhs

Alternatively, it can also be computed as follows:

Combined Value of Entity	52 lakhs
No. of shares after Merger	132000
Value of Per Share	₹ 39.39
Value of P Ltd. Shareholders (100000 x ₹ 39.39)	₹ 39.39 lakhs
Value of R Ltd. Shareholders (32000 x ₹ 39.39)	₹ 12.60 lakhs

Question 2 2 Questions Merged | (8 Marks) Exam May 2019

Given is the following information:

	Day Ltd.	Night Ltd.
Net Earnings	₹ 5 crores	₹ 3.5 crores
No. of Equity Shares	10,00,000	7,00,000

The shares of Day Ltd. and Night Ltd. trade at 20 and 15 times their respective P/E ratios. Day Ltd. considers taking over Night Ltd. by paying ₹ 55 crores considering that the market price of Night Ltd. reflects its true value. It is considering both the following options:

I. Takeover is funded entirely in cash.
II. Takeover is funded entirely in stock.

You are required to calculate the cost of the takeover and advise Day Ltd. on the best alternative.

Also calculate Purchase Price Premium offered by Day Ltd.

Solution: Working Notes	Day Ltd.	Night Ltd.
Net Earnings	₹ 5 crores	₹ 3.5 crores
No. of Equity Shares	10,00,000	7,00,000
EPS	50	50
P/E	20 times	15 times
MPS	₹ 1000	₹ 750
Market Value	1,00,00,00,000	52,50,00,000

(i) If takeover is funded by Cash

Since Market Price of Night Ltd. reflects its full value, cost of takeover to Day Ltd is 55 crore - 52.50 crore = ₹ 2.5 crore.

(ii) If the takeover is funded by stock

Number of shares to be issued to Night Ltd. = ₹ 55 Crore/ ₹ 1000 = 5.50 Lakhs

Market Value of Merged Firm = ₹ 1,00,00,00,000 + ₹ 52,50,00,000
= ₹ 1,52,50,00,000 i.e. ₹ 152.50 Crore

Proportion that Night Ltd.'s shareholders get in Day Ltd.'s Capital Structure will be:

$$= \frac{5.5 \text{ Lakhs}}{5.5 \text{ Lakhs} + 10 \text{ Lakhs}} = 0.3548$$

As per ICAI

True Cost of Merger = ₹ 152.50 Crore x 0.3548 - ₹ 55 Crore
= - ₹ 0.893 Crore

Ideal Solution

= ₹ 152.50 Crore x 0.3548 - ₹ 52.5 Crore
= ₹ 1.607 Crore

Note: It is students own choice whether he/she wishes to replicate ICAI'S Solution or the ideal solution.

Since true cost is negative in case of funding from stock, Day Ltd. would better off by funding the takeover by stock.

Since true cost is lesser in case of funding from stock, Day Ltd. would be better off by funding the takeover by stock.

Purchase Price Premium (in ₹) = Offer Price *less* Pre-merger MP of Target
= ₹ 55 crores *less* ₹ 52.5 crores OR ₹ 785.71 - ₹ 750 per share
= 2.5 crores = ₹ 35.71 per share

$$\text{Purchase Price Premium (in \%)} = \frac{\text{Offer Price } \textit{less} \text{ Pre-merger MP of Target}}{\text{Pre-merger MP of Target}} = \frac{₹\ 785.71 - ₹\ 750}{₹\ 750} = 4.76\%$$

Question 3 Study Material, Practice Manual, RTP Nov 2022

AFC Ltd. wishes to acquire BCD Ltd. The shares issued by two companies are 10,00,000 and 5,00,000 respectively:

(i) Calculate the increase in the total value of BCD Ltd. resulting from the acquisition on the basis of the following conditions:

Current expected growth rate of BCD Ltd.	7%
Expected growth rate under control of AFC Ltd., (without any additional capital investment and without any change in risk of operations)	8%
Current Market price per share of AFC Ltd.	₹ 100
Current Market price per share of BCD Ltd.	₹ 20
Expected Dividend per share of BCD Ltd.	₹ 0.60

(ii) On the basis of aforesaid conditions calculate the gain or loss to shareholders of both the companies, if AFC Ltd. were to offer one of its shares for every four shares of BCD Ltd.

(iii) Calculate the gain to the shareholders of both the Companies, if AFC Ltd. pays ₹ 22 for each share of BCD Ltd., assuming the P/E Ratio of AFC Ltd. does not change after the merger. EPS of AFC Ltd. is ₹ 8 and that of BCD is ₹ 2.50. It is assumed that AFC Ltd. invests its cash to earn 10%.

Solution:

(i) For BCD Ltd., before acquisition

The cost of capital of BCD Ltd. may be calculated by using the following formula:

$$\frac{\text{Dividend}}{\text{Price}} + \text{Growth\%}$$

Cost of Capital i.e., Ke = (0.60/20) + 0.07 = 0.10

After acquisition g (i.e. growth) becomes 0.08

Therefore, price per share after acquisition = 0.60/(0.10-0.08) = ₹ 30

The increase in value therefore is = ₹ (30-20) x 5,00,000 = ₹ 50,00,000/-

Tutorial Note:
₹ 50,00,000 may also be termed as 'Gain from Acquisition' or 'Synergy'

(ii) To share holders of BCD Ltd. the immediate gain is ₹ 100 - ₹ 20 x 4 = ₹ 20 per share The gain can be higher if price of shares of AFC Ltd. rise following merger which they should undertake.

To AFC Ltd, shareholders	(₹ in lakhs)
Value of Company now	1,000
Value of BCD Ltd.	150
	1,150
No. of shares	11.25
∴ Value per share	1150/11.25 = ₹ 102.22

Tutorial Note: If ICAI asks to 'Calc the net cost of acquisition by AFC ltd.' then remember that it means 'Gain to Target' hence ₹ 22.22 per new share issued or ₹ 5.555 per existing share of target or ₹ 27,77,778 (₹ 22.22 x 1,25,000) in total would be the correct answer

Gain to shareholders of BCD Ltd. = ₹ 102.22 - ₹ (4 x 20) = ₹ 22.22
Gain to shareholders of AFC Ltd. = ₹ 102.22 - ₹ 100.00 = ₹ 2.22

(iii)

Gain to shareholders of AFC Ltd:-	
Earnings of BCD Ltd. (5,00,000 x 2.50)	₹ 12,50,000
Less: Loss of earning in cash (5,00,000 x ₹22x 0.10)	₹ 11,00,000
Net Earning	₹ 1,50,000
Number of shares	10,00,000
Net increase in earning per share	0.15

P/E ratio of AFC Ltd. = 100/8 = 12.50

Therefore, Gain per share of shareholders of AFC Ltd. = 0.15x12.50 = ₹ 1.88

Alternatively, it can also be computed as follows:

Post-Merger Earnings (10,00,000 x ₹ 8 + 5,00,000 x ₹ 2.5 - 11,00,000)	₹ 81,50,000
EPS after Merger $\left(\frac{81,50,000}{10,00,000}\right)$	₹ 8.15
PE Ratio	12.50
Post Merger Price of Share (₹ 8.15 x 12.50)	₹ 101.875
Less: Price before merger	₹ 100.00
Gain per share	₹ 1.875
Say	₹ 1.88

Gain to the shareholders of BCD Ltd. ₹ (22-20) = ₹ 2/- per share

Question 4 Study Material, RTP May 18, (12 Marks) Exam Nov 18 (Similar), MTP M 25

T Ltd. and E Ltd. are in the same industry. The former is in negotiation for acquisition of the latter. Important information about the two companies as per their latest financial statements is given below:

	T Ltd.	E Ltd.
₹ 10 Equity shares outstanding	12 Lakhs	6 Lakhs
Debt:		
10% Debentures (₹ Lakhs)	580	---
12.5% Institutional Loan (₹ Lakhs)	---	240
Earning before interest, depreciation and tax (EBIDAT) (₹ Lakhs)	400.86	115.71
Market Price/share (₹)	220.00	110.00

T Ltd. plans to offer a price for E Ltd., business as a whole which will be 7 times EBIDAT reduced by outstanding debt, to be discharged by own shares at market price.

E Ltd. is planning to seek one share in T Ltd. for every 2 shares in E Ltd. based on the market price. Tax rate for the two companies may be assumed as 30%.

Calculate and show the following under both alternatives - T Ltd.'s offer and E Ltd.'s plan:
(i) Net consideration payable.
(ii) No. of shares to be issued by T Ltd.
(iii) EPS of T Ltd. after acquisition.
(iv) Expected market price per share of T Ltd. after acquisition.
(v) State briefly the advantages to T Ltd. from the acquisition.

Calculations (except EPS) may be rounded off to 2 decimals in lakhs.

Solution: As per T Ltd.'s Offer

	₹ in lakhs
(i) Net consideration Payable	
7 times EBIDAT, i.e. 7 × ₹ 115.71 lakh	809.97
Less : Debt	240.00
	569.97
(ii) No. of shares to be issued by T Ltd	
₹ 569.97 lakh/₹ 220 (rounded off) (Nos.)	2,59,000
(iii) EPS of T Ltd after acquisition	
Total EBIDT (₹ 400.86 lakh + ₹ 115.71 lakh)	516.57
Less : Interest (₹ 58 lakh + ₹ 30 lakh)	88.00
	428.57
Less : 30% Tax	128.57
Total earnings (NPAT)	300.00
Total no. of shares outstanding (12 lakh + 2.59 lakh)	14.59 lakh
EPS (₹ 300 lakh/14.59 lakh)	₹ 20.56

(iv) Expected Market Price:

	₹ in lakhs
Pre-acquisition P/E multiple: EBIDAT	400.86
Less: Interest $\left(580 \times \frac{10}{100}\right)$	58.00
	342.86
Less: 30% Tax	102.86
	240.00
No. of shares (lakhs)	12.00
EPS	₹ 20.00
Hence, PE multiple $\frac{220}{20}$	11
Expected market price after acquisition (₹ 20.56 × 11)	₹ 226.16

As per E Ltd's Plan

		₹ in lakhs
(i)	Net consideration payable	
	6 lakhs share × ₹ 110	660
(ii)	No. of shares of be issued by T Ltd	
	₹ 660 lakhs ÷ ₹ 220	3 lakh
(iii)	EPS to T Ltd after Acquisition	
	NPAT (as per earlier calculations)	300.00
	Total no. of shares outstanding (12 lakh + 3 lakhs)	15 lakh
	Earning per share (EPS) ₹ 300 lakh/15 lakh	₹ 20.00
(iv)	Expected Market Price (₹ 20 × 11)	220.00

(v) Advantages of Acquisition to T Ltd

Since the two companies are in the same industry, the following advantages could accrue:

- Synergy, cost reduction and operating efficiency.
- Better market share.
- Avoidance of competition.

Question 5

Study Material, (6 Marks) Exam May 2014, MTP Sep 2022, (6 Marks) Exam May 2024

The equity shares of XYZ Ltd. are currently being traded at ₹ 24 per share in the market. XYZ Ltd. has total 10,00,000 equity shares outstanding in number; and promoters' equity holding in the company is 40%.

PQR Ltd. wishes to acquire XYZ Ltd. because of likely synergies. The estimated PV of these synergies is ₹80,00,000.

Further PQR feels that management of XYZ Ltd. has been over paid. With better motivation, lower salaries and fewer perks for the top management, will lead to savings of ₹ 4,00,000 p.a. Top management with their families are promoters of XYZ Ltd. Present value of these savings would add ₹ 30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

Earnings per share	:	₹ 4
Total number of equity shares outstanding	:	15,00,000
Market price of equity share	:	₹ 40

Required:

(i) What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd.?

(ii) What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

Solution

(i) Calculation of maximum price per share at which PQR Ltd. can offer to pay for XYZ Ltd's share

Market Value (10,00,000 x ₹ 24)	₹ 2,40,00,000
Synergy Gain	₹ 80,00,000
Saving of Overpayment	₹ 30,00,000
	₹ 3,50,00,000
Maximum Price (₹ 3,50,00,000/10,00,000)	₹ 35

Alternatively, it can also be computed as follows:

Let ER be the swap ratio then,

$$40 = \frac{24 \times 10,00,000 + 40 \times 15,00,000 + 80,00,000 + 30,00,000}{15,00,000 + 10,00,000 \times ER}$$

$$ER = 0.875$$

$$MP = PE \times EPS \times ER = \frac{40}{4} \times ₹ 4 \times 0.875 = ₹ 35$$

(ii) Calculation of minimum price per share at which the management of XYZ Ltd's will be willing to offer their controlling interest

Value of XYZ Ltd's Management Holding (40% of 10,00,000 x ₹ 24)	₹ 96,00,000
Add: PV of loss of remuneration to top management	₹ 30,00,000
	₹ 1,26,00,000
No. of Shares	4,00,000
Minimum Price (₹ 1,26,00,000/4,00,000)	₹ 31.50

Question 6

Study Material

The CEO of a company thinks that shareholders always look for EPS. Therefore he considers maximization of EPS as his company's objective. His company's current Net Profits are ₹ 80 lakhs and P/E multiple is 10.5. He wants to buy another firm which has current income of ₹ 15.75 lakhs & P/E multiple of 10.

What is the maximum exchange ratio which the CEO should offer so that he could keep EPS at the current level, given that the current market price of both the acquirer and the target company are ₹ 42 and ₹ 105 respectively?

If the CEO borrows funds at 15% and buys out Target company by paying cash, how much should he offer to maintain his EPS? Assume tax rate of 30%.

Solution

(i)	Acquirer Company	Target Company
Net Profit	₹ 80 lakhs	₹ 15.75 lakhs
PE Multiple	10.50	10.00
Market Capitalization	₹ 840 lakhs	₹ 157.50 lakhs
Market Price	₹ 42	₹ 105
No. of shares	20 lakhs	1.5 lakhs
EPS	₹ 4	₹ 10.50

Maximum Exchange Ratio 4 : 10.50 or 1 : 2.625

The correct way to write is 2.625:1

Thus, for every one share of Target Company 2.625 shares of Acquirer Company.

(ii) Let x lakhs be that amount paid by Acquirer company to Target Company. Then to maintain same EPS i.e. ₹ 4 the number of shares to be issued will be:

$$= \frac{(80 \text{ lakhs} + 15.75 \text{ lakhs}) - 0.70 \times 15\% \times X}{20 \text{ lakhs}} = 4$$

$$= \frac{95.75 - 0.105\ X}{20} = 4$$

X = ₹ 150 lakhs Thus, ₹ 150 lakhs shall be offered in cash to Target Company to maintain same EPS.

Question 7

2 Questions Merged | Study Material, (8 Marks) CA Final MTP Oct 2019, Nov 2024 (Similar)

During the audit of the Weak Bank (W), RBI has suggested that the Bank should either merge with another bank or may close down. Strong Bank (S) has submitted a proposal of merger of Weak Bank with itself. The relevant information and Balance Sheets of both the companies are as under:

Particulars	Weak Bank (W)	Strong Bank (S)	Assigned Weights (%)
Gross NPA (%)	40	5	30
Capital Adequacy Ratio (CAR) [Total Capital/ Risk Weight Asset]	5	16	28
Market price per Share (MPS)	12	96	32
Book value			10
Trading on Stock Exchange	Irregular	Frequent	

Balance Sheet (₹ in Lakhs)

Particulars	Weak Bank (W)	Strong Bank (S)
Paid up Share Capital (₹ 10 per share)	150	500
Reserves & Surplus	80	5,500
Deposits	4,000	44,000
Other Liabilities	890	2,500
Total Liabilities	5,120	52,500
Cash in Hand & with RBI	400	2,500
Balance with Other Banks	-	2,000
Investments	1,100	19,000
Advances	3,500	27,000
Other Assets	70	2,000
Preliminary Expenses	50	-
Total Assets	5,120	52,500

You are required to
(i) Calculate Swap ratio based on the above weights
(ii) Ascertain No. of Shares to be issued to Weak Bank & find out Post-merger Equity-ownership distribution
(iii) Prepare Balance Sheet after merger; and
(iv) Calculate CAR and Gross NPA of Strong Bank after merger.

Solution: (i) Swap Ratio

Gross NPA	5:40	5/40 x 30%	0.0375
CAR	5:16	5/16 x 28%	0.0875
Market Price	12:96	12/96 x 32%	0.0400
Book Value Per Share	12:120	12/120 x 10%	0.0100
			0.1750

Thus, for every share of Weak Bank, 0.1750 share of Strong Bank shall be issued.

Calculation of Book Value Per Share

Particulars	Weak Bank (W)	Strong Bank (S)
Share Capital (₹ Lakhs)	150	500
Reserves & Surplus (₹ Lakhs)	80	5,500
	230	6,000
Less: Preliminary Expenses (₹ Lakhs)	50	-
Net Worth or Book Value (₹ Lakhs)	180	6,000
No. of Outstanding Shares (₹ Lakhs)	15	50
Book Value Per Share (₹)	12	120

(ii) No. of equity shares to be issued:

$\frac{150}{10}$ x 0.1750 = 2.625 lakh shares

Calculation of Post-merger Equity Ownership

% Ownership of Original Strong Bank Shareholders = 50 / (50 + 2.625) = 95.01%

% Ownership of Original Weak Bank Shareholders = 2.625 / (50 + 2.625) = 4.99%

(iii) Balance Sheet after Merger

Calculation of Capital Reserve

Book Value of Shares	₹ 180.00 lac
Less: Value of Shares issued	₹ 26.25 lac
Capital Reserve	₹ 153.75 lac

Balance Sheet

	₹ lac		₹ lac
Paid up Share Capital	526.25	Cash in Hand & RBI	2900.00
Reserves & Surplus	5500.00	Balance with other banks	2000.00
Capital Reserve	153.75	Investment	20100.00
Deposits	48000.00	Advances	30500.00
Other Liabilities	3390.00	Other Assets	2070.00
	57570.00		**57570.00**

(iv) Calculation of CAR & Gross NPA % of Bank 'S' after merger

$$CAR / CRWAR = \frac{\text{Total Capital}}{\text{Risky Weighted Assets}}$$

	Weak Bank	Strong	Merged
	5%	16%	
Total Capital	₹ 180 lac	₹ 6000 lac	₹ 6180 lac
Risky Weighted Assets	₹ 3600 lac	₹ 37500 lac	₹ 41100 lac

$$CAR = \frac{6180}{41100} \times 100 = 15.04\%$$

$$GNPA\ Ratio = \frac{\text{Gross NPA}}{\text{Gross Advances}} \times 100$$

	Weak Bank	Strong Bank	Merged
GNPA (Given)	0.40	0.05	
	$0.40 = \frac{GNPA_R}{₹\ 3500\ lac}$	$0.50 = \frac{GNPA_S}{₹\ 27000\ lac}$	
Gross NPA	1400 lakhs	1350 lakhs	2750 lakhs
Gross Advances	3500 lakhs	27000 lakhs	30500 lakhs
		∴ Gross NPA %	9.016% ~ 9.02%

Question 8

Study Material, Exam Nov 2005

The following information is relating to Fortune India Ltd. having two division, viz. Pharma Division and Fast Moving Consumer Goods Division (FMCG Division). Paid up share capital of Fortune India Ltd. is consisting of 3,000 Lakhs equity shares of Re. 1 each. Fortune India Ltd. decided to de-merge Pharma Division as Fortune Pharma Ltd. w.e.f. 1.4.2022. Details of Fortune India Ltd. as on 31.3.2022 and of Fortune Pharma Ltd. as on 1.4.2022 are given below:

Particulars (₹)	Fortune Pharma Ltd. (₹)	Fortune India Ltd.
Outside Liabilities		
Secured Loans	400 lakhs	3000 lakhs
Unsecured Loans	2,400 lakhs	800 lakhs
Current Liabilities & Provisions	1,300 lakhs	21,200 lakhs
Assets		
Fixed Assets	7,740 lakhs	20,400 lakhs
Investments	7,600 lakhs	12,300 lakhs
Current Assets	8,800 lakhs	30,200 lakhs
Loans & Advances	900 lakhs	7,300 lakhs
Deferred tax / Misc. Expenses	60 lakhs	(200) lakhs

BOD of the Company have decided to issue necessary equity shares of Fortune Pharma Ltd. of Re. 1 each, without any considerations to the shareholders of Fortune India Ltd.

For that purpose following points are to be considered:

1. Transfer of Liabilities & Assets at Book value.
2. Estimated Profit for the year 2022-23 is ₹ 11,400 Lakh for Fortune India Ltd. & ₹ 1,470 lakhs for Fortune Pharma Ltd.
3. Estimated Market Price of Fortune Pharma Ltd. is ₹ 24.50 per Share.
4. Average P/E Ratio of FMCG sector is 42 & Pharma sector is 25, which is to be expected for both the companies.

Calculate:

a) The Ratio in which shares of Fortune Pharma are to be issued to the shareholders of Fortune India Ltd.

b) Expected Market Price of Fortune India Ltd.

c) Book Value per share of both the Companies immediately after Demerger.

Solution: Share holders' funds

Particulars	Fortune India Ltd	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd
Assets	70,000	25,100	44,900
Outside liabilities	25,000	4,100	20,900
Net worth	45,000	21,000	24,000

a) Calculation of Shares of Fortune Pharma Ltd. to be issued to shareholders of Fortune India Ltd.

	Fortune Pharma Ltd
Estimated Profit (₹ in lakhs)	1,470
Estimated market price (₹)	24.5
Estimated P/E	25
Estimated EPS (₹)	0.98
No. of shares lakhs	1,500

Hence, Ratio is 1 share of Fortune Pharma Ltd. for 2 shares of Fortune India Ltd.
OR for 0.5 share of Fortune Pharma Ltd for 1 Share of Fortune India Ltd.

b) Expected market price of Fortune India Ltd.

	Fortune India (FMCG) Ltd.
Estimated Profit	₹ 11,400 lakhs
No. of equity share	3,000 lakhs
Estimated EPS	₹ 3.8
Estimated P/E	42
Estimated market price	₹ 159.60

c) Book value per share

	Fortune Pharma Ltd.	Fortune India (FMCG) Ltd.
Net worth (₹ in lakhs)	21,000	24,000
No. of shares (₹ in lakhs)	1,500	3,000
Book value of shares	₹ 14	₹ 8

Question 9

2 Questions Merged | Study Material, MTP Nov 18, RTP Nov 20, RTP Nov 23

The following is the Balance-sheet of XYZ Company Ltd as on March 31st, 2023.

Liabilities	Amount	Assets	Amount
6 lakh Equity shares of ₹ 100/- each	600	Land & Building	200
2 lakh 14% Preference shares of ₹ 100/- each	200	Plant & Machinery	300
13% Debentures	200	Furniture & Fixtures	50
Debenture Interest accrued and Payable	26	Inventory	150
Loan from Bank	74	Sundry debtors	70
Trade Creditors	300	Cash at Bank	130
		Preliminary Expenses	10
		Cost of Issue of debentures	5
		Profit & Loss A/c	485
	1,400		1,400

The XYZ Company did not perform well and has suffered sizable losses during the last few years. However, it is now felt that the company can be nursed back to health by proper financial restructuring and consequently the following scheme of reconstruction has been devised:

(i) Equity shares are to be reduced to ₹ 25/- per share, fully paid up;

(ii) Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of ₹ 50 each, fully paid up

(iii) Debenture holders have agreed to forego interest accrued to them. Beside this, they have agreed to accept new debentures carrying a coupon rate of 9%.

(iv) Trade creditors have agreed to forgo 25 per cent of their existing claim; for the balance sum they have agreed to convert their claims into equity shares of ₹ 25/- each.

(v) In order to make payment for bank loan and augment the working capital, the company issues 6 lakh equity shares at ₹ 25/- each; the entire sum is required to be paid on application.The existing shareholders have agreed to subscribe to the new issue.

(vi) While Land and Building is to be revalued at ₹ 250 lakh, Plant & Machinery is to be written down to ₹ 104 lakh. A provision amounting to ₹ 5 lakh is to be made for bad and doubtful debts.

You are required to show the impact of financial restructuring/re-construction. Also, prepare the new balance sheet assuming the scheme of re-construction is implemented in letter and spirit.

Also state that who will control the company and by how big margin after the restructuring ?

Solution:

Impact of Financial Restructuring

(i) Benefits to XYZ Ltd (₹ in lakhs)

(a)	Reduction of liabilities payable	
	Reduction in equity share capital (6 lakh shares x ₹ 75 per share)	450
	Reduction in preference share capital (2 lakh shares x ₹ 50 per share)	100
	Waiver of outstanding debenture Interest	26
	Waiver from trade creditors (₹ 300 lakhs x 0.25)	75
		651
(b)	Revaluation of Assets	
	Appreciation of Land and Building (₹ 250 lakhs - ₹ 200 lakhs)	50
		701

(ii) Amount of ₹ 701 lakhs utilized to write off losses, fictious assets and over- valued assets. (₹ in lakhs)

Writing off profit and loss account	485
Cost of issue of debentures	5
Preliminary expenses	10
Provision for bad and doubtful debts	5
Revaluation of Plant and Machinery (₹ 300 lakhs – ₹ 104 lakhs)	196
	701

Balance sheet of XYZ Ltd as at_____ (after re-construction) (₹ in lakhs)

Liabilities	Amount	Assets	Amount
21 lakhs equity shares of ₹ 25 each	525	Land & Building	250
2 lakhs 10% Preference shares of ₹50 each	100	Plant & Machinery	104
9% Debentures	200	Furniture & Fixtures	50
		Inventory	150
		Sundry debtors (70-5)	65
		Cash-at-Bank (Bal figure)*	206
	825		825

*Opening Balance of ₹ 130 lakhs + Sale proceeds from issue of new equity shares ₹ 150 lakhs – Payment of bank loan of ₹ 74 lakhs = ₹ 206 lakhs.

The original shareholders will still own 12 lakh shares (approx 57%), while the creditors will own 9 lakh shares (approx 43%). Hence, the control will remain with original shareholders.

Question 10 Study Material, (8 Marks) Exam Nov 2012, RTP Nov 2018

Note: We cover this Q while teaching Valuation chapter

Yes Ltd. wants to acquire No Ltd. and the cash flows of Yes Ltd. and the merged entity are given below :

(in ₹ lakhs)

Year	1	2	3	4	5
Yes Ltd.	175	200	320	340	350
Merged Entity	400	450	525	590	620

Earnings would have witnessed 5% constant growth rate without merger and 6% with merger on account of economies of operations after 5 years in each case. The cost of capital is 15%.

The number of shares outstanding in both the companies before the merger is the same and the companies agree to an exchange ratio of 0.5 shares of Yes Ltd. for each share of No Ltd.

PV factor at 15% for years 1-5 are 0.870, 0.756, 0.658, 0.572, 0.497 respectively.

You are required to :

(i) Compute the Value of Yes Ltd. before and after merger.

(ii) Value of Acquisition and

(iii) Gain to shareholders of Yes Ltd.

Solution: (1) Working Notes:

Present Value of Cash Flows (CF) up to 5 years

Year End	CF of Yes Ltd. (₹ lakhs)	PVF @15%	PV of CF (₹ lakhs)	CF of Merged Entity (₹ lakhs)	PV of CF of Merged Entity (₹ lakhs)
1	175	0.870	152.25	400	348.00
2	200	0.756	151.20	450	340.20
3	320	0.658	210.56	525	345.45
4	340	0.572	194.48	590	337.48
5	350	0.497	173.95	620	308.14
			882.44		1679.27

PV of Cash Flows of Yes Ltd. after the forecast period

$$TV_5 = \frac{CF_5 (1 + g)}{K_e - g} = \frac{350 (1 + 0.05)}{0.15 - 0.05} = \frac{367.50}{0.10} = ₹ 3675 \text{ lakhs}$$

PV of TV_5 = ₹ 3675 lakhs x 0.497 = ₹ 1826.475 lakhs

PV of Cash Flows of Merged Entity after the forecast period

$$TV_5 = \frac{CF_5 (1 + g)}{K_e - g} = \frac{620 (1 + 0.06)}{0.15 - 0.06} = \frac{657.20}{0.09} = ₹ 7302.22 \text{ lakhs}$$

PV of TV_5 = ₹ 7302.22 lakhs x 0.497 = ₹ 3629.20 lakhs

Value of Yes Ltd.

	Before merger (₹ lakhs)	After merger (₹ lakhs)
PV of CF (1-5 years)	882.440	1679.27
Add: PV of TV_5	1826.475	3629.20
	2708.915	5308.47

(2) Value of Acquisition

= Value of Merged Entity – Value of Yes Ltd.

= ₹ 5308.47 lakhs - ₹ 2708.915 lakhs = ₹ 2599.555 lakhs

(3) Gain to Shareholders of Yes Ltd.

Share of Yes Ltd. in merged entity = ₹ 5308.47 lakhs x $\frac{1}{1.5}$ = ₹ 3538.98 lakhs

Less: Pre - merger value of Yes Ltd. = ₹ 2708.915 lakhs

Gain to shareholder of Yes Ltd. = ₹ 830.065 lakhs

Question 11

Study Material, (10 Marks) Exam Nov 2013, Jan 2021 (Similar), MTP April 2024

Note: We cover this Q while teaching Valuation chapter

M/s Tiger Ltd. wants to acquire M/s Leopard Ltd. The balance sheet of Leopard Ltd. as on 31st March, 2012 as follows:

Liabilities	₹	Assets	₹
Equity Capital (70,000 shares)	7,00,000	Cash	50,000
Retained earnings	3,00,000	Debtors	70,000
12% Debentures	3,00,000	Inventories	2,00,000
Creditors and other liabilities	3,20,000	Plants & Equipment	13,00,000
	16,20,000		16,20,000

Additional information:

1. Shareholders of Leopard Ltd. will get one share in Tiger Ltd. for every two shares. External liabilities are expected to be settled at ₹ 5,00,000. Shares of Tiger Ltd. would be issued at its current price of ₹ 15 per share. Debenture holders will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize ₹ 2,00,000.
2. Tiger Ltd. has decided to operate the business of Leopard Ltd. as a separate division. The division is likely to give cash flows (after tax) to the extent of ₹ 5,00,000 per year for 6 years. Tiger Ltd. has planned that, after 6 years, this division would be demerged and disposed of for ₹ 2,00,000.
3. The company's cost of capital is 16%

Make a report to the Board of the company advising them about the financial feasibility of this acquisition.

Net present values for 16% for ₹ 1 are as follows:

Years	1	2	3	4	5	6
PVF	.862	.743	.641	.552	.476	.410

Solution: (a) Calculation of Purchase Consideration

	₹
Issue of Share 35000 × ₹ 15	5,25,000
External Liabilities settled	5,00,000
13% Debentures	3,00,000
	13,25,000
Less: Realization of Debtors and Inventories	2,00,000
Cash	50,000
	10,75,000

Net Present Value = PV of Cash Inflow + PV of Demerger of Leopard Ltd. – Cash Outflow

= ₹ 5,00,000 x PVAF(16%,6) + ₹ 2,00,000 PVF (16%,6) – ₹ 10,75,000

= ₹ 5,00,000 × 3.684 + ₹2,00,000 × 0.410 – ₹ 10,75,000

= ₹ 18,42,000 + ₹ 82,000 – ₹ 10,75,000

= ₹ 8,49,000

Since NPV of the decision is positive it is advantageous to acquire Leopard Ltd.

Equity Valuation Techniques

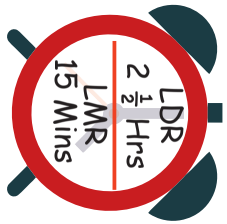
Asset based valuation	Dividend/Earnings based valuation	Cash flow based valuation	Relative valuation/ Market Approach	Other Valuation Technique	Special Valuation Situations
1. Net assets value 2. Net realizable value 3. Net replacement value	4. Earnings capitalization model	11. Free cash flow to the Firm 12. Free cash flow to the Equity 13. Alcar model/ Shareholder value analysis	14. PE Multiple 15. PEG Multiple 16. Price to BV Multiple 17. Yield based approach	18. Economic value added 19. Market value added 20. Chop-shop model / Sum of the parts approach	22. Startup / Digital Platform / Service firms 23. Non-going Concern / Distressed Company Valuation
5. Fair value method 6. Super profits method			21. Enterprise Value Approach		
7. Dividend capitalization model - No Growth - Constant Growth - Variable Growth 8. Earnings Growth Model 9. Walter's Model 10. H - Model					

IF Q is silent then prefer writing valuation in both 'total' terms & 'per share' terms.

Basic Valuation Principle

Value of any Asset today is the 'Present Value of Expected Cash Flows' from that Asset discounted @ Required Rate of Return.

Here, Required rate of return is the Opportunity Cost of Capital in similar risky opportunities.



Assets Based Valuation

Net Assets value
aka Book value method
= Book Value of assets
Less: Outside Liabilities

Net Realizable value
aka Liquidation value method
= Realizable Value of assets
Less: Outside Liabilities

Net Replacement value
aka Replacement cost method
= Replacement cost of assets
Less: Outside Liabilities

Exam Tips

1. Sometimes ICAI may use these three terminologies interchangeably & doesn't strictly follow the exact interpretation. In exams, irrespective of whether NAV/NRV/NRV word is used , if market value of assets is given then it must be taken into account for Valuation.
2. Treatment of Contingent Liabilities ?
   - Question uses a general language such as
     - There is a high chance of materializing → Deduct
     - There is low/ remote prob. of materializing → Ignore & Put a Note to that effect
   - Probability of materializing of contingent liab. is given, say 60% → Deduct = Contingent Liabilities × Prob. of materializing
   - Question is silent → Two Alternatives
     (i) Deduct Assuming contingent liab. will materialize in full
     (ii) Ignore Assuming it has remote chances of materializing
3. Value of Non-Trade investment must be included as part of valuation

Dividend/ Earnings based valuation

Earnings Capitalisation Model

$$\text{Value of business} = \frac{\text{Future Maintainable Profits*}}{\text{Capitalization rate or } K_e} + \text{MV of Non-trade investments}$$

***Future Maintainable profit**
= Past year / last year profit ← Remember to start with before tax profits
Add: Extraordinary loss in the past year
Less: Extraordinary gain eg. gain on sale of asset in the past year
Less: Addl Expenditure in future eg. addl advertisement exps
Add: Addl Income on expected geographical expansion/ addition of new product or new branch etc
Less: Addl Depreciation on revaluation of assets
Less: Income from non- trade investments eg Intt on FD or Income from Inv in Mutual funds
= Future Maintainable Profit before tax
Less: Taxes
= **FMP after taxes** ← Remember to end with after tax profits

Tutorial Note:
Earnings capitalization model assumes that Earnings will remain constant for infinite years.

Fair value method / Berliner method

$$= \frac{\text{Asset based val}^{n} \text{ ie. NAV or NRV } \textit{Plus} \text{ Value of business as per earnings capitalization model}}{2}$$

Exam Tip: If weights to be assigned to each of the method are given in the Q then use such weights. Else take simple Avg as is done above.

Super Profits Method

Value of business = Assets based valn (NAV or NRV) + Goodwill

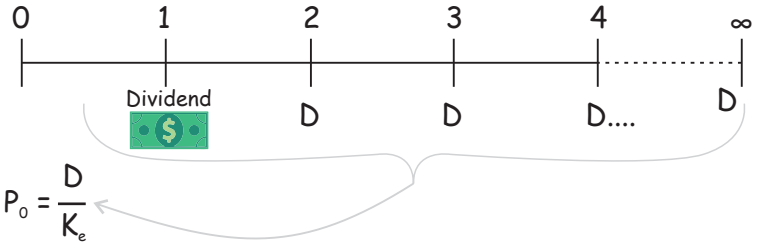
No. of years of purchase of super profits x Super Profits

Actual profits - Normal profits

Capital Invested x NRR i.e Normal rate of return

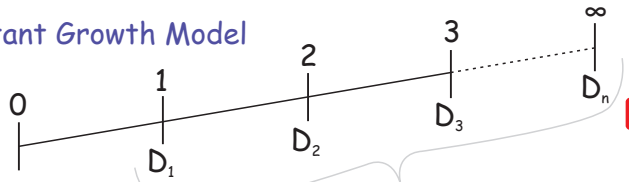
Dividend Capitalization model Or Dividend valn model / Dividend discount model / Gordon's model

(a) No Growth Model



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

(b) Constant Growth Model



$$P_0 = \frac{D_1}{K_e - g}$$

Here, g means growth rate from Yr 1 to ∞ (not g from 0th year to ∞). Hence growth rate between yr 0 to yr 1 doesn't matter because D_1 already incorporates 1st year growth rate.

This formula gives PV of growing perpetuity of dividends from D_1 to D_∞. P_0 so calculated using this formula is always ex-today's dividend ie ex-D_0. In other words D_0 is not a part of P_0.

Eg. TCS had a EPS of ₹ 100 with retention ratio of 40 %. If reqd. rate of return by Eq shhl is 14% & TCS's dividends are expected to grow @ 12 %, calc P_0 ?

$$\text{Solve : } P_0 = \frac{D_1}{K_e - g} = \frac{₹\ 60 \times 1.12}{0.14 - 0.12} = 3360 \text{ [It is fair price]}$$

Q What would be your action if TCS is currently trading @ ₹ 3100 ?

Answer: Since actual price (₹ 3100) < fair price (₹ 3360), therefore, shares of TCS are UNDERVALUED. Hence an investor should buy shares of TCS .

Components of above formula:

How to find Cost of equity i.e. K_e

Given in the Q, may be termed as
- ✓ Required rate of return by shhl.
- ✓ Expected rate of return by shhl.
- ✓ Cost of equity

Using CAPM

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

here, Rf means risk free rate of return

Note:
1. If both 'Coupon' rate & 'Yield' on Govt securities are given in the Q then use 'Yield' as Rf rate
2. If 2 or more Rf are given in the Q then as per moderate approach take their average

$K_e = \frac{D_1}{P_o} + g$

Note: This formula is not applicable if Ke so found is again reqd. to be used to calc P_0 using $\frac{D_1}{K_e - g}$ formula

$K_e = \frac{1}{\text{PE Ratio}}$

$\left[\because K_e = \text{EPS / MP is one of the formulas}\right]$

K_e & PER have inverse relationship. Use this method when other ways to calc K_e are not possible in Exam

Growth rate i.e. g

Given in the Q, may be termed as
- growth rate in earnings
- growth rate in dividends

g = RR x ROE

Based on past trends

Symmetric trends

Eg.

Yr.	2020	2021	2022	2023
DPS	10	11 (g = 10%)	12.1 (g = 10%)	13.31 (g = 10%)

Asymmetric trends

Eg.

Yr.	2020	2021	2022	2023	2024
DPS	10	12 (g = 20%)	12.5 (g = 4.167%)	13 (g = 4%)	15 (g = 15.38%)

Geometric mean

$GM = \sqrt[n]{(1 + r_1)(1 + r_2)....(1 + r_n)} - 1$

$= \sqrt[4]{(1.20)(1.04167)(1.04)(1.1538)} - 1$

$= 0.10667 \sim 10.667\%$

or

FV PV formula

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

$15 = 10 (1+r)^4$

$\sqrt[4]{1.5} = (1 + r)$

$1.10667 = 1 + r$

$\therefore r = 0.10667 \text{ or } 10.667\%$

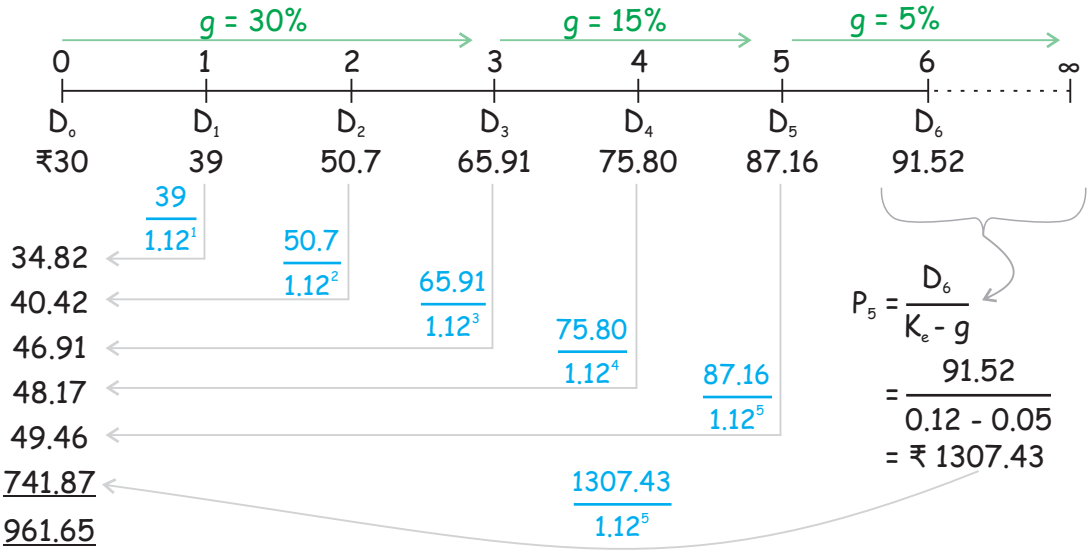
STEPS TO CALCULATE n^{th} ROOT of any number
1. Press "$\sqrt{\ }$" 12 Times
2. Subtract "1" i.e. -1
3. Divide by Rooth no. OR Multiply by Power
4. Add "1" i.e. +1
5. Press "x=" 12 Times

(c) Variable Growth rates / Two - stage growth rates / Three - stage growth model

Eg. Infosys | Do = ₹ 30 | Growth rate in dividends is expected to be 30% for first 3 yrs, thereafter it will fall to 15% for next 2 yrs, and thereafter @ 5% pa forever. | K_e = 12% | Calc P_0 ?

Solve :

P_0 = ?



Exam Presentation Caln of Po

Year	Cash flows	PV @ 12%
1	D_1 = 30 x 1.30 = 39	34.82
2	D_2 = 39 x 1.30 = 50.7	40.42
3	D_3 = 50.7 x 1.30 = 65.91	46.91
4	D_4 = 65.91 x 1.15 = 75.80	48.17
5	D_5 = 75.80x 1.15 = 87.16	49.46
5	$P_5 = \frac{D_6}{K_e - g} = \frac{87.16 \times 1.05}{0.12 - 0.05} = 1307.43$	741.87
Fair P_0 (aka Intrinsic value / Equilibrium Price / Theoretical Price/ Max amt an investor must be ready to pay)		= ₹ 961.65

Q. Suppose , share of Infy are trading @ ₹ 1100, would you buy the share ?

Actual price (₹ 1100) > Fair price (₹ 961.65), shares are OVERVALUED. We don't recommend buying the shares.

Q. Calc fair price at the end of Yr 1,2,3, & 4.

Solve: Caln of P_1

Yr	Cf's	PV @12%
1	D_2 = 50.7	45.27
2	D_3 = 65.91	52.54
3	D_4 = 75.8	53.95
4	D_5 = 87.16	55.39
4	P_5 = 1307.43	830.90
	P_1 =	1038.05

However, above process is cumbersome.
A better way is shown on the right side

Alternatively,

$P_1 = P_0(1 + K_e) - D_1$
$= 961.65 (1.12) - 39$
$= 1038.05$

by rearranging

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

Calc of P_4

$P_4 = \frac{D_5 + P_5}{1 + K_e}$

$= \frac{87.16 + 1307.43}{1.12}$

$= 1245.17$

Calc of P_3

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

$= \frac{75.8 + 1245.17}{1.12}$

$= 1179.44$

Calc of P_2

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

$= \frac{65.91 + 1179.44}{1.12}$

$= 1111.92$

$P_3 = P_2 (1 + K_e) - D_3$
$= 1111.92 (1.12) - 65.91$

Q. Coming back to today's price, Suppose you still decide to buy Infy @ ₹ 1100 today, how much return will you earn ? Definitely less than 12%, but exactly how much return% !

Use IRR Technique

Year	Cash flows	PV @ 11%	PV @ 12%
1	D_1 ₹ 39	.	
2	D_2 ₹ 50.7	.	
3	D_3 65.91	.	
4	D_4 75.80	.	
5	D_5 87.16	.	
5	$P_5 = \frac{D_6}{K_e - g} = \frac{91.52}{K_e - 0.05}$	905.21	
	PV Inflows	1131.32	961.65
	(-) PV Outflows	1100	1100
	NPV	+ 31.32	- 138.35

Caution Note

Don't make the mistake of writing result of the formula directly i.e. P_5 in the PV column. Remember to first further disc. P_5 for 5 Yrs & then write value in the PV column

Caution Note

Discount only for 5th yr don't go by flow & make mistake of disc. by 6th yr. Remember that for last two lines, discounting is done for the same no. of years

Caution Note

Don't make the mistake of writing P_5 = 1307.43 (as calc earlier) directly because that's been calc when K_e was 12%

NPV = "0" lies between a +ve & a -ve NPV. Interpolation can be used only when one of the NPV is +ve & another is -ve.

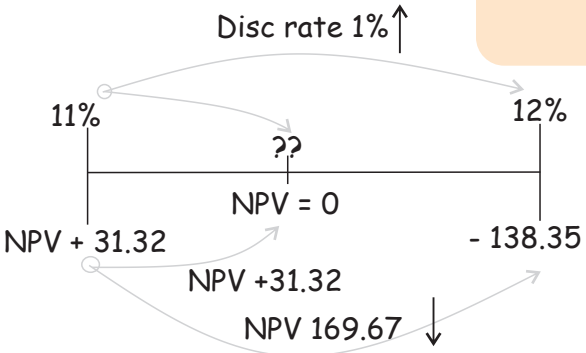
Using Interpolation Formula : -

$$= LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} (HR - LR)$$

$$= 11\% + \frac{31.32}{31.32 - (-138.35)} (12\% - 11\%)$$

$$= 11.18\%$$

Logically



NPV Falls by ∵169.67

∴ 31.32%

When Disc Rate ↑ by 1%

$= \frac{31.32 \times 1\%}{169.67}$

= 0.18%

∴ IRR = 11% + 0.18%

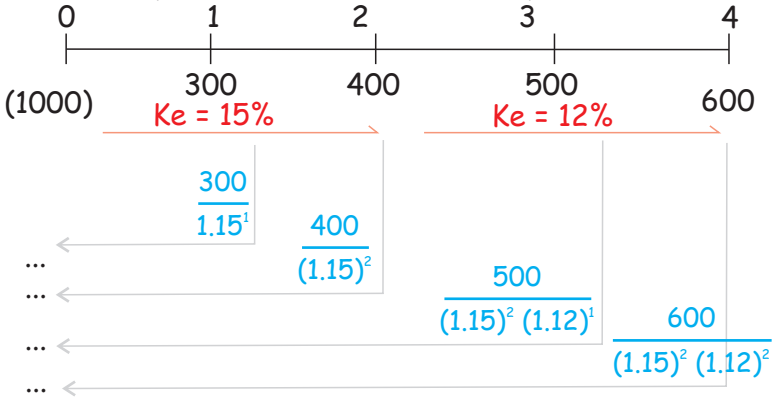
= 11.18%

Note: Above calculated IRR of 11.18% is aka Yield% ie. Return for an investor. The same IRR of 11.18% may also be termed as K_e i.e. Cost of equity to the company.

Things to Remember

1. How to discount cash-flows when multiple discount rates are given?

Eg. Calc NPV if Ke for first 2 years is 15% & for 3rd & 4th year is 12%



PV_I	1262.5
(-)Ini Inv	(1000)
NPV	262.5

2. How to calc growth rate

Eg.

Year	1	2	3	4	5
RR	0.40	0.40	0.60	0.60	0.60
ROE	15%	15%	18%	18%	18%

Calc growth rates?

Solve: $G = RR \times ROE$ ~~6%~~ ~~6%~~ ~~10.8%~~ ~~10.8%~~ ~~10.8%~~

✗ Wrong answer

Correct Approach: $G_{\text{current year}} = RR_{\text{previous year}} \times ROE_{\text{current year}}$ i.e. $G_1 = RR_0 \times ROE_1$

Solve: $g_n = RR_{n-1} \times ROE_n$

Year	1	2	3	4	5
RR_{n-1}	-	0.40 x 15%	0.40 x 18%	0.6 x 18%	0.6 x 18%
ROE_n	-	6%	7.2%	10.8%	10.8%

Growth rate for 1st Year cannot be calculated beause we don't hv RR for 0th yr. However, if such situation comes up in exam then assume $RR_0 = RR_1$ & calc g_1

i. Sometimes Students make the mistake of using "growth rate as discounting rate". Growth rate is meant for growing earnings & dividends i.e. for compounding (not for discounting). Since both K_e & g rates are given in % terms hence there is scope for confusion & mistake in exams.

ii. $G = RR \times ROE$

Please use RR here. Student sometimes make the mistake of using DPR here

eg. DPR = 60% & ROE = 10%

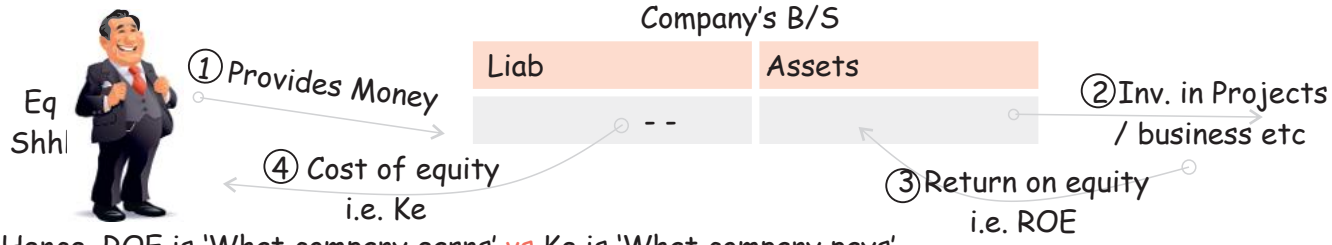
Solve: $g = 0.60 \times 10\%$ = 6% is wrong

3. Whether given Dividend is D_0 or D_1?

If words "had/has paid/declared" are used or Dividend info is available from Income Statement then given Dividend is assumed as D_0. In rest of the cases, ICAI assumes given Dividend as D_1 most of the times!

4. If Q gives both 'Coupon rate on bonds & Debentures' as well as 'effective interest rate' then use effective interest rate to calc 'Interest Exps' on Income statement.

5. Difference between Ke vs ROE ?



Hence, ROE is 'What company earns' vs Ke is 'What company pays'

6. If DPR is changing then how to calc g & D_1?

Eg. Forecasted dividend = ₹ 5 | g = 6% | P_0 = ₹ 80 | ROE = 15%

Calc K_e ?

Solve: $K_e = \frac{D_1}{P_0} + g = \frac{5}{80} + 0.06 = 12.25\%$

Caution Note Don't make the mistake of computing like 5 ÷ 80 + 6 = 6.0625%
or 5 ÷ 80 + 6% = 6.625%
Don't write it like 6%. Write it in decimal format to avoid mistake

Q. What if in above case, company changes DPR to 50%, will it change growth rate. What will be the new K_e?

Solve: New g = RR x ROE
= 0.50 x 15%
= 7.5%

Yes, growth rate has changed from 6% to 7.5%

Calc of New K_e

Ans by students: 15%, 13.84%, 13.75%, 15.31%, 12.78%, 12.71%
× × × × ✓ ✓

P_0 = ₹ 80 ; g = 0.075

How much should be D_1 ?

there are 2 alternative ways

Alt 1

Change D_1 due to changes in both
✓ Δ in DPR
✓ Δ in growth rate

$D_1 = ₹ 5 \times \frac{\text{New DPR } 50\%}{\text{Existing DPR } 60\%} \times \frac{1.075}{1.06} = ₹ 4.229 \sim ₹ 4.23$

"Assumption is that 0th yr dividend has NOT been paid yet, hence DPR will change right from 0th yr itself till ∞. Hence, D_1 will be impacted by change in growth rate".

$K_e = \frac{D_1}{P_0} + g = \frac{4.23}{80} + 0.075 = 12.78\%$

Alt 2

ICAI prefers this 2nd alternative as of now

Change D_1 due to changes in
✓ Δ in DPR
× Δ in growth rate

$D_1 = ₹ 5 \times \frac{50\%}{60\%} = ₹ 4.1667$

"Assumption is that 0th yr dividend has already been paid hence retention has already been done so growth rate for yr 1 will be same @6%. New growth rate of 7.5% will be applicable after 1st yr till ∞"

$K_e = \frac{D_1}{P_0} + g = \frac{4.1667}{80} + 0.075 = 12.71\%$

Earnings Growth Model

It is just like Dividend growth model with only difference that "DPS" will be replaced by "EPS".

$$P_0 = \frac{E_1}{K_e - g}$$

Tutorial Note: In one of the Q of earnings growth model ICAI has used ROE % as K_e

Walter's Model

$$P_o = \frac{D + \frac{r}{K_e}(E - D)}{K_e}$$

here,
r means Rate of Return on retained earnings/ Return on equity/ Return on investment

Why ΔP replaced by $= \frac{r}{K_e}(E - D)$?

Change in price takes place because of retained earnings. If there is no retained earnings & co. distributes every single ₹ it earns then share prices will not change. Hence if we retain the earnings then share price increases. The increase will be equal to PV of return on investment of such retained earnings discounted at Ke [PVP]

Derivation of Walter's model

$$P_o = \frac{D_1 + P_1}{1 + K_e} = \frac{D + P_1}{1 + K_e}$$

$$\Rightarrow 1 + K_e = \frac{D + P_1}{P_o}$$

$$\Rightarrow K_e = \frac{D + P_1}{P_o} - 1$$

$$\Rightarrow K_e = \frac{D + P_1 - P_o}{P_o}$$

$$\Rightarrow K_e = \frac{D + \Delta P}{P_o}$$

$$\Rightarrow K_e = \frac{D + \frac{r}{K_e}(E - D)}{P_o}$$

$$\Rightarrow P_o = \frac{D + \frac{r}{K_e}(E - D)}{K_e}$$

Eg 1: Eq sh hl fund = ₹ 150 crores
n = 1 crore shares
ROE = 20 %
Calc Po using Walter's model

RR = 40 %
Ke = 15 %

Solve :

$$P_o = \frac{D + \frac{r}{K_e}(E - D)}{K_e} = \frac{18 + \frac{0.20}{0.15}(30 - 18)}{0.15}$$

= ₹ 226.67

Workings:
Earnings = ₹ 150 cr. x 20 % = ₹ 30 cr
n = 1 cr
EPS = ₹ 30
DPS = ₹ 18

Q. What if in above example DPR is decreased from 60% to 20% calc P_0?
Solve:

$$P_0 = \frac{D + \frac{r}{Ke}(E - D)}{Ke} = \frac{6 + \frac{0.20}{0.15}(30 - 6)}{0.15} = ₹\ 253.33$$

Q. Refer original example, suppose Ke = 25%. Calc P_0
Case (i) DPR = 60% (ii) DPR = 20%
Solve:

$$P_0 = \frac{18 + \frac{0.20}{0.25}(30 - 18)}{0.25} = ₹\ 110.4$$

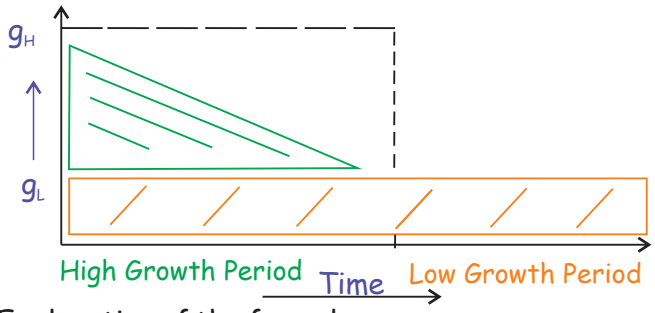
$$P_0 = \frac{6 + \frac{0.20}{0.25}(30 - 6)}{0.25} = ₹\ 100.8$$

Observation — The same observation also applies to valuation as per Gordon's model

Situation	Optimum DPR	Comment
r > K_e 20% 15%	0%	Co. is making better utilization of funds (r = 20%) as compared to shhl requirement (K_e = 15%), ∴ shhl will be happy when co. retains 100%.
r < K_e 20% 25%	100%	Sh hl can now make better utilization of such funds since Co. is unable to meet their expectations
r = K_e 20% 20%	Any payout ratio	Co. is exactly meeting sh hl expectations. Sh hl will be indifferent about dividend policy. If K_e = ROE, then it will have NO effect on P_0. Any DPR will lead to same P_0.

Exam Tip: If Q asks comment about "Whether co. is following optimum div policy" then make it a habit to also calc P_0 at both - the actual DPR as well as optimum DPR.

H Model



$$P_o = \frac{D_o \times (1 + g_L)}{K_e - g_L} + \frac{D_o \times H \times (g_H - g_L)}{K_e - g_L}$$

here,
H means half life of higher growth period

Explanation of the formula :

The 1st component of the formula completely ignores the higher growth rate & simply assumes that only **lower growth rate** will prevail for infinite years & accordingly calculates the PV of dividends growing at lower growth rate .

The 2nd component of the formula takes into account the **differential growth rate**. However, since it is a transition period & differential growth rate will gradually decline to 0% hence we multiplied it by H, where h means half of the life of transition period.

Also , the incremental dividend during the transition period will exist not only during the transition period , but it will also lift up the base for all the future dividends till perpetuity hence we used $k_e - g_L$ in the denominator.

Eg. Last Dividend = ₹ 15
Co. will grow @ 25% for 8 yrs (transition period) thereafter growth rate will fall to 10% forever.
If K_e = 18 %, Calc P_0 using H -Model

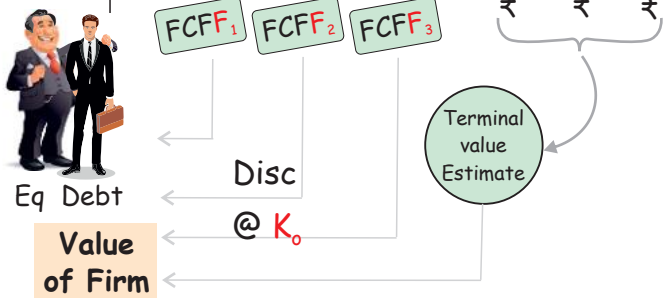
Solve: $P_0 = \frac{D_0 \times (1 + g_L)}{K_e - g_L} + \frac{D_0 \times H \times (g_H - g_L)}{K_e - g_L} = \frac{15 \times 1.10}{0.18 - 0.10} + \frac{15 \times 4 \text{ yrs} \times (0.25 - 0.10)}{0.18 - 0.10} = ₹\ 318.75$

Exam Tip: Use "H model" in exams only when Q specifically says so, otherwise deal that situation with Gordon's Model only.
It means if Q says "growth rate at present is 40% & will start falling in a liner manner so as to become 10% from 5th year onwards forever". In this case use Gordon's model only unless Q specifically asks to use H Model in Exams

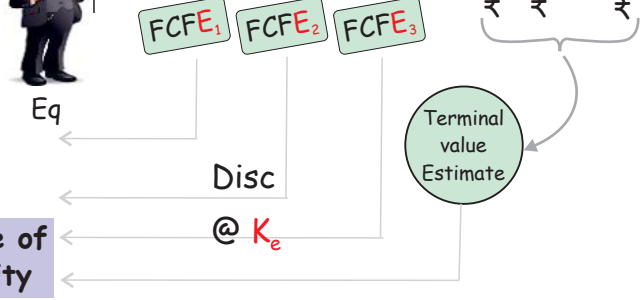
Cash - Flow Based Approaches

aka Discounted Cash flow Approach

Free Cash Flows to the Firm [FCFF]



Free Cash Flows to the Equity [FCFE]



Step 1: Prepare forecasted Balance sheet & P&L A/c (or excerpt of B/S & P&L A/C)

Step 2: Calc Free cash flows to the Firm / Equity

FCFF = EBIT (1 - t) + Noncash items eg Depreciation - Capital Expenditure - Increase in non-cash net working capital (i.e. change in w/c excluding cash)

FCFF = Cashflow from operations (CFO)* + Interest (1 - t) - Capital expenditure

* However, If interest is already adjusted in CFO, then interest will not be added again.

FCFE = EAT or EAES + Noncash items eg Depreciation - Capital Expenditure - Increase in non-cash net working capital + Net Borrowings

⚠ Caution Note: Don't make the mistake of deducting full amount of working capital required in a particular year. It's only the *increase in working capital* between current Yr vs Previous Yr that needs to be funded.

Step 3: Calc Terminal Value Estimate

Constant Amount Perpetuity

$$TVE = \frac{FCF}{K_o \text{ or } K_e \text{ (as the case may be)}}$$

[Just Like PVR = A/r]

Growing Perpetuity

$$TVE_n = \frac{FCF_{n+1}}{K_o \text{ or } K_e - g}$$

g = growth in FCF's

Other Techniques

Eg. Relative Valn Technique

Step 4 : Calc K_o or K_e

$$K_o = K_e \times W_e + K_d \times W_d$$

1. Market value weights (if available) are preferred over book value weights
2. How to calculate cost of Debt i.e. K_d

If Irredeemable

$$Kd = \frac{I\,(I - t)}{MP \text{ or Net Proceeds}}$$

If Redeemable

$$Kd = \frac{I\,(I - t) + \frac{RV - NP}{n}}{\frac{RV + NP}{2}}$$

⚠ Don't make the mistake of directly finding Kd = I% (1 - t) when MV of Debt is given in Q & such MV is different from Face Value.

Step 5: Calc V_F or V_E by discounting FCFs & TVE @K_O or K_e

Year	Cash flows	PV @ 11% (Say)
1	FCF_1 = ₹ 100 (Say)	.
2	FCF_2 = ₹ 120	.
3	FCF_3 = ₹ 144	.
4	FCF_4 = ₹ 158.4	.
5	FCF_5 = ₹ 174.24	.
5	PV of Terminal value Estimate	1284
	Value of business	1784.52

Caution Note Don't write TVE directly in PV column. Remember to calc PV today.

Why EBIT (1-t) ? or Why Tax benefit on interest is not considered while calc FCFF's ?

Since we disc. CFs by Ko which in itself incorporates after tax int. rates (i.e. tax benefit has been considered in disc. rate itself), there fore, again claiming tax benefit while calculating FCFF's would amount to double counting of the same benefit.

How to calc net borrowings ?

Eg. EAT = ₹ 1,00,000, Depn. = ₹ 25,000
Capex = ₹ 60,000, Increase in w/c = ₹ 10,000 DE Ratio = 0.30
Calc FCFE ?

Solve: FCFE = EAT + Depn - Capital Exp. - Inc. in Working Cap + Net Borrowings
= ₹ ~~100000~~ + 25000 - 60000 - 10000 + 21000
= ₹ 76000 [70000 x 0.3] i.e. 60000 cape x + W/c 10000
× Wrong answer

Caution Note There are 2 mistakes in the above calc
1. DE Ratio wrongly interpreted 2. Funds avlbl from Depreciation not considered

1. DE Ratio Vs. Debt to value ratio or Debt ratio

$= \frac{\text{Debt}}{\text{Equity}} = \frac{0.3}{1}$ $= \frac{\text{Debt}}{\text{Debt + Equity}} = \frac{0.3}{1}$

D = 0.3, Eq = 1 D = 0.3 , Eq = 0.70
Overall capital = 1.3 Overall capital = 1

2. Fund raising equivalent to 'Capex + Inc. in w/c' is not required. In fact, funds equivalent to 'Depn Amount ' are already available within the firm itself.
Therefore , net fund raising programme = 'Capex + Inc. in w/c - Depn'

FCFE = ₹ 100000 + 25000 - 60000 - 10000 + 10385 $\left[45000 \times \frac{0.3}{1.3}\right]$ = ₹ 65385

Value of equity can be calculated in two ways

Using FCFF Approach
Value of firm
Less: Value of Debt (Prefer MV of debt if given in the Q)
=Value of equity

Using FCFE Approach
Value of equity

but don't try to match these 2 values

Tutorial Note
The 'Value of equity' calculated using this approaches is Fair value of equity. It can be compared against actual share price to make buy/sell investment decisions.

Exam Tips

1. Whether calc Depn on Opening WDV or on Op WDV + Capex ?
   If Q is silent then Depn must be calc on 'Op WDV + Capex' assuming capex is incurred during the year (& not at the end of the yr)

2. Which approach - FCFF or FCFE shall I use in exams?
   If growth rate in free cash flows to the Firm is given then use FCFF approach.
   If growth rate in free cash flows to the Equity is given then use FCFE approach.

ALCAR Model / Shareholder Value Analysis

Alcar model helps in determining the value of strategy .

Example: Co. wishes to launch a new product & plans to incur heavy expenditure on Research, Capex & Advertisements, then how to find out whether strategy will be Value additive or not ?

Value of strategy = Value of firm with strategy *less* Value of firm without strategy

Use FCF Approach as taught earlier to calc Value of firm with / without strategy

Decision: If value of strategy is positive then implement the strategy .

Exam Tip: Even if there is NO sales growth & hence no business expansion, still an amount of Capex equivalent to Depn needs to be incurred to run the business & maintain the same level of sales.

Relative Valuation Technique

PE Multiple Approach

Step 1: Find PER of a Comparable firm i.e. a Proxy firm

Step 2: Adjust PER to account for difference between Proxy firm & Firm to be valued.

Step 3: Apply Adjusted PER on EPS of Firm to be valued so as to find Fair MP.

Infosys		Vs	Local software Co.	
MP	₹ 1500		Fair MP	₹ 360 ~~₹ 300~~
EPS	₹ 50		EPS	₹ 12
PE Ratio =	30 times			~~30 times~~ 25 times

Same PER may or may not be applicable

Adjustments in PER are done to account for the differences in:

- Goodwill/ Reputation
- Perceived Risk Level
- Less diversified vs Well diversified
- Niche Technology, patents
- Difference in growth rates etc.

PEG Multiple

$$\text{PEG Multiple} = \frac{\text{PE Ratio}}{g}$$

PER of one Co. cannot be directly applied to another Co. PE Ratios differs due to difference in growth rates hence we actually need to account for the diff. in growth rate as well.

Example	SBI	HDFC Bank	Kotak
MP	₹ 720	₹ 1500	₹ 1650
EPS	₹ 60	₹ 75	₹ 55
PE Ratio	12 times	20 times	30 times
g	4%	6%	12 %
PEG Ratio $\left(= \frac{\text{PE Ratio}}{g}\right)$	3 times	3.33 times	2.5 times

PEG Multiple provides us PE ratio per 1% of growth rate.

Note: Observe that prime facie, based on PE ratio, SBI appeared undervalued & Kotak appeared to be most overvalued bank. However, based on PE ratio, Kotak turned out to be the most undervalued bank.

If IDFC first bank has EPS of ₹ 2 & expected growth rate of 18 %, calc relative val^{-n} using avg. PEG multiple of the banking sector

Avg PEG Multiple = $\frac{3 + 3.33 + 2.5}{3}$ = 2.94 i.e. 2.94 is Avg PE multiple per 1% of growth

Applicable PE multiple for IDFC bank = 18 x 2.94 = 52.98 ~ 53 times

Fair price = 53 times x ₹ 2 EPS = ₹ 106

Price to Book-value multiple or P/BV multiple

P to BV Ratio = $\frac{MP}{BVPS}$

	Tata Steel	Sunflag Iron & Steel	
MP	₹ 125	Fair MP	~~₹ 87.5~~ ₹ 70
BVPS	₹ 50	BVPS	₹ 35
P/BV ratio	2.5 times		~~2.5 times~~ 2 times

Adjustments in P/BV multiple are done to account for the differences in
- Age of the assets
- Alc'n g & depn policies etc
- Same factors as written for differences in PE Ratio.

Yield based approach

It is an Accounting based method based on the premise that Value = $\frac{\text{Performance}}{\text{Expectations}}$

$V_0 = \frac{\text{Actual Yield on Equity Shares \%}}{\text{Expected Yield on Equity Shares \%}}$ x Paid up Value of Equity Shares i.e. Face value

here, Dividends + Retained earnings.

Actual Yield on Equity Shares % = $\frac{\text{Yield ₹ on Equity Shares}}{\text{Equity Share Capital}}$ x 100

Expected Yield on Equity Shares %

= Normal Rate of Return on Eq shares of similar companies in Market	xxx
+/- Risk Premium for our Company [on account of differences in fundamental factors eg. diff in accounting ratios]	xxx
	xxx

Other Valuation Techniques

Economic Value Added

EVA = NOPAT - Capital charge

i.e EBIT (1 - t) - [Capital Employed x K_o]

Things to Remember

1. NOPAT excludes Non - operating items such as
   - Gain on sale of plant
   - Inc from non - trade inv.
2. Capital Employed excludes Non - operating assets and hence calculated as below:

Liability side approach
Equity share capital
+ Reserves & surplus
+ Long term debt
+ Intangible assets [eg Patents] not yet recorded in books
(-) Non - trade Inv
(-) P& L A/c Dr. bal/ Misc exp.
(-) Advance for purchase of plant
(-) Capital WIP
(-) Land & building held as investment
+ Non operating adjustment done in NOPAT [eg Provision for bad debts]

If Patent is not shown in Balance Sheet but it commands some Market Value and helps in generating Revenues & Operating Income then it must be included as part of Capital Employed.

Asset side approach
Total Assets (excluding Non-trade inv, P&L A/c Dr bal, Advance for purchase of Plant, Capital W/P, L&B held as investment)
(+) Intangible asset [eg Patents] not yet recorded in books
(-) Current Liabilities
(+) Non operating adjustment done in NOPAT [eg Provision for bad debts]

3. If Beginning of the year Capital Employed is easily / clearly available in the Q then it should be preferred to calc Capital charge.
4. While calculating Capital employed for EVA, the Value of Equity used is book value (not market value)
5. As per ICAI, if "Prov. for bad debts" is given then calc Adjusted NOPAT = EBIT (1 - t) + Prov. for bad debts
6. Higher the EVA, better is company for investment.
7. Max dividend (as per EVA) before which company's value starts declining $= \frac{\text{EVA (as calc above)}}{\text{No. of equity shares}}$
8. Some useful ratios helpful while solving EVA sums:
   (a) Capital Gearing ratio
   $= \frac{\text{Debt + Preference}}{\text{Eq sh hl fund}}$

(b) Leverage

Operating Leverage
it exists due to the presence of Fixed cost

$$DOL = \frac{\%\ \Delta \text{ in EBIT}}{\%\ \Delta \text{ in Sales}} \text{ or } \frac{\text{Contribution}}{\text{EBIT}}$$

Financial Leverage
it exists due to the presence of Debt & Pref.

$$DFL = \frac{\%\ \Delta \text{ in EAES or EPS}}{\%\ \Delta \text{ in EBIT}} \text{ or } \frac{\text{EBIT}}{\text{EBIT - I}} \text{ or } \frac{\text{EBIT}}{\text{EBIT - I - } \frac{\text{Pref Div}}{1-t}}$$

Combined Leverage

$$DCL = \frac{\%\ \Delta \text{ in EAES or EPS}}{\%\ \Delta \text{ in Sales}} \text{ or } DCL = DOL \times DFL \text{ or } \frac{\text{Contribution}}{\text{EBIT - I - } \frac{\text{Pref Div}}{1-t}}$$

(c) Coverage Ratios

I/S	
EBIT	₹ 60 cr
(-) Intt	₹ 10 cr
EBT	₹ 50 cr
(-) T@30%	₹ 15 cr
EAT	₹ 35 cr
(-) PD	₹ 15 cr
EAES	₹ 20 cr

$$\text{Intt Coverage Ratio} = \frac{\text{EBIT}}{\text{Intt}} = \frac{60}{10} = 6 \text{ times}$$

$$\text{Pref Div Cov. Ratio} = \frac{\text{EAT}}{\text{PD}} = \frac{35}{15} = 2.33 \text{ times}$$

$$\text{Intt \& Pref Div Cov. Ratio} = \frac{\text{EAT + Intt}}{\text{Intt + PD}} = \frac{35+10}{10+15} = 1.8 \text{ times}$$

Market Value Added

shows extent of wealth creation by company since its inception

MVA = Market value less Book Value

MV of all 3 sources i.e. Eq, Pref & Debt

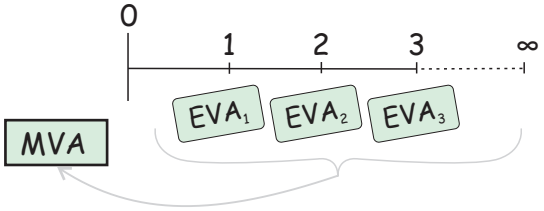
BV of all 3 sources i.e. Eq Pref & Debt

Exam Tip: However, if Q provides data about only Equity then use MV & BV of Equity only to calc MVA

Connection between MVA & EVA

Put differently , MVA is sum of PV of all future EVA's

Hence, Alternative method to calculate MVA is



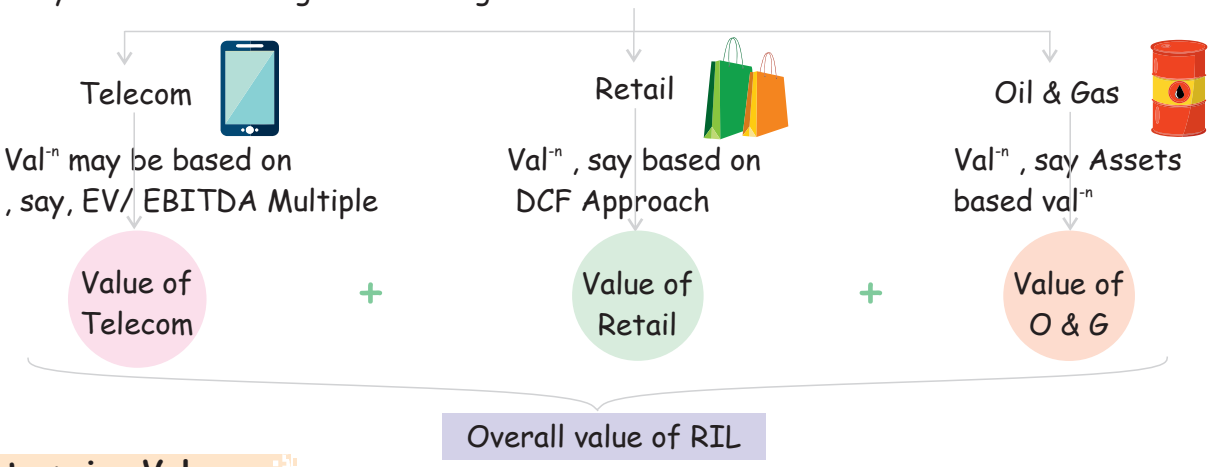
Now we can actually Value a firm using the concept of EVA & MVA

Steps to value a firm under MVA approach

1. Prepare a forecast of EBIT & then calc Forecasted EVA's
2. Calc PV of all the future EVA's. It is called as MVA
3. MV of firm = MVA as per step 2 + Book value i.e. capital employed i.e invested capital
4. MV of Equity = MV of Firm less MV of Debt

Chop Shop Model

Break -up value approach / SOTP (Sum-Of-The-Parts) Model is mainly used to value conglomerates e.g. Reliance Industries Ltd.



Enterprise Value

Enterprise value = MV of Equity
+ Value of Longterm Debt
+ Minority interest
- Cash & Cash Equivalents

1. Why Minority interest is added ?
Since EV values a business in its entirety/ totality hence minority interest is also added. In other words, it assumes that 100% of subsidiary cos. stake will also be bought while acquiring the target co.
Why 100% subsidiary stake? Since we generally calc EV Multiples such as EV/Sales or EV/EBITDA and here Sales/EBITDA means Consolidated Sales/EBITDA that includes 100% subsidiary data, therefore, EV has to also include Value of minority interest for matching purposes.
2. Why Cash & cash Eq is deducted ?
Cash is subtracted because it reduces the Net Cost of acquisition for a potential buyer

Ratios based on EV

$$\text{EV to Sales Multiple} = \frac{\text{Enterprise Value}}{\text{Sales}} \qquad \text{EV to EBITDA Multiple} = \frac{\text{Enterprise Value}}{\text{EBITDA}}$$

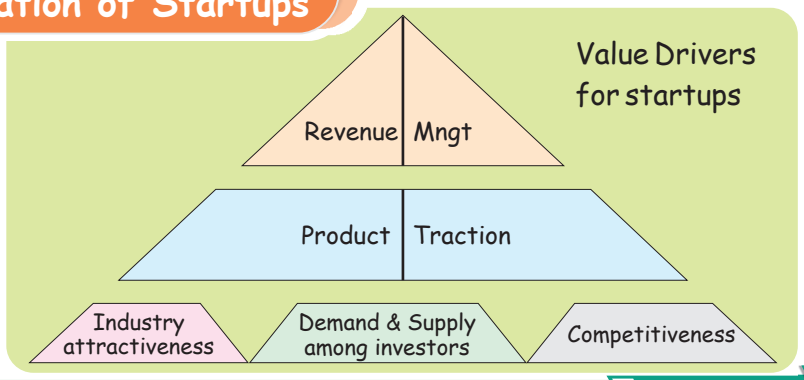
For valuation purposes,
Step 1: Find EV to Sales or EBITDA multiple of comparable companies
Step 2: Rearrange above formulas to find valuation of our company

$$EV_{our company} = \text{EV to Sales or EBITDA multiple}_{comparable\ co.} \times \text{Sales or EBITDA}_{our\ company}$$

Valuation of Startups

Techniques for Valuation

1. Berkus Approach
2. Cost - to - Duplicate Approach
3. Comparable Transactions method
4. Scorecard valuation method
5. First Chicago method
6. Venture Capital method



Berkus Approach

developed by an American angel investor Dave Berkus

Valuation is done based on five key success factors. Each of the key success factors carries maximum valuation of $500,000.

Key success factors	Assigned Valn, Say
Idea/ Basic value how exciting business idea is ? whether it is solving an unsolved problem ? does it update the current business model ?	$400,000
Technology / prototype a solid product that attracts customer	$200,000
Execution / Team Strength of the management team	$500,000
Strategic relationships in its core market	$150,000
Production & Consequent sales/ Product rollouts	$100,000

This method caps pre- revenue valuation @ $ 2 mn & Post - revenue valuation @ $ 2.5 mn] these are pre-money valuations

Berkus Approach is suitable for very young, pre- revenue startups. Not much suitable for cos. with recurring revenue streams.

Cost - to - Duplicate Approach

it values a startup by including all costs associated with the startup - product development costs, physical assets, customer acquisition cost.

Limitation of this Approach doesn't focus on future revenue projections or intangibles of the startup.

Comparable Transactions Method

The question being answered is "How much were similar startups valued at ?"

Example you wish to invest in a startup named 'Docto+' that services doctors & patients.
Below are operational parameters of Docto+ & a similar startup that has recently been valued at $10 mn by a group of investors.

	Docto+	Health OK (Comparable startup)
No. of Doctor onboard	400	1500
No. of patients registered	2000	10000

A doctor registered carries a weight of 10 times the patients.

Solve: Cal. of weighted avg users

	Docto+	Health OK
Equivalent no. of Doctors	4000	15000
Equivalent no. of patients	2000	10000
	6000	25000

$\therefore$ Valuation of Docto+ = $ 10 mn $\times \frac{6000}{25000}$

= $ 2.4 mn

Scorecard valuation method

- ✓ applicable for pre - revenue businesses
- ✓ it compares a startup to others but with added criteria

Step 1 Find the average pre - money valuation of comparable companies.

Say,3 comparable companies exist with following valuations

Co. A ₹ 70 cr

Co. B ₹ 90 cr

Co. C ₹ 120 cr

∴ Avg valuation = ₹ 93.33 crore

Alternatively, if Q mentions about taking median valuation then it will be ₹ 90 cr in the present case

Step 2 Find out Multiplier which shows how business stacks up according to the following qualities

Assign comparison% at par(100%), above par(> 100%) below par(< 100%)

Qualities of a Start-up	Weights of quality	Comparison Percentage	Weights x Comparison %
Strength of the Team [0 - 30%]	0.25	130%	0.325
Size of the Opportunity [0 - 25%]	0.20	140%	0.28
Product or service [0 - 15%]	0.20	100%	0.20
Competitive environment [0 - 10%]	0.115	80%	0.092
Marketing , sales channels & partnerships [0 - 10%]	0.115	90%	0.1035
Need for addl. investment [0 - 5%]	0.06	100%	0.06
Others [0 - 5%]	0.06	100%	0.06
			1.1205

Find out weighted avg multiplier

Step 3 Find valuation

∴ Valuation of our startup = Valuation of similar start-up (Step 1) x Multiplier (Step 2)

= ₹ 93.33 cr x 1.1205

= ₹ 104.57 crores

First Chicago method

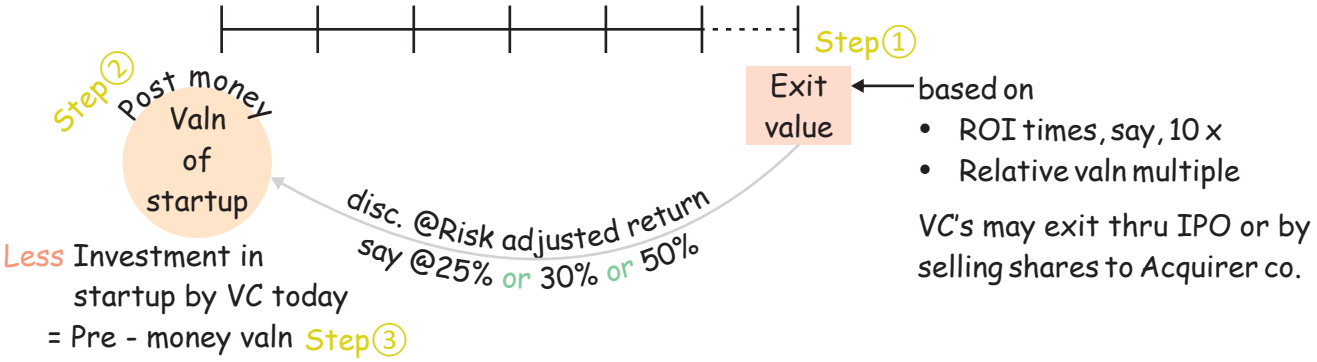
This method combines a discounted cashflow approach and a market approach to give a fair estimate of startup value.

Valuation is done under 3 scenarios

	Valn (Say)	Prob.	Valn x P
Worst - case / conservative scenario	₹ 50 cr	1/6	8.33
Normal - case or Base-case / realistic scenario	₹ 150 cr	4/6	100
Best - case / aggressive scenario	₹ 400 cr	1/6	66.67
			₹ 175 cr

Tutorial Note: These are recommended prob. if Q is silent

Venture Capital Method



Example 30ne4 Capital, an early stage venture capital fund based in Bangalore is planning to invest ₹ 15 crores at the seed stage in an Edutech startup, EduGorilla, with inv. horizon of 5 yrs.

The founder Mr. Rohit Manglik presently holds 25000 shares. It is estimated that Edugorilla will come out with an IPO is 5 Years time. IPO is estimated to be priced at 6 times the forecasted sales at the end of 5th yr which is forecasted to be ₹ 60 crores.

Given the high risk levels, reqd return is 25%. Calculate:

1. Post money valn
2. Pre-money valn
3. Ownership position required by 30ne4 capital
4. No. of shares issued to 30ne4 capital
5. Issue price

Solve:

1. Post money Valn

   V_5 = 6 times x ₹ 60 crores
   = ₹ 360 crores

   Post money val^{-n} today
   = ₹ 360 crores x $PVF_{@25\%,\ 5th\ yr}$
   = ₹ 117.96 crores

2. Pre money Valn

   = ₹ 117.96 cr - ₹ 15 cr
   = ₹ 102.96 cr

3. Ownership Position required by VCF

   $= \frac{₹\ 15\ cr}{₹\ 117.96\ cr} \times 100 = 12.72\%$

4. No. of shares to be issued to VCF

   ∵ ₹ 102.96 cr — 25000 sh
   ∴ ₹ 15 cr — ?

   $= \frac{₹\ 15\ cr}{₹\ 102.96\ cr} \times 25000\ sh$
   = 3643 Shares

5. Issue Price

   $= \frac{₹\ 15\ cr}{3643\ shares}$

   = ₹ 41184

Note Instead of a confirm 100% sure Exit value, Q may give you Exit value conditional upon success

In that case,

Expected valn at the end of 5th yr = Valn x Jt. Prob of success

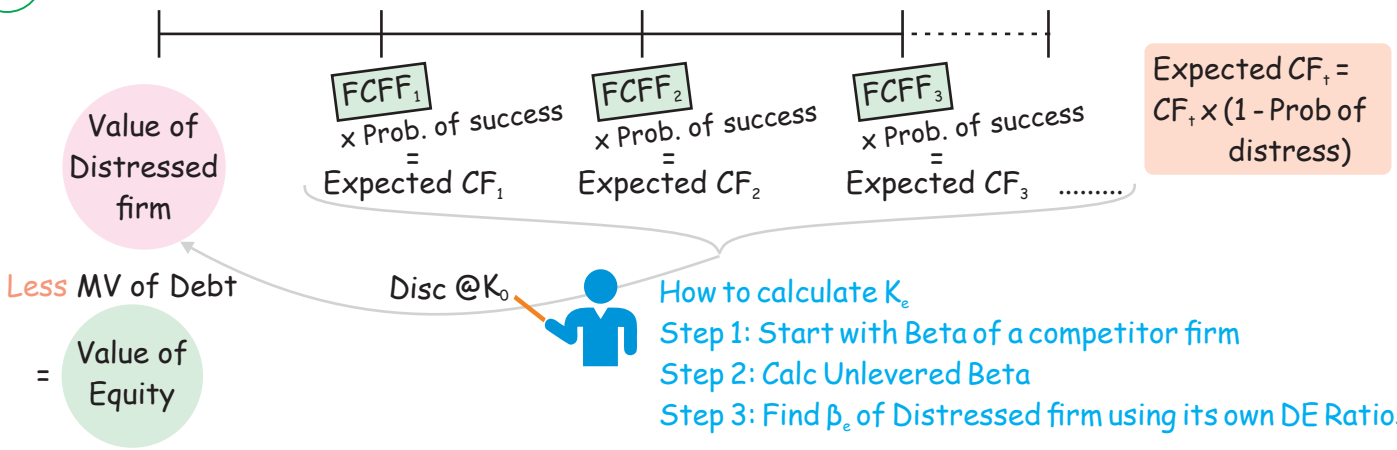
Caution Note

Jt. prob. of Success ≠ ~~1 - Jt. prob. of Failure~~
The correct approach calc Jt prob of success is =
(1 - Prob. of Failure) x .... x (1 - Prob. of Failure)

Valn of Non-going Concern/ Valn of distressed companies

- Failure to make debt payments
- inability to meet operating expenses

Modified Discounted Cash Flow Valuation



Expected CF_t = CF_t x (1 - Prob of distress)

DCF Valn + Distress Value

$$\text{Value of Equity} = \text{DCF value of Equity} \underbrace{(1 - \text{Prob. of distress})}_{\text{Prob. of success}} + \text{Distress sale value of equity} \times \text{Prob of distress}$$

Adjusted Present Value Model

Value of Firm = Unlevered firm value + Tax benefits on debt (-) Expected Bankruptcy cost

Prob of distress x [Unlevered firm Value as a going concern *less* Distress sale value]

Relative Valuation

Relative valn multiples such as EV/Sales & EV/EBITDA multiples are more popular for distressed firms. These Multiples are generally adjusted downwards for a distressed firm.

Miscellaneous

Stock Split

No. of equity shares Outstanding increases and Face value of each share decreases but total amount of share capital remains same after split.

$$\text{No. of equity shares Outstanding after split} = \frac{\text{Existing amount of share Capital}}{\text{New face value per share after split}}$$

Bonus Issue

Additional shares are issued to existing shareholders without any consideration by capitalisation of Reserves.

Example: say, Bonus Ratio is 1:2
It means 1 bonus share for every 2 existing shares

Effects of Bonus Issue

✓ No. of equity share Outstanding increases after Bonus Issue

No. of equity share Outstanding after bonus = No. of existing equity shares + No. of Bonus shares issued

✓ Amount of share capital also increases after Bonus Issue

Amount of share capital after bonus = No. of equity share Outstanding after bonus × Face Value per share

✓ Amount of reserves will decrease after bonus issue [Since bonus issue is made out of Reserves]

Amount of reserves after bonus = Amount of reserves before bonus - [No. of Bonus share x Face value per share]

✓ EPS after bonus issue = $\frac{\text{Pre-bonus EAES}}{\text{No. of equity share Outstanding after bonus}}$

✓ MP after bonus issue = EPS after bonus issue x P/E Ratio

✓ Market Capitalization after bonus issue = MP after bonus issue × No. of equity share Outstanding after bonus

Equity Buyback aka share repurchase or Ownership Restructuring

Company buys its own equity share from the market thereby reducing the no. of equity shares Outstanding . Buyback price is generally at a premium over current market price of share.

(i) Buyback price per share = Current MP + Buyback Premium per share

(ii) Total amount required for buyback = No. of Equity shares to be bought back x Buyback price per share

Effects of Equity Buyback

✓ No. of equity share Outstanding after buyback = No. of equity shares Outstanding before buyback - No. of equity share bought back

✓ EPS after buyback = $\frac{\text{EAES Before buyback - After tax Interest amount on loan taken for Buyback}}{\text{No. of equity shares Outstanding after buyback}}$

✓ Interest on loan taken for buyback = Total amount required for buyback borrowed × Interest rate on loan (%)

✓ MP after buyback = EPS after buyback x PE Ratio

✓ Market Capitalization after buyback = MP after buyback × No. of equity share Outstanding after buyback

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Question 1

RTP May 2010, May 2019

Seawell Corporation, a manufacturer of do-it-yourself hardware and house wares reported earnings per share of ₹ 2.10 in 2013 on which it paid dividend of ₹ 0.69. Earnings are expected to grow 15 % a year from 2013 to 2018 during which period the payout ratio shall remain unchanged. After 2018 the earnings growth shall drop to stable 6% and the payout shall increase to 65% of earnings. Currently the beta of firm is 1.4 and beta shall be 1.1 after 2018. Market risk premium is 5.5% and Treasury bill rate is 6.25%.

i. What is the expected price of the stock at the end of 2018?
ii. What is the value of the stock as on today using the two-stage dividend discount model?

Solution

The expected rate of return on equity after 2018 = 0.0625 + 1.10(0.055) = 12.3%
The dividends from 2013 onwards can be estimated as:

Year	2013	2014	2015	2016	2017	2018	2019
Earnings Per Share (₹)	2.1	2.415	2.78	3.19	3.67	4.22	4.48
Dividends Per Share (₹)	0.69	0.794	0.913	1.048	1.206	1.387	2.91

i. The price as of 2018 = ₹ 2.91/(0.123- 0.06) = ₹ 46.19

ii. The required rate of return upto 2018 = 0.0625 + 1.4(0.055) = 13.95%. The dividends upto 2018 are discounted using this rate as follow:

Year	PV of Dividend
2014	0.794/1.1395 = 0.70
2015	$0.913/(1.1395)^2$ = 0.70
2016	$1.048/(1.1395)^3$ = 0.71
2017	$1.206/(1.1395)^4$ = 0.72
2018	$1.387/(1.1395)^5$ = 0.72
Total	3.55

The current price = ₹ 3.55 + ₹ 46.19/$(1.1395)^5$ = ₹ 27.59

Question 2

RTP Nov 2010

The Digital Electronic System Corporation (DESC) pays no cash dividends currently and is not expected to for the next five years. Its latest EPS was ₹ 10, all of which was reinvested in the company. The firm's expected ROE for the next five years is expected to be 20% per year, and during this time it is also expected to continue to reinvest all of its earnings. It is expected that starting six years from now the DESC's ROE on new investments is expected to fall to 15%, and it is expected that the corporation shall start paying out 40% of its earnings in form of cash dividends, which it will continue to do forever after. DESC's market capitalization rate is 15% per year.

(a) Using DDM model, what is the value of DESC's share today?

(b) Now suppose that the current market price of share is equal to as computed in (a) above, then what do you expect to happen to its price over the next year? The year after?

(c) If you are expecting that DESC to pay out only 20% of earning starting in year 6 then how your estimates will be effected.

Solution: (a) Expected EPS for next years.

$EPS_1 = ₹10\,(1+0.20) = ₹12$
$EPS_2 = ₹12\,(1+0.20) = ₹14.40$
$EPS_3 = ₹14.40\,(1+0.20) = ₹17.28$
$EPS_4 = ₹17.28\,(1+0.20) = ₹20.736$
$EPS_5 = ₹20.736\,(1+0.20) = ₹24.88$
$EPS_6 = ₹24.88\,(1+0.15) = ₹28.61$
Thus $D_6 = 0.40\,(₹28.61) = ₹11.44$

Tutorial Note:
$g_6 = RR_5 \times ROE_6$
$g_7 = RR_6 \times ROE_7$

Hence, value Of DESCs share 5 years from now $= \frac{D_6}{r-g} = \frac{11.44}{15\% - 9\%} = 191$

So value of DEDC share today is $\frac{191}{1.15^5} = 94.96$

(b) The price should rise by 15% per year until year 6. Since there is no dividend, the entire return must be in the form of capital gains.

(c) There will be no effect as ROE = Ke [hence any dividend payout ratio will be optimal & share price will remain the same]. The value of DESC's share 5 years from now will be

$= \frac{D_6}{K_e - g} = \frac{5.72}{15\% - 12\%} = 191$

Question 3

Study Material, Exam May 2002, Nov 2011

A company has a book value of ₹ 137.80. Its return on equity is 15% and it follows a policy of retaining 60% of its earnings. If the opportunity cost of capital is 18% what is the price of the share today using both Dividend growth model & Walter's model.

Solution: The company earnings and dividend per share after a year are expected to be:

EPS = ₹ 137.8 x 0.15 = ₹ 20.67
Dividend = 0.40 x 20.67 = ₹ 8.27

The growth in dividend would be: $g = 0.6 \times 0.15 = 0.09$

(a) As per dividend growth model

Perpetual growth model formula: $P_0 = \frac{\text{Dividend}}{K_e - g} = \frac{8.27}{0.18 - 0.09} = ₹ 91.89$

(b) Walter's approach showing relationship between dividend and share price can be expressed by the following formula

$$V_c = \frac{D + \frac{R_a}{R_c}(E - D)}{R_c} = \frac{8.27 + \frac{.15}{.18}(20.67 - 8.27)}{.18} = \frac{18.60}{.18} = ₹ 103.35$$

Question 4

(8 Marks) Exam May 2007

The following information is supplied to you: ₹

Total earnings	2,00,000
No. of equity shares (of ₹ 100 each)	20,000
Dividend paid	1,50,000
Price / Earnings Ratio	12.5

Ascertain whether the company is following an optimal dividend policy.
Find out what should be the P/E ratio at which the dividend policy will have no effect on the value of the share.
Will your decision change, if the P/E ratio is 8 instead of 12.5?

Solution:

(i) The EPS of the firm is ₹ 10 (i.e., ₹ 2,00,000/20,000). The P/E Ratio is given at 12.5 and the cost of capital, k_e, may be taken at the inverse of P/E ratio. Therefore, k_e is 8% (i.e., 1/12.5). The firm is distributing total dividends of ₹ 1,50,000 among 20,000 shares, giving a dividend per share of ₹ 7.50. the value of the share as per Walter's model may be found as follows:

$$P = \frac{D}{K_e} + \frac{(r/K_e)(E-D)}{K_e} = \frac{7.50}{.08} + \frac{(.10/.08)(10-7.5)}{.08} = ₹\ 132.81$$

The firm has a dividend payout of 75% (i.e., ₹ 1,50,000) out of total earnings of ₹ 2,00,000. Since, the rate of return of the firm, r, is 10% and it is more than the k_e of 8%, therefore, by distributing 75% of earnings, the firm is not following an optimal dividend policy. The optimal dividend policy for the firm would be to pay zero dividend and in such a situation, the market price would be

$$P = \frac{D}{K_e} + \frac{(r/K_e)(E-D)}{K_e} = \frac{0}{.08} + \frac{(.10/.08)(10-0)}{.08} = ₹\ 156.25$$

So, theoretically the market price of the share can be increased by adopting a zero payout.

(ii) The P/E ratio at which the dividend policy will have no effect on the value of the share is such at which the k_e would be equal to the rate of return, r, of the firm. The K_e would be 10% (=r) at the P/E ratio of 10. Therefore, at the P/E ratio of 10, the dividend policy would have no effect on the value of the share.

(iii) If the P/E is 8 instead of 12.5, then the k_e which is the inverse of P/E ratio, would be 12.5 and in such a situation $k_e > r$ and the market price, as per Walter's model would be

$$P = \frac{D}{K_e} + \frac{(r/K_e)(E-D)}{K_e} = \frac{7.50}{.125} + \frac{(.1/.125)(10-7.5)}{.125} = ₹\ 76$$

The optimal dividend policy for the firm would be to pay 100% dividend and market price of share in such case would be

$$P = \frac{10.0}{0.125} + \frac{(0.1/0.125)(10-10)}{0.125} = ₹\ 80$$

Question 5 (8 Marks) Exam May 2012

X Ltd. has an internal rate of return @ 20%. It has declared dividend @ 18% on its equity shares, having face value of ₹ 10 each. The payout ratio is 36% and Price Earnings Ratio is 7.25. Find the Cost of equity according to Walter's Model and hence determine the limiting value of its shares in case the payout ratio is varied as per the said model.

Solution: Internal Rate of Return (r) = 0.20

Dividend (D) = 1.80

Earnings Per share (E) = $\frac{1.80}{0.36} = 5$

Price of Share (P) = 5 x 7.25 = 36.25

$$\Rightarrow P = \frac{D + \frac{r}{k_e}(E-D)}{k_e} \qquad \Rightarrow 36.25 = \frac{1.80 + \frac{0.20}{k_e}(5-1.80)}{k_e}$$

$$\Rightarrow 36.25\ K_e = 1.80 + \frac{0.20\ (3.20)}{k_e} \qquad \Rightarrow 36.25\ K_e = 1.80 + \frac{0.64}{k_e} \qquad \Rightarrow 36.25k^2_e = 1.80k_e + 0.64$$

$$k_e = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$k_e = \frac{-1.80 \pm \sqrt{(1.80)^2 - 4\ (-36.25) \times 0.64}}{2 \times (-36.25)}$$

$$= \frac{-1.80 \pm \sqrt{3.24 + 92.80}}{-72.50} = 16\%$$

Alternatively, it can also be calculated as follows:

$36.25\ K_e^2 - 1.80\ K_e - 0.64 = 0$

Taking 36.25 common

$K_e^2 - 0.05\ K_e - 0.0176 = 0$

$K_e^2 - 0.16\ K_e + 0.11\ K_e - 0.0176 = 0$

$K_e (K_e - 0.16) + 0.11 (K_e - 0.16) = 0$

$(K_e + 0.11) (K_e - 0.16) = 0$

Since K_e = -0.11 is not possible, the possible answer shall be K_e = 0.16 i.e. 16%.

Since the firm is a growing firm, then 100% payout ratio will give limiting value of share

$$P = \frac{5.00 + \frac{0.20}{0.16}(5 - 5)}{0.16} = \frac{5.00}{0.15} = ₹\ 31.25$$

Thus, limiting value is ₹ 31.25

Alternatively, 0% payout ratio gives limiting value of shares as follows:

$$P = \frac{0 + \frac{0.20}{0.16}(5 - 0)}{0.16} = \frac{1}{(0.16)^2} = ₹\ 39.06$$

Thus, limiting value is ₹ 39.06

Question 6

RTP May 2018, RTP Nov 2023

BRS Inc. deals in computer and IT hardware and peripherals.

The expected revenue for the next 8 years is as follows:

Year	Sales ($ Mn)	Year	Sales ($ Mn)
1	8	5	30
2	10	6	26
3	15	7	23
4	22	8	20

Summarized financial position as on 31 March 2012 was as follows:

Liabilities	$ Mn	Assets	$ Mn
Equity Stocks	12	Fixed Assets (Net)	17
12% Bonds	8	Current Assets	3
	20		20

Additional Information:

(a) Its variable expenses is 40% of sales revenue and fixed operating expenses (cash) are estimated to be as follows:

Period	Amount ($ Million)
1-4 years	1.6
5-8 years	2

(b) An additional advertisement and sales promotion campaign shall be launched requiring expenditure as per following details:

Period	Amount ($ Million)
1 year	0.50
2-3 years	1.50
4-6 years	3.00
7-8 years	1.00

(c) Fixed assets are subject to depreciation at 15% as per WDV method.

(d) The company has planned capital expenditure for the coming 8 years as follows:

Period	Amount ($ Million)
1	0.50
2	0.80
3	2.00
4	2.50
5	3.50
6	2.50
7	1.50
8	1.00

(e) Investment in Working Capital is estimated to be 20% of Revenue.

(f) Applicable tax rate for the company is 30%.

(g) Cost of Equity is estimated to be 16%.

(h) The Free Cash Flow of the firm is expected to grow at 5% per annum after 8 years.

With above information you are required to determine the:

(i) Value of Firm

(ii) Value of Equity

Hint: Assume that any excess amount of Current Assets would be used to finance Capital Expenditure to be incurred & there would be no return of the excess Working Capital.

Solution: Working notes :

(a) Determination of weighted average cost of capital

Sources of funds	Cost (%)	Proportions	Weights	Weighted cost
Equity stock	16	12/20	0.60	9.60
12% bonds	12%(1-0.30)=8.40	8/20	0.40	3.36
				12.96 say 13%

(b) Schedule of depreciation $ Million

Year	Opening balance of fixed assets	Addition during the year	Total	Depreciation @15%
1	17.00	0.50	17.50	2.63
2	14.87	0.80	15.67	2.35
3	13.32	2.00	15.32	2.30
4	13.02	2.50	15.52	2.33
5	13.19	3.50	16.69	2.50
6	14.19	2.50	16.69	2.50
7	14.19	1.50	15.69	2.35
8	13.34	1.00	14.34	2.15

(c) Determination of investment $ Million

Year	Existing investment in CA at the beginning of the year	Investment required			Additional investment required
		For capital expenditure	CA (20% of revenue)	Total	
1	3.00	0.50	1.60	2.10	0.00
2	2.50*	0.80	2.00	2.80	0.30
3	2.00**	2.00	3.00	5.00	3.00
4	3.00	2.50	4.40	6.90	3.90
5	4.40	3.50	6.00	9.50	5.10
6	6.00	2.50	5.20	7.70	1.70
7	5.20	1.50	4.60	6.10	0.90
8	4.60	1.00	4.00	5.00	0.40

* Balance of CA in year 1 ($3 million) - Capital expenditure in year 1 ($ 0.50 million)

** Similarly balance of CA in year 2 ($ 2.80) - Capital expenditure in year 2 ($ 0.80 million)

(d) Determination of present value of cash inflows $ Million

Particulars	Years							
	1	2	3	4	5	6	7	8
Revenue (A)	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
Expenses								
Variable costs	3.20	4.00	6.00	8.80	12.00	10.40	9.20	8.00
Fixed cash operating cost	1.60	1.60	1.60	1.60	2.00	2.00	2.00	2.00
Advertisement cost	0.50	1.50	1.50	3.00	3.00	3.00	1.00	1.00
Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Total expenses(b)	7.93	9.45	11.40	15.73	19.50	17.90	14.55	13.15
EBIT (C)=(A)-(B)	0.07	0.55	3.60	6.27	10.50	8.10	8.45	6.85
Less: Taxes@30% (D)	0.02	0.16	1.08	1.88	3.15	2.43	2.53	2.06
NOPAT (E) = (C)- (D)	0.05	0.39	2.52	4.39	7.35	5.67	5.92	4.79
Gross cash flow (f) = (e) + depreciation	2.68	2.74	4.82	6.72	9.85	8.17	8.27	6.94
Less: Investment in capital assets plus current assets (G)	0	0.30	3.00	3.90	5.10	1.70	0.90	0.40
Free cash flow (H) = (F) - (G)	2.68	2.44	1.82	2.82	4.75	6.47	7.37	6.54
PVF @13% (I)	0.885	0.783	0.693	0.613	0.543	0.480	0.425	0.376
PV (H) (I)	2.371	1.911	1.261	1.729	2.579	3.106	3.132	2.46

Total present value =$ 18.549 million

(e) Determination of present value of continuing value (CV)

$$CV = \frac{FCFF_9}{K_o - g} = \frac{\$6.54 \text{ Million } (1.05)}{0.13 - 00.05} = \frac{\$6.867 \text{ Million}}{0.08} = \$85.837 \text{ Million}$$

Present Value of continuing value (CV) = $85.8375 million x $PVF_{13\%,8}$
= $85.8375 million x 0.376
= $ 32.2749 million

(i) Value of Firm

	$ Million
Present value of cash flow during explicit period	18.5490
Present value of continuing value	32.2749
Total value	50.8239

(ii) Value of Equity

	$ Million
Total Value of firm	50.8239
Less : Value of debt	8.0000
Value of equity	42.8239

Question 7

2 Questions Merged | Study Material, (10 Marks) Exam May 2010, May 2022

Following information are available in respect of XYZ Ltd. which is expected to grow at a higher rate for 4 years after which growth rate will stabilize at a lower level:

Base year information:

Revenue	-	₹ 2,000 crores
COGS	-	₹ 1000 crores
Operating Exps	-	₹ 700 Crores
Capital expenditure	-	₹ 280 crores
Depreciation (included in COGS & Operating Exps)	-	₹ 200 crores

Information for high growth and stable growth period are as follows:

	High Growth	Stable Growth
Growth in Revenue & EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capital expenditure are offset by depreciation
Risk free rate	10%	9%
Equity beta	1.15	1
Market risk premium	6%	5%
Pre tax cost of debt	13%	12.86%
Debt equity ratio	1:1	2:3

For all time, working capital is 25% of revenue and corporate tax rate is 30%.

What is the value of the firm?

Solution

High growth phase:

$K_e = 0.10 + 1.15 \times 0.06 = 0.169$ or 16.9%.

$K_d = 0.13 \times (1-0.3) = 0.091$ or 9.1%.

Cost of capital = $0.5 \times 0.169 + 0.5 \times 0.091 = 0.13$ or 13%.

Stable growth phase:

$K_e = 0.09 + 1.0 \times 0.05 = 0.14$ or 14%.

$K_d = 0.1286 \times (1 - 0.3) = 0.09$ or 9%.

Cost of capital = $0.6 \times 0.14 + 0.4 \times 0.09 = 0.12$ or 12%.

Determination of forecasted Free Cash Flow of the Firm (FCFF) (₹ in crores)

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Terminal Year
Revenue	2,400	2,880	3,456	4,147.20	4,561.92
EBIT	360	432	518.40	622.08	684.29
EAT	252	302.40	362.88	435.46	479.00
Capital Exp *less* Depn	96	115.20	138.24	165.89	-
Working Capital	100.00	120.00	144.00	172.80	103.68
Cash Flow (FCF)	56.00	67.20	80.64	96.77	375.32

Present Value (PV) of FCFF during the explicit forecast period is:

FCFF (₹ in crores)	PVF @ 13%	PV ₹ in crores
56.00	0.885	49.56
67.20	0.753	52.62
80.64	0.693	55.88
96.77	0.613	59.32
		217.38

PV of the terminal value is:

$$\frac{375.32}{0.12 - 0.10} \times \frac{1}{(1.13)^4} = 18{,}766 \text{ Crores} \times 0.613 = ₹\ 11{,}503.56 \text{ Crores}$$

The value of the firm is: ₹ 217.38 Crores + ₹ 11,503.56 Crores = ₹ 11,720.94 Crores

Question 8

Study Material, (8 Marks) Exam June 09, May 22, RTP May 20, May 24, MTP Nov 24, May 25

Calculate the value of share from the following information:

Profit of the company	₹ 290 crores
Equity capital of company	₹ 1,300 crores
Par value of share	₹ 40 each
Debt ratio of company	27%
Long run growth rate of the company	8%
Beta 0.1; risk free interest rate	8.7%
Market returns	10.3%
Capital expenditure per share	₹ 47
Depreciation per share	₹ 39
Change in Working capital	₹ 3.45 per share

Tutorial Note:
Instead of Debt ratio, Q may directly give the amount of 'New debt to be raised for funding'. Use such amount directly in place of 'Net borrowings' in FCFE formula.

Solution

$$\text{No. of Shares} = \frac{₹\ 1{,}300 \text{ crores}}{40} = 32.5 \text{ Crores}$$

$$\text{EPS} = \frac{\text{PAT}}{\text{No. of shares}} = \frac{₹\ 290 \text{ crores}}{32.5 \text{ crores}} = ₹\ 8.923$$

$$\text{FCFE} = \text{Net income} - [(1-b)(\text{Capex} - \text{Dep}) + (1-b)(\Delta WC)]$$

$$\text{FCFE} = 8.923 - [(1-0.27)(47-39) + (1-0.27)(3.45)]$$
$$= 8.923 - [5.84 + 2.5185] = 0.5645$$

$$\text{Cost of Equity} = R_f + \beta (R_m - R_f)$$
$$= 8.7 + 0.1 (10.3 - 8.7)$$
$$= 8.86\%$$

$$P_0 = \frac{\text{FCFE}(1+g)}{K_e - g} = \frac{0.5645\ (1.08)}{0.0886 - .08} = \frac{0.60966}{0.0086} = ₹\ 70.89$$

Alternative Presentation

FCFE = Net Income + Depn - Capex - ΔWC + Net borrowings
= 8.923 + 39 - 47 - 3.45 + 3.0915*
= 0.5645

*(47 - 39 + 3.45) x 0.27

Question 9 Study Material, Exam May 2007, RTP May 2020

ABC Co., is considering a new sales strategy that will be valid for the next 4 years. They want to know the value of the new strategy. Following information relating to the year that has just ended is, available

Income statement	₹
Sales	20,000
Gross margin (20%)	4,000
Administration, selling & distribution expense (10%)	2,000
PBT	2,000
Tax (30%)	600
PAT	1,400
Balance sheet information	
Fixed assets	8,000
Current assets	4,000
Equity	12,000

If it adopts the new strategy, sales will grow at the rate of 20% per year for three years. From 4th year onwards cash flow will be stabilized. The gross margin ratio, Assets turnover ratio, the Capital structure and the income tax rate will remain unchanged.

Depreciation would be at 10% of net fixed assets at the beginning of the year.
The company's target rate of return is 15%.
Determine the incremental value due to adoption of the strategy.

Solution

Projected Balance Sheet

	Year 1	Year 2	Year 3	Year 4
Fixed assets (40% sales)	9,600	11,520	13,824	13,824
Current assets (20% sales)	4,800	5,760	6,912	6,912
Total assets	14,400	17,280	20,736	20,736
Equity	14,400	17,280	20,736	20,736

Projected Cash Flows

	Year 1	Year 2	Year 3	Year 4
Sales	24,000	28,800	34,560	34,560
PBT (10% of sale)	2,400	2,880	3,456	3,456
PAT (70%)	1,680	2,016	2,419.20	2,419.20
Depreciation	800	960	1,152	1,382
Addition to fixed assets	2,400	2,880	3,456	1,382
Increase in current assets	800	960	1,152	-
Operating cash flow (FCFF)	(720)	(864)	(1,036.80)	2,419.20

Present value of projected cash flows :-

Year	Cash flows	PVF at 15%	PV
1	-720	0.870	-626.40
2	-864	0.756	-653.18
3	-1,036.80	0.658	-682.21
			-1,961.79

Residual Value = 2419.20/0.15 = 16,128

Present value of Residual value = $16128/(1.15)^3$ = 10603.55

Total shareholders' value = 10,603.55 - 1,961.79 = 8,641.76

Pre strategy value = 1,400 / 0.15 = 9,333.33

∴ Value of strategy = 8,641.76 - 9,333.33 = - 691.57

Conclusion: The strategy is not financially viable.

Question 10

2 Questions Merged | Study Material, (8 Marks) Exam May 2019, RTP Nov 2024

Compute EVA of A Ltd. with the following information: **All Figure are in ₹ Lac**

Profit and Loss Statement		Balance Sheet	
Revenue	1000	PPE	1000
Direct Costs	-390	Current Assets	300
Selling, General & Admin. Exp. (SGA)	-200		1300
EBIT	410	Equity	700
Interest	-10	Reserves	100
EBT	400	Non-Current Borrowings	100
Tax Expense	-120	Current Liabilities & Provisions	400
EAT	280		1300

Assume Bad Debts provision of ₹ 20 Lac is included in the SGA, and same amount is reduced from the trade receivables in current assets.

Also assume that the pre-tax Cost of Debt is 12%, Tax Rate is 30% and Cost of Equity (i.e. shareholder's expected return) is 8.45%.

If MV of the firm is ₹ 1000 lac then calculate MVA ?

Solution:

Step I: Computation of NOPAT

EBIT	410
Less: Taxes	-123
Add: Non-Cash Expenses	20
NOPAT	**307**

Step II: Finding out the Invested Capital:

Total Assets	1300
Less: Non Interest bearing liabilities	-400
	900
Add: Non Cash adjustment	20
	920

Note: It is assumed that the current liabilities also include the 120 of tax liability.

Step III: Compute the WACC

WACC = Cost of equity + Cost of debt

In this case, WACC = (800/900 x 8.45%) + [100/900 x 12% (1 - 0.30)] = 8.44%

Step IV: Find out the Capital Charge

Capital Charge = Invested Capital x WACC = 920 x 8.44% = ₹ 77.65 lakhs

Step V: EVA = Adjusted NOPAT – Capital Charge
= 307 – 77.65 = ₹ 229.35 lakhs

MVA = Current Market Value of the firm - Invested capital
= 1000 - 920 = ₹ 80 lakhs

Question 11 (4 Marks) Exam Nov 2024

Economic Value Added (EVA) of ABC Ltd was ₹ 31,10,000.

Following is the capital structure of ABC Ltd. at the end of current financial year:

Equity (Share Capital + Reserves & Surplus)	₹ 170 lakhs
Debt (Coupon Rate 10%)	₹ 80 lakhs
Invested Capital	₹ 250 lakhs

Following data is given to estimate the cost of equity capital :

Beta of ABC Ltd.	0.90
Risk-free rate (i.e. current yield on Govt. Bonds)	8%
Average market risk premium	10%

The applicable corporate income tax rate is 30%.

You are required to calculate the Profit After Tax of ABC Ltd.

Solution: To compute Profit after Tax (PAT) of ABC Ltd. first we shall compute Cost of Equity, Cost of Debt and WACC as follows:

Cost of Equity (k_e) as per CAPM

$k_e = 8\% + 0.90 \times 10\% = 17\%$

Post Tax Cost of Debt (k_d) = 10% (1 – 0.30) = 7.00%

$$WACC = 17\% \times \frac{170}{250} + 7\% \times \frac{80}{250}$$

= 11.56% + 2.24% = 13.80%

EVA = Net Op Profit after Tax (NOPAT) – (Invested Capital x WACC)

₹ 31,10,000 = NOPAT – (₹ 2,50,00,000 x 0.1380)

NOPAT = ₹ 65,60,000

$$\text{Operating Profit} = \frac{65,60,000}{0.70} = ₹\ 93,71,429$$

Calculation of profit after Tax

Operating Profit	₹ 93,71,429
Less: Interest	₹ 8,00,000
Profit before Tax	₹ 85,71,429
Less: Tax @ 30%	₹ 25,71,429
Profit after Tax	₹ 60,00,000

Question 12 MTP Nov 2024

The ABC Startup has the following expected profits under different scenarios along respective probabilities:

Year	Best Case		Base Case		Worst Case	
	Revenue	Expenses	Revenue	Expenses	Revenue	Expenses
1	₹ 100,00,000	₹ 80,00,000	₹ 100,00,000	₹ 90,00,000	₹ 100,00,000	₹ 95,00,000
2	₹ 120,00,000	₹ 92,40,000	₹ 110,00,000	₹ 95,70,000	₹ 102,00,000	₹ 98,94,000
3	₹ 144,00,000	₹ 108,00,000	₹ 121,00,000	₹ 102,85,000	₹ 104,04,000	₹ 101,95,920
Probability		30%		60%		10%

You are required to suggest the value of ABC Startup using First Chicago Method assuming that:

(i) Applicable discounting rate is 20%.

(ii) Startup is located in Tax-free Zone.

(iii) The multiple for Terminal is 10.

(iv) No depreciable assets are held by the ABC Startup.

Note: 1. Present Value Factor (PVF)

Year	1	2	3
PVF@20%	0.8333	0.6944	0.5787

2. Round off the calculation to whole numbers.

Solution:

Valuation of Startup under different scenarios:

(i) Best Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 100,00,000	₹ 120,00,000	₹ 144,00,000	
Expenses	₹ 80,00,000	₹ 92,40,000	₹ 108,00,000	
Cash Flow/ Earnings	₹ 20,00,000	₹ 27,60,000	₹ 36,00,000	
Terminal Value				₹ 3,60,00,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 16,66,600	₹ 19,16,544	₹ 20,83,320	₹ 2,08,33,200
Value of Startup				₹ 2,64,99,664

(ii) Base Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 100,00,000	₹ 110,00,000	₹ 121,00,000	
Expenses	₹ 90,00,000	₹ 95,70,000	₹ 102,85,000	
Cash Flow/ Earnings	₹ 10,00,000	₹ 14,30,000	₹ 18,15,000	
Terminal Value				₹ 181,50,000
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 8,33,300	₹ 9,92,992	₹ 10,50,341	₹ 105,03,405
Value of Startup				₹ 133,80,038

(iii) Worst Case Scenario

	Year 1	Year 2	Year 3	
Revenue	₹ 100,00,000	₹ 102,00,000	₹ 104,04,000	
Expenses	₹ 95,00,000	₹ 98,94,000	₹ 101,95,920	
Cash Flow/ Earnings	₹ 5,00,000	₹ 3,06,000	₹ 2,08,080	
Terminal Value				₹ 20,80,800
PVF @ 20%	0.8333	0.6944	0.5787	0.5787
PV	₹ 4,16,650	₹ 2,12,486	₹ 1,20,416	₹ 12,04,159
Value of Startup				₹ 19,53,711

Value of ABC Startup as per First Chicago Method
= 0.30 x ₹ 2,64,99,664 + 0.60 x ₹ 133,80,038 + 0.10 x ₹ 19,53,711
= ₹ 79,49,899 + ₹ 80,28,023 + ₹ 1,95,371
= ₹ 1,61,73,293

Question 13 RTP May 2011

TMC is a venture capital financier. It received a proposal for financing requiring an investment of ₹ 45 crore which returns ₹ 600 crore after 6 years if succeeds. However, it may be possible that the project may fail at any time during the six years.

The following table provide the estimates of probabilities of the failure of the projects.

Years	1	2	3	4	5	6
Probability of Failure	0.28	0.25	0.22	0.18	0.18	0.10

In the above table the probability that the project fails in the second year is given that it has survived throughout year 1. Similarly, for year 2 and so forth.

TMC is considering an equity investment in the project. The beta of this type of project is 7. The market return and risk-free rate of return are 8% and 6% respectively. You are required to compute the expected NPV of the venture capital project and advice the TMC.

Solution:

i. First we shall find out the probability the venture capital project survives to the end of six years.

Year	Probability Project survives
1	(1 - 0.28) = 0.72
2	(1 - 0.28)(1 - 0.25) = 0.72 × 0.75 = 0.54
3	(1 - 0.28)(1 - 0.25)(1 - 0.22) = 0.72 × 0.75 × 0.78 = 0.4212
4	(1 - 0.28)(1 - 0.25)(1 - 0.22)(1 - 0.18) = 0.72 × 0.75 × 0.78 × 0.82 =0.3454
5	(1- 0.28)(1 - 0.25)(1 - 0.22)(1-0.18) (1 - 0.18) = 0.72x0.75 × 0.78 × 0.82 × 0.82 = 0.2832
6	(1 - 0.28)(1 - 0.25)(1 - 0.22)(1 - 0.18) (1 - 0.18) (1- 0.10) = 0.72 × 0 .75 × 0.78 × 0.82 × 0.82 × 0.90 = 0.255

Thus, probability of project will fail 1 — 0.255 = 0.745

ii. Next using CAPM we shall compute the cost of equity to compute the Present Value of Cash Flows

$K_e = R_f + \beta (R_m - R_f)$
$= 6\% + 7 (8\% - 6\%) = 20\%$

iii. Now we shall compute the net present value of the project

The present value of cash inflow after 6 years	
(Rs.600 Crore × PVIF 20%)	₹ 201 Crore
Less:- Present value of Cash outflow	₹ 45 Crore
	₹ 156 Crore
Net Present Value of project if it fails	- ₹ 45 Crores
And expected NPV = (0.255)(156) + (0.745)(-45)	₹ 6.255 Crores

Since expected NPV of the project is positive it should be accepted.

Question 14

Imagicaa World Entertainment Ltd. is a distressed adventure park. The firm has been facing financial difficulties due to multiple factors, including intense competition, regulatory challenges, and a decline in market share. IEL has a high debt burden resulting from an unfavourable government regulations and increasing operating costs.

The firms latest financial statements are shown below:

Income Statement for the year just ended (₹ in Crores)

Revenue	12000
EBIT (5%)	600
Intt expense (10%)	700
PBT	-100
Tax (@25%)	0
PAT	-100

Balance Sheet at T = 0 (₹ in Crores)

Uses of fund	
Fixed assets	10000
Current assets (Including Cash and Marketable securities of 1000)	2000
Less: Current liability	2500
Net Current Assets	-500
Invested capital	**9500**
Source of fund	
10% Long term debt	7000
Equity share capital (₹ 10 Face Value)	3000
P&L A/c Debit Balance	-500
Net worth	2500
Invested capital	**9500**

Other relevant information is given below:

Other Information (₹ in Crores)	
Market value of equity	2400
Market value of debt	5000
Tax rate	25%
Rf	6%
Market Risk Premium	5%
Debt Rating	B

Based on bond ratings, below table shows the default risk premium over and above Rf over a 5 years period.

Rating	Default risk premium
AAA	1
AA	2
A	3
BBB	4
BB	6
B	7
CCC	10
CC	14
C	20

The conditional probability of distress (i.e. probability of distress in a year given no distress in the previous year) is given below:

Years	1	2	3	4	5
Conditional PD	20%	15%	10%	5%	5%

You are a research analyst and specialized in the valuation of distressed companies. A client of yours is contemplating buying the stock of the company as it has fallen by more than 50% in the last two weeks. Hence he has approached you for advise. You decide to use "Adjusted present value (APV)" method for valuation purpose.

For the purpose of estimated going concern value, use the following-

- Take a 5 year horizon
- Revenue is expected to fall by 5% p.a. for the next 2 years, stay flat for the 3rd year, grow by 3% for the 4th year and then stabilize at 7% p.a. from the 5th year onward forever.
- Operating margin will fall to 3% for the first 2 years, 4% for the 3rd year, 5% for the 4th year and 6% from the 5th year onwards forever.
- Tax rate 25%
- Re-investment rate as a percentage of NOPAT would be -10% for year 1, -5% for year 2, flat year 3, 2% year 4 and 4% year 5 onwards forever
- Debt equity ratio (Market value based) is forecasted to be 2 for year 1(rating B), 1.5 year 2(rating BB), 1.2 year 3(rating BBB), 1.1 year 4 (rating BBB) and stabilize at 1(rating A) from the 5th year onwards.
- There are three comparable firms to IEL which are declining but not under distress-

Firms	Beta	D/E
A	1.6	1.5
B	1.9	2
C	0.9	0.2

  Unlevered beta may be taken as an average of the above
- Beyond year 5, FCFF will grow at 7% p.a. forever

For the purpose of distress sale value, we can take that to be 20% of invested capital.

Calculate the per share value of equity, **compare** that with the existing market price and advise.

Solution: Step 1: Going concern value on an enterprise value basis

Particulars	1	2	3	4	5
Revenue growth rate	-5%	-5%	0	3%	7%
OPM	3%	3%	4%	5%	6%
Revenue	11,400	10,830	10,830	11,155	11,936
EBIT	342	324.90	433.2	557.75	716.16
NOPAT	256.5	243.675	324.9	418.31	537.12
Reinvestment rate	-10%	-5%	0	2%	4%
FCFF	282.15	255.86	324.90	409.94	515.63
Debt equity ratio	2	1.5	1.2	1.1	1
Levered beta	1.913	1.62605	1.45388	1.39649	1.3391
Ke	15.565%	14.13%	13.27%	12.98%	12.70%
Rating	B	BB	BBB	BBB	A

Default risk premium	7%	6%	4%	4%	3%
Pre tax Kd	13%	12%	10%	10%	9%
Post tax Kd	9.75%	9.00%	7.50%	7.50%	6.75%
Wd	0.67	0.60	0.55	0.52	0.50
We	0.33	0.40	0.45	0.48	0.50
Ko	11.69%	11.05%	10.12%	10.11%	9.72%
PV of CF	**252.62**	**206.28**	**237.87**	**272.57**	**312.46**
Terminal Value					20263.26
PV of terminal value					**12279.27**
Going concern value					**13561.08**

Step 2: Distress value on an enterprise value basis

Book value of invested capital	9500
Distress sale value (20%)	1900

Step 3: PV of bankruptcy cost = Difference between the value of a firm as a going concern and the distress sale value.

= 13561.08 – 1900

= 11661.08

Step 4: Probability of bankruptcy

Conditional Probability of distress	20%	15%	10%	5%	5%
Conditional Probability of survival	80%	85%	90%	95%	95%
Cumulative prob of survival	55.23%				
Cumulative Prob of distress	44.77%				

Step 5: Expected bankruptcy cost = (Probability of bankruptcy) × (PV of bankruptcy cost)

= 44.77% × 11661.08

= 5220.67

Step 6: Present value of tax benefits = Tax rate × Market value of debt (Assuming debt to be perpetual)

= 25% × 5000

= 1250

Step 7: Unlevered cost of equity

Firms	Levered Beta	D/E	Unlevered beta
A	1.6	1.5	0.7529
B	1.9	2	0.76
C	0.9	0.2	0.7826
Average i.e. beta unlevered			**0.7652**
Rf			6%
Rm - Rf			5%
Unlevered cost of equity			**9.826%**

Step 8: Unlevered firm value = PV of FCFF discounted at unlevered cost of equity + Cash & marketable securities

Particulars	1	2	3	4	5
FCFF	282.15	255.86	324.90	409.94	515.62
PV of FCFF @ 9.826%	256.91	212.13	245.26	281.77	322.70
Terminal Value					19522.77
PV of terminal value					12218.44
Unlevered value of operating assets	**13537.21**				
Add: Cash and marketable securities	**1000**				
Unlevered firm value	**14537.21**				

Step 9: Adjusted Present Value = Unlevered firm value + Present value of tax benefits of Debt (-) Expected bankruptcy costs from the Debt

= 14537.21 + 1250 - 5220.67

= 10566.54

Step 10: Value of equity = Adjusted Present Value - Market value of debt

Unlevered value of operating assets	10566.54
Less: Market value of debt	(5000)
Value of equity	5566.54
Number of equity shares	300
Value per share	18.56
Market price of the share	8
Comment	**Underpriced**
Advice	**Buy/Go long**

Question 15

(8 Marks) Exam Nov 2012, Nov 2016 July 2021, RTP Nov 2018, May 23, MTP Oct 22

Eagle Ltd. reported a profit of ₹ 77 lakhs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of ₹ 8 lakhs and an extraordinary loss of ₹ 10 lakhs. The existing operations, except for the extraordinary items, are expected to continue in the future. In addition, the results of the launch of a new product are expected to be as follows:

	₹ in lakhs
Sales	70
Material costs	20
Labour costs	12
Fixed costs	10

You are required to:

(i) Calculate the value of the business, given that the capitalization rate is 14%.

(ii) Determine the market price per equity share, with Eagle Ltd.'s share capital being comprised of 1,00,000 13% preference shares of ₹ 100 each and 50,00,000 equity shares of ₹ 10 each and the P/E ratio being 10 times.

Solution: (i) Computation of Business Value (₹ Lakhs)

Profit before tax (77 / 1 - 0.30)			110
Less: Extraordinary income			(8)
Add: Extraordinary losses			10
			112
Profit from new product	(₹ Lakhs)		
Sales		70	
Less: Material costs	20		
Labour costs	12		
Fixed costs	10	(42)	28
			140.00
Less: Taxes @30%			42.00
Future Maintainable Profit after taxes			98.00
Relevant Capitalisation Factor			0.14
Value of Business (₹ 98/0.14)			700

(ii) Determination of Market Price of Equity Share

Future maintainable profits (After Tax)	₹98,00,000
Less Preference share dividends 1,00,000 shares of ₹100 @ 13%	₹13,00,000
Earnings available for Equity Shareholders	₹85,00,000
No. of Equity Shares	50,00,000
Earnings per share (₹85,00,000 / 50,00,000)	₹1.70
PE ratio	10
Market price per share	₹17

Question 16 RTP Nov 2013

Hanky Ltd. and Shanky Ltd. operate in the same field, manufacturing newly born babies clothes. Although Shanky Ltd. also has interest in communication equipments, Hanky Ltd. is planning to take over Shanky Ltd. and the shareholders of Shanky Ltd. do not regard it as a hostile bid.

The following information is available about the two companies.

	Hanky Ltd.	Shanky Ltd.
Current Earnings	₹ 6,50,00,000	₹ 2,40,00,000
Number of Shares	50,00,000	15,00,000
Percentage of Retained earnings	20%	80%
Return on new investment	15%	15%
Return required by equity shareholders	21%	24%

Dividends have just been paid and the retained earnings have already been reinvested in new projects. Hanky Ltd. plans to adopt a policy of retaining 35% of earnings after the takeover and expects to achieve a 17% return on new investment.

Saving due to economies of scale are expected to be ₹85,00,000 per annum.

Required return to equity shareholders will fall to 20% due to portfolio effects.

Requirements

(a) Calculate the existing share prices of Hanky Ltd. and Shanky Ltd.

(b) Find the value of Hanky Ltd. after the takeover

(c) Advise Hanky Ltd. on the maximum amount it should pay for Shanky Ltd.

Solution

(a) Existing share price of Hanky (P) Ltd.

g = r x b
r = 15%
b = 20%
g = 0.15 x 0.2
= 0.03

Ex dividend market value $= \frac{\text{Next year's dividend}}{k_e - g}$

$= \frac{6,50,00,000 \times 0.8 \times 1.03}{0.21 - 0.03} = ₹\ 29,75,55,556$

or ₹ 59.51 per share

Existing share price Shanky (P) Ltd.

g = r x b
= 0.15 x 0.8
= 0.12

Ex dividend market value $= \frac{\text{Next year's dividend}}{k_e - g}$

$= \frac{2,40,00,000 \times 0.2 \times 1.12}{0.24 - 0.12} = ₹\ 4,48,00,000$

or ₹ 29.87 per share

(b) Value of Hanky Ltd. after the takeover: Care must be taken in calculating next year's dividend and the subsequent growth rate. Next year's earnings are already determined, because both companies have already reinvested their retained earnings at the current rate of return. In addition, they will get cost savings of 85,00,000.

The dividend actually paid out at the end of next year will be determined by the new 35% retention and the future growth rate will take into account the increased return on new investment.

Growth rate for combined firm, g = 0.17 x 0.35 = 0.0595

New cost of equity = 20%

Next year's earnings = ₹ 6,50,00,000 x 1.03 + ₹ 2,40,00,000 x 1.12 + ₹ 85,00,000
= ₹ 10,23,30,000

Next year's dividend = ₹ 10,23,30,000 x 0.65
= ₹ 6,65,14,500

$$\text{Market Value} = \frac{₹\ 6,65,14,500}{0.20 - 0.0595} = ₹\ 47,34,12,811$$

(c) Maximum Hanky Ltd. should pay for Shanky Ltd.

Combined value = ₹ 47,34,12,811
Present Value of Hanky Ltd. = ₹ 29,75,55,556
= ₹ 17,58,57,255

Question 17 2 Q Merged | Study Material, MTP Sep 2022

Mr. A is thinking of buying shares at (having a Beta of 2) ₹ 500 each having face value of ₹ 100. He is expecting a bonus at the ratio of 1:5 during the fourth year. Annual expected dividend is 20% and the same rate is expected to be maintained on the expanded capital base. He intends to sell the shares at the end of seventh year at an expected price of ₹ 900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. The risk free return & market return are 7% & 9.5% respectively.

Should Mr. A buy the share? If so, what maximum price should he pay for each share?
Assume no tax on dividend income and capital gain.

Solution: K_e = 7% + 2 (9.5% - 7%) = 12%

P.V. of dividend stream and sales proceeds

Year	DPS	PVF (12%)	PV (₹)
1	20	0.893	17.86
2	20	0.797	15.94
3	20	0.712	14.24
4	24	0.636	15.26
5	24	0.567	13.61
6	24	0.507	12.17
7	24	0.452	10.85
7	1026 [900 x 1.2x0.95]	0.452	463.75
			₹ 563.68
	Less: Cost of share (₹ 500 x 1.05)		₹ 525.00
		Net gain	₹ 38.68

Since Mr. A is gaining ₹ 38.68 per share, he should buy the share.

Maximum price Mr. A should be ready to pay is ₹ 563.68 which will include incidental expenses. So the maximum price should be ₹ 563.68 x 100/105 = ₹ 536.84

Question 18 Study Material, MTP Nov 2018, RTP May 2025

Capital structure of Sun Ltd., as at 31.03.2023 was as under:

	(₹ in lakhs)
Equity share capital (₹ 100 each)	80
8% Preference share capital	40
12% Debentures	64
Reserves	32

Sun Ltd., earns a profit of ₹ 32 lakhs annually on an average before deduction of income-tax, which works out to 35%, and interest on debentures.

Normal return on equity shares of companies similarly placed is 9.6% provided:

a. Profit after tax covers fixed interest and fixed dividends at least 3 times.

b. Capital gearing ratio is 0.75.

c. Yield on share is calculated at 50% of profits distributed and at 5% on undistributed profits.

Sun Ltd., has been regularly paying equity dividend of 8%.

Compute the value per equity share of the company assuming

(1) 1% for every one time of difference for Interest and Fixed Dividend Coverage.

(2) 2% for every one time of difference for Capital Gearing Ratio.

Solution:

(a) Calculation of Profit after tax (PAT)

		₹
Profit before interest and tax (PBIT)		32,00,000
Less: Debenture interest (% 64,00,000 = 12/100)		768,000
Profit before tax (PBT)		24,32,000
Less: Tax @ 35%		851,200
Profit after tax (PAT)		15,80,800
Less: Preference Dividend (₹ 40,00,000 = 8/100)	3,20,000	
Equity Dividend (₹ 80,00,000 x 8/100)	6,40,000	9,60,000
Retained earnings (Undistributed profit)		6,20,800

Calculation of Interest and Fixed Dividend Coverage

$$= \frac{\text{PAT + Debenture interest}}{\text{Debenture interest + Preference dividend}} \text{ or } \frac{\text{PAT + Debenture interest Net of Tax}}{\text{Debenture interest + Preference dividend}}$$

$$= \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} \text{ or } \frac{15,80,800 + 4,99,200}{7,68,000 + 3,20,000}$$

$$= \frac{23,48,800}{10,88,000} \text{ or } \frac{20,80,000}{10,88,000} = 2.16 \text{ times or } 1.91 \text{ times}$$

(b) Calculation of Capital Gearing Ratio

$$\text{Capital Gearing Ratio} = \frac{\text{Fixed interest bearing funds}}{\text{Equity shareholders funds}} = \frac{\text{Preference Share Capital + Debentures}}{\text{Equity Share Capital + Reserves}}$$

$$= \frac{40,00,000 + 64,00,000}{80,00,000 + 32,00,000} = \frac{1,04,00,000}{1,12,00,000} = 0.93$$

(c) Calculation of Yield on Equity Shares:

Yield on equity shares is calculated at 50% of profits distributed and 5% on undistributed profits:

50% on distributed profits (₹ 6,40,000 x 50/100)	₹ 3,20,000
5% on undistributed profits (₹ 6,20,800 x 5/100)	₹ 31,040
Yield on equity shares	₹ 351,040

$$\text{Yield on equity shares \%} = \frac{\text{Yield on shares}}{\text{Equity share capital}} \times 100 = \frac{3,51,040}{80,00,000} \times 100 = 4.39\% \text{ or, } 4.388\%$$

Calculation of Expected Yield on Equity shares

(a) Interest and fixed dividend coverage of Sun Ltd. is 2.16 times but the industry average is 3 times. Therefore, risk premium is added to Sun Ltd. Shares @ 1% for every 1 time of difference. Hence,
Risk Premium = 3.00 - 2.16 (1%) = 0.84 (1%) = 0.84%

(b) Capital Gearing ratio of Sun Ltd. is 0.93 but the industry average is 0.75 times. Therefore, risk premium is added to Sun Ltd. shares @ 2% for every 1 time of difference. Hence,
Risk Premium = (0.75 - 0.93) (2%) = 0.18 (2%) = 0.36%

Normal return expected	9.60%
Add: Risk premium for low interest and fixed dividend coverage	0.84%
Add: Risk premium for high interest gearing ratio	0.36%
	10.80%

Value of Equity Share

$$= \frac{\text{Actual yield}}{\text{Expected yield}} \times \text{Paid-up value of share} = \frac{4.39}{10.80} = ₹\ 40.65$$

Question 19 Study Material (Similar), (8 Marks) Exam Nov 14(Similar), May 18, RTP May 19

You are looking at the valuation of a Stable firm, Network Limited, done by an investment analyst. Based on an expected free cash flows of ₹ 54 million for the following year and an expected growth rate of 9%, the analyst has estimated the value of firm to be ₹ 1800 million. However, he committed a mistake of using the book value of debt and equity. You do not know the book value weights employed by him but you know that the firm has a cost of equity of 20% and post tax cost of debt of 10%. The market value of equity is thrice its book value, whereas the market value of its debt is nine-tenth of its book value.

What is the correct value of the firm?

Solution: Cost of capital by applying Free Cash Flow to Firm (FCFF) Model is as follows:-

$$\text{Value of Firm } V_0 = \frac{FCFF_1}{K_C - g_n}$$

Thus, ₹ 1800 million = ₹ 54 million /(K_C - g)
Since g = 9%, then Kc = 12%
Now, let X be the weight of debt & given cost of equity=20% and cost of debt=10%, then 20% (1 – X) + 10% X= 12%
Hence, X = 0.80, so book value weight for debt was 80%
Correct weight should be 60 of equity and 72 of debt.

Cost of capital = K_C = 20% (60/132) + 10% (72/132) = 14.5455% and

Correct Value of Firm = ₹ 54 million/(0.1454 – 0.09) = ₹ 974.73 million.

Question 20 Study Material, RTP May 2018, (8 Marks) MTP Oct 2022

SAM Ltd. has just paid a dividend of ₹ 2 per share and it is expected to grow @ 6% p.a. After paying dividend, the Board declared to take up a project by retaining the next three annual dividends. it is expected that this project is of same risk as the existing projects. The results of this project will start coming from the 4th year onward from now. The dividends will then be ₹ 2.50 per share and will grow @ 7% p.a.

An investor has 1,000 shares in SAM Ltd. and wants a receipt of atleast ₹ 2,000 p.a. from this investment.

Show that the market value of the share is affected by the decision of the Board. Also show as to how the investor can maintain his target receipt from the investment for first 3 years and improved income thereafter, given that the cost of capital of the firm is 8%.

Solution: Value of share at present = $\frac{D_1}{k_e - g}$ = $\frac{2\ (1.06)}{0.08 - 0.06}$ = ₹ 106

However, if the Board implement its decision, no dividend would be payable for 3 years and the dividend for year 4 would be ₹ 2.50 and growing at 7% p.a. The price of the share, in this case, now would be:

$$P_0 = \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^3} = ₹\ 198.46$$

So, the price of the share is expected to increase from ₹ 106 to ₹ 198.45 after the announcement of the project. The investor can take up this situation as follows:

Expected market price after 3 years	$= \frac{2.50}{0.08 - 0.07}$	₹ 250.00
Expected market price after 2 years	$= \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)}$	₹ 231.48
Expected market price after 1 years	$= \frac{2.50}{0.08 - 0.07} \times \frac{1}{(1 + 0.08)^2}$	₹ 214.33

In order to maintain his receipt at ₹ 2,000 for first 3 year, he would sell

10 shares in first year @ ₹ 214.33 for	₹ 2,143.30
9 shares in second year @ ₹ 231.48 for	₹ 2,083.32
8 shares in third year @ ₹ 250 for	₹ 2,000.00

At the end of 3rd year, he would be having 973 shares valued @ ₹ 250 each i.e. ₹ 2,43,250. On these 973 shares, his dividend income for year 4 would be @ ₹ 2.50 i.e. ₹ 2,432.50.

So, if the project is taken up by the company, the investor would be able to maintain his receipt of at least ₹ 2,000 for first three years and would be getting increased income thereafter.

Question 21

5 Questions Merged | Study Material, Exam May 2018, RTP Nov 2022

RST Ltd.'s current financial year's income statement reported its net income as ₹ 30 crores. The applicable corporate income tax rate is 30%.

The company has ₹ 120 crores of invested capital, of which 1/3rd is debt carrying coupon rate of 11% The company has developed a high tech product which has reduced the carbon emission from the burning of fossil fuel. The product is in high demand. The product has been patented and has a market value of ₹ 45 crores which is not recorded in the books.

Following data is given to estimate cost of equity capital:

Variance of Market	25%
Equity Beta of RST Ltd.	1.36
Return on 182 days T-bills / Current yield on Govt. Bonds	8.5% p.a.
Average market risk premium (i.e. Excess of return on market portfolio over risk-free rate)	9%
Covariance of RST Ltd's return with that of the market	34%

Required:

(i) Estimate Weighted Average Cost of Capital (WACC) of RST Ltd.; and

(ii) Estimate Economic Value Added (EVA) of RST Ltd.

(iii) RST ltd has 2,50,00,000 equity shares outstanding. According to the EVA you computed in (ii) how much can RST pay in dividend per share before the value of the company would start to decrease ? If RST does not pay any dividends, what would you expect to happen to the value of the company ?

Solution:

(i) $\beta = \frac{\text{Covariance}_{im}}{\text{Variance}_{m}} = \frac{34\%}{25\%} = 1.36 \text{ times}$

Cost of Equity as per CAPM

K_e = Rf + β x Market Risk Premium
= 8.5% + 1.36 x 9%
= 8.5% + 12.24% = 20.74%

Cost of Debt K_d = 11%(1 – 0.30) = 7.70%

Total capital employed = Eq shhl funds + Debt + Value of patent
= 80 + 40 + 45
= 165 crores

WACC $K_o = K_e \times \frac{E}{E+D} + K_d \times \frac{D}{E+D}$
$= 20.74 \times \frac{125}{165} + 7.70 \times \frac{40}{165}$
= 15.71 + 1.87
= 17.58%

(ii) Taxable Income = ₹ 30 crores/ (1 – 0.30) = ₹ 42,85,71,429

Operating Income = Taxable Income + Interest
= ₹ 42,85,71,429 + ₹ 4,40,00,000
= ₹ 47,25,71,429

EVA = EBIT (1 - Tax Rate) – WACC x Invested Funds
= ₹ 47,25,71,429 (1 – 0.30) – 17.58% x ₹ 1,65,00,00,000
= 33,08,00,000 -₹ 29,00,70,000 = ₹ 4,07,30,000

(iii) EVA Dividend = ₹ 4,07,30,000 / 2,50,00,000 shares = ₹ 1.63
If RST Ltd. does not pay a dividend, we would expect the value of the firm to increase because it will achieve higher growth, hence a higher level of EBIT. If EBIT is higher, then all else equal, the value of the firm will increase.

Question 22

Q Trimmed to save time | Study Material, MTP Oct 2019, Exam Nov 2023, RTP May 2024

The following information is given for a company Orange ltd.

Total invested capital	1,00,000
Debt/assets ratio	0.8
Shares outstanding	6,100
Pre tax cost of debt	16%
Beta	1.25
Net Income	8,970

The tax rate is uniform 35%. Risk free interest rate is 6% and market risk premium is 16%.

(i) Compute the Weighted average cost of capital
(ii) Compute the Economic Valued Added (EVA)
(iii) If the industry PE ratio is 11x, estimate the price for the share
(iv) Calculate the estimated market capitalisation

[Round off EPS & Share Prices upto 4 and 2 Decimal places respectively]

Solution: **(i) Working for calculation of WACC**

	Amount
Total debt	80,000
Post tax Cost of debt	10.4%
Equity Fund	20,000
Ke [6% + 1.25 x 16%]	26%

WACC = (10.4 x 0.8) + (26 x 0.2) = 13.52

(ii) EVA can be computed as follows:

	Amount
Net Income (₹)	8,970
Pre Tax Income (₹) (A)	13,800
Debt Amount (₹)	80,000
Interest (₹) (B)	12,800
EBIT (₹) (A) + (B)	26,600
Tax 35% (₹)	9,310
EAT	17,290
Less: WACC x Invested Capital	13,520
EVA (₹)	3,770

(iii) Estimated Price of shares

	Amount
Net Income (Given) (₹)	8,970
Shares	6,100
EPS (₹)	1.4705
Stock Price (EPS x PE Ratio) (₹)	16.18

(iv) Market Capitalisation

Estimated Stock Price (₹)	16.18
No. of shares	6,100
Estimated Market Cap (₹)	98,698

Question 23

Study Material, (8 Marks) Exam May 19, July 21, Nov 24, RTP Nov 22, MTP Sep 22, Sep 25

Rahul Ltd. has surplus cash of ₹ 100 lakhs and wants to distribute 27% of it to the shareholders. The company decides to buy back shares. The Finance Manager of the company estimates that its share price after re-purchase is likely to be 10% above the buyback price-if the buyback route is taken. The number of shares outstanding at present is 10 lakhs and the current EPS is ₹ 3.

You are required to determine:

(i) The price at which the shares can be re-purchased, if the market capitalization of the company should be ₹ 210 lakhs after buyback,

(ii) The number of shares that can be re-purchased, and

(iii) The impact of share re-purchase on the EPS, assuming that net income is the same.

Solution:

(i) Let P be the buyback price decided by Rahul Ltd.

Market Capitalisation after Buyback

1.1P (Original Shares - Shares Bought Back)

$$= 1.1P\left(10 \text{ lakhs} - \frac{27\% \text{ of } 100 \text{ lakhs}}{P}\right)$$

= 11 lakhs x P - 27 lakhs x 1.1 = 11 lakhs P - 29.7 lakhs

Again, 11 lakhs P - 29.7 lakhs

or 11 lakhs P = 210 lakhs + 29.7 lakhs

$$\text{or } P = \frac{239.7}{11} = ₹ 21.79 \text{ Per Share}$$

(ii) Number of Shares to be Bought Back :-

$$\frac{₹ 27 \text{ Lakhs}}{₹ 21.79} = 1.24 \text{ lakhs (approx.)} \text{ or } 123910 \text{ share}$$

(iii) New equity shares :-

10 lakhs - 1.24 lakhs = 8.76 lakhs or

1000000 - 123910 = 876090 shares

$$\therefore \text{EPS} = \frac{3 \text{ x } 10 \text{ Lakhs}}{8.79 \text{ Lakhs}} = ₹ 3.43$$

Thus, EPS of Rahul Ltd, increases to ₹ 3.43

Question 24 RTP Nov 2015

Telbel Ltd. is considering undertaking a major expansion an immediate cash outlay of ₹ 150 crore. The Board of Director of company are expecting to generate an additional profit of ₹ 15.30 crore after a period of one year. Further, it is expected that this additional profit shall grow at the rate of 4% for indefinite period in future.

Presently, Telbel Ltd. is completely equity financed and has 50 crore shares of ₹ 10 each. The current market price of each share is ₹ 22.60 (cum dividend). The company has paid a dividend of ₹ 1.40 per share in last year. For the last few years dividend is increasing at a compound rate of 6% p.a. and it is expected to be continued in future also. This growth rate shall not be affected by expansion project in any way.

Board of Directors are considering following ways of financing the possible expansion:

(1) A right issue on ratio of 1:5 at price of ₹ 15 per share.

(2) A public issue of shares.

In both cases the dividend shall become payable after one year.

You as a Financial Consultant required to:

(a) Determine whether it is worthwhile to undertake the project or not.

(b) Calculate ex-dividend market price of share if complete expansion is financed from the right issue.

(c) Calculate the number of new equity shares to be issued and at what price assuming that new shareholders do not suffer any loss after subscribing new shares.

(d) Calculate the total benefit from expansion to existing shareholders under each of two financing option.

Solution:

Working Notes:

Calculation of Cost of Capital

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

D_0 = ₹ 1.40

P_0 = ₹ 22.60 - ₹ 1.40 = ₹ 21.20

$$K_e = \frac{1.40 (1 + 0.06)}{21.20} + 0.06 = 13\%$$

(a) NPV of the Project

This Ke shall be used to value PV of income stream

$$V = \frac{15.3 \text{ crore}}{K_e - g} = \frac{₹ 15.30 \text{ crore}}{0.13 - 0.04} = ₹ 170 \text{ crore}$$

PV of Cash Inflows from Expansion Project	₹ 170 crore
Less: PV of Initial Outlay	₹ 150 crore
NPV	₹ 20 crore

Since NPV is positive we should accept the project.

(b) By right issue new number of equity shares to be issued shall be:

50 crore (Existing) + 10 crore (Right Issue) = 60 crore

Market Value of Company = PV of existing earnings + PV of earnings from Expansion

$$= \frac{₹\ 1.40 \times 50 \text{ crore} \times (1 + 0.06)}{0.13 - 0.06} + ₹\ 170 \text{ crore}$$

= ₹ 1060 crore + ₹ 170 crore = ₹ 1230 crore

Price Per Share = ₹ 1230 crore / 60 crore = ₹ 20.50

(c) Let n be the number of new equity shares to be issued then such shares are to be issued at such price that new shareholders should not suffer any immediate loss after subscribing shares. Accordingly,

$$\frac{n}{50 \text{ crore} + n} \times 1230 \text{ crore} = ₹\ 150 \text{ crore}$$

1230 n = 7500 + 150n

N = 7500/1080 = 6.9444 crore

$$\text{Issue Price Per Share} = \frac{₹\ 150 \text{ crore}}{6.9444 \text{ crore}} = ₹\ 21.60$$

Or

$$\text{Ex - Dividend Price Per Share} = \frac{₹\ 1230 \text{ crore}}{56.9444 \text{ crore}} = ₹\ 21.60$$

(d) Benefit from expansion

(i) Right Issue

		₹ Crore
Shareholder's Current Wealth (₹ 22.60 x 50 crore)	1130	
Less:	₹ Crore	
Value of 60 crore shares @ ₹ 20.50	1230	
Cash Dividend Received @ ₹ 1.40 per share on 50 crore shares	70	
Cash paid to subscribe Right Shares (₹15 x 10 crore)	(150)	1150
Net Gain		20

or

		₹ Crore
Shareholder's Current Wealth (₹ 21.20 x 50 crore)		1060
Less:	₹ Crore	
Value of 60 crore shares @ ₹ 20.50	1230	
Cash paid to subscribe Right Shares (₹ 15 x 10 crore)	(150)	1080
Net Gain		20

(ii) Public issue

Existing shareholder's current wealth (₹ 21.20 x 50cr)	₹ 1060 cr
Existing shareholder's wealth after public issue (₹ 21.60 x 50cr)	₹ 1080 cr
Net gain	₹ 20 cr

Start up Finance

Startup financing means some initial infusion of money needed to turn an idea into reality.

Some of the Innovative Ways to Finance a Startup (4 Marks) May 19

Traditional lenders such as banks are not interested in startups.

Here are some of the innovative sources for funding a startup:

(i) Personal financing Important because investors will not put money into a deal if you have not contributed any money from your personal sources.

(ii) Personal credit lines Example - personal credit lines, Credit cards etc. However, banks grant personal credit facility only when the business has enough cash flow to repay the line of credit.

(iii) Family and friends believe in you. However, loan obligations should always be in writing.

(iv) Peer-to-peer lending Business groups having similar faith or interest come together and generally support each other.

(v) Crowdfunding use of small amounts of capital from a large number of individuals through social media and crowdfunding websites to bring investors and entrepreneurs together.

(vi) Microloans small loans issued by a single individual or aggregated across a number of individuals.

(vii) Vendor financing Vendor lends money to customers so that they can buy products from the company itself. It includes extending the payment terms to a longer period or defer payment until the goods are sold.

(viii) Purchase order financing In case of Startups inability to fund a large new order, Purchase order financing companies often advance the required funds but directly to the supplier.

(ix) Factoring accounts receivables a facility is given to the seller to fund his receivables. Factor will pay most of the sold receivables amount upfront and rest of the amount later.

Pitch Presentation

Pitch deck presentation is a brief presentation made either during face to face meetings or online meetings using PowerPoint to investors explaining about the prospects of the company and why they should invest

How to approach a pitch presentation:

(i) Introduction give a brief account of yourself, milestones achieved etc. Use this opportunity to get investors interested in your company.

(ii) Team Introduce the people behind the scenes who will make the product or service successful. Investors are not only putting money towards the idea but they are also investing in the team. If applicable, then highlight that the team has worked together in the past and achieved significant results.

(iii) Problem explain the problem you are going to solve. Investors should be convinced that the newly introduced product or service will solve the problem.

(iv) Solution DESCRIBE how the company is planning to solve the problem. For instance, when Flipkart first started e-commerce in India payment through credit card was rare. So they introduced cash on delivery.

(v) Marketing/Sales Communicate the Market size of the product. This can include profiles of target customers, how the promoter is planning to attract the customers.

(vi) Projections or Milestones It is difficult for a startup but an educated guess can be made. Projected financial statements gives idea about where is the business heading? whether making profit or loss?

Financial projections include three basic documents

- **Income statement:** shows how much money business will generate.
- **Cash flow statement:** depict how much cash will be coming and how it will be utilized.
- **Balance sheet:** shows overall finances including assets, liabilities and equity.

(vii) Competition highlight

- as to how the products or services are different from their competitors.
- If competitors have been acquired, give their complete details

(viii) Business Model is a wide term denoting core aspects of a business including purpose, business process, target customers, offerings, strategies, infrastructure, organizational structures, sourcing, trading practices, and operational processes and policies including culture.

A business model is the way in which a company generates revenue and makes a profit.

It is better to

- show a list of the various revenue streams and a timeline for each of them,
- how to price the product and what does the competitor charge
- discuss the cost of customer acquisition, lifetime value of the customer and strategy to retain customers.

(ix) Financing If already raised money, talk about

- how much money has been raised,
- who invested and
- what they did about it.

If pitching to raise capital, then list

- how much looking to raise and
- how intend to use the funds.

Unicorn

(4 Marks) MTP March 2024, RTP Nov 2024, Sep 2025, MTP Nov 2024

A Unicorn is a privately held start-up company which has achieved a valuation of US$ 1 billion. This term was coined by venture capitalist Aileen Lee, first time in 2013. Unicorn, a mythical animal represents the statistical rarity of successful ventures.

A start-up is referred as a Unicorn if it has following features:

(i) A privately held start-up.
(ii) Valuation of start-up reaches US$ 1 Billion.
(iii) Emphasis is on the rarity of success of such start-up.
(iv) Other common features are new ideas, disruptive innovation, consumer focus, high on technology etc.

If the valuation slips below US$ 1 billion it can lose its status of 'Unicorn'. Hence a start-up may be Unicorn at one point of time and may not be at another point of time.

The next milestone is to become a Decacorn, i.e., attain a valuation of US$ 10 billion.

In september 2011, InMobi, an ad-tech startup, became the first unicorn of India.

Modes of Financing for Startups

(i) Bootstrapping

means build a company from personal finances or from the operating revenues of the new company.

It leads to cautious approach & curb wasteful expenditures towards marketing, offices and equipment.

Methods to bootstrap:

(a) *Trade Credit* prepare a well-crafted financial plan and pay a visit to the supplier's office. Communication skills are important here.

The trick is to get the goods shipped, and sell them before one has to pay for them. It reduces the working capital requirements.

(b) *Factoring* is a financing method where accounts receivable is sold to a commercial finance company. The factor now assumes the task of collecting the receivables.

Merits -

- reduce costs associated with maintaining accounts receivable such as bookkeeping, collections and credit verifications.
- frees up money tied up in receivables

(c) *Leasing* take the equipment on lease rather than purchasing it.

Benefits-

- reduce the capital cost
- claim tax exemption on lease rentals
- making smaller payments retain the ability to walk away from the equipment at the end of the lease term.

(ii) Angel Investors

(4 Marks) MTP Oct 2019

Angel investors are affluent individuals who inject capital for startups in exchange for ownership equity or convertible debt.

Salient Features of Angel Investors:

- typically use their own money, unlike venture capitalists who take care of pooled money from many other investors and place them in a strategically managed fund.
- usually represent individuals, but the entity that actually provides the fund may be a limited liability company, a business, a trust or an investment fund, among many other kinds of vehicles.
- some angel investors invest through crowdfunding platforms online or build angel investor networks to pool in capital.
- capital provided may be a one-time investment or an ongoing injection of money to support through difficult early stages.
- provide more favorable terms compared to other lenders
- focused on helping startups rather than the possible profit they may get from the business.
- may lose their investments completely if startup fails.

(iii) Venture Capital Funds

Venture capital means funds made available for startup firms and small businesses with exceptional growth potential.

Venture capital is money provided by professionals who alongside management invest in young, rapidly growing companies that have the potential to develop into significant economic contributors.

Venture Capitalists generally:

- ❖ Finance new and rapidly growing companies
- ❖ Purchase equity securities
- ❖ Assist in the development of new products or services
- ❖ Add value to the company through active participation.

Venture Capital Funds could be in the form of (i) Trust, (ii) Company, or (iii) Limilited Liability Partnership.

Investors in Venture Capital Funds could be (i) Financial Institutions, (ii) Banks, (iii) Pension Funds, (iv) Corporations, and (v) High Networth Individuals

Structure of Venture Capital Fund in India [MTP Sep 2025]

Three main types of fund structure exist: one for domestic funds and two for offshore ones:

(a) **Domestic Funds** Domestic Funds (i.e. one which raises funds domestically) are usually structured as:

(i) a domestic vehicle (either in the form of Trust or a Company) for the pooling of funds from the investor, and

(ii) a separate investment adviser that carries those duties of asset manager.

(b) **Offshore Funds** Two common alternatives available to offshore investors are: the "offshore structure" and the "unified structure".

Offshore structure Under this structure, an investment vehicle (an LLC or an LP organized in a jurisdiction outside India) makes investments directly into Indian portfolio companies.

Typically, the assets are managed by an offshore manager, while the investment advisor in India carries out the due diligence and identifies deals.

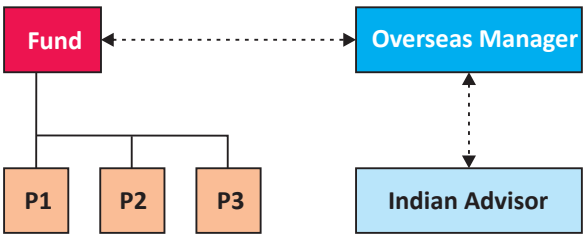
Unified Structure When domestic investors are expected to participate in the fund, a unified structure is used.

Overseas investors pool their assets in an offshore vehicle that invests in a locally managed trust.

Domestic investors directly contribute to the trust.

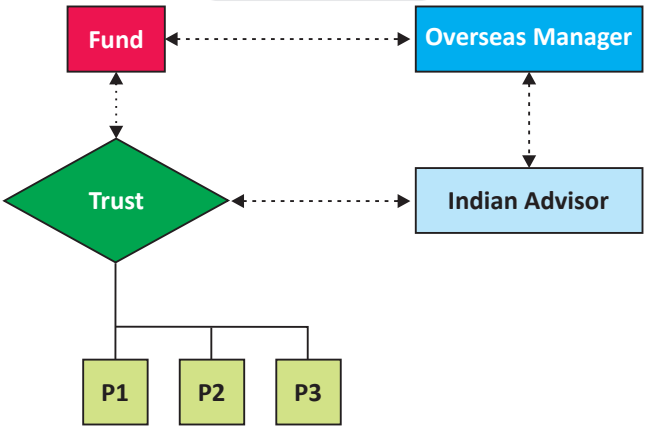
Trust then makes the local portfolio investments.

Off shore structure



Portfolio company 1/2/3

Unified Structure



Characteristics of Venture Capital Financing [(4 Marks) Exam Nov 2019, MTP Nov 2023]

1. Long time horizon Minimum period - 3 years & Maximum period - 10 years.
2. Lack of liquidity When VC invests, it assumes less liquidity and accordingly adjust this liquidity premium against the price and required return.
3. High Risk VC works on principle of high risk and high return.
4. Equity Participation VC invest in the form of equity and participate in the management, help the company grow and supervise a lot of board decisions.

Advantages of bringing VC in the company:

- ✓ It injects long- term equity finance which provides a solid capital base for future growth.
- ✓ The venture capitalist is a business partner, sharing both the risks and rewards. Venture capitalists are rewarded with business success and capital gain.
- ✓ Provide practical advice and assistance to the company based on past experience with other companies which were in similar situations.
- ✓ The venture capitalist also has a network of contacts in many areas that can add value to the company. The venture capitalist may be capable of providing additional rounds of funding should it be required to finance growth.
- ✓ Venture capitalists are experienced in the process of preparing a company for an initial public offering (IPO) of its shares onto the stock exchanges or overseas stock exchange such as NASDAQ.
- ✓ They can also facilitate a trade sale. (4 Marks) Exam May 2025

Stages of Funding for VC - Risk in each stage is different. An indicative Risk matrix is given below:

Financial Stage	Period (Funds locked in years)	Risk Perception	Activity to be financed
Seed Money	7-10	Extreme	Low level financing for supporting a concept or idea or R&D for product development
Start Up	5-9	Very High	Early stage firms that need funding for expenses associated with marketing, initializing prototypes operations or product development.
First Stage	3-7	High	Funds to start commercial marketing production and sales
Second Stage	3-5	Sufficient ly High	Expand market and growing Working capital for early stage companies that are selling product, but not yet turning in a profit.
Third Stage	1-3	Medium	Also called Mezzanine financing, this is Market expansion, acquisition & product development money for profit making company
Fourth Stage	1-3	Low	Also called bridge financing, it is intended to facilitating public issue

VC Investment Process

The entire VC Investment process can be segregated into the following steps:

1. **Deal Origination** VC gets deals directly or through intermediaries such as practicing Chartered Accountants.

   VC indicates in advance about

   - ✓ Sector focus
   - ✓ Promoter focus
   - ✓ Stages of business focus
   - ✓ Turnover focus

   Here the Company looking for VC funding provides Investment Memorandum which contains a detailed business plan which consists of business model, financial plan, tentative valuation and exit plan.

2. **Screening** is generally carried out by a committee consisting of senior level people of the VC.

3. **Due Diligence** VC would now carry out due diligence in order to verify the veracity of the documents taken. This is generally handled by external bodies, mainly renowned consultants. The fees of due diligence could be paid by the VC or may be shared between the VC and the company.

4. **Deal Structuring** The deal is structured in such a way that both parties win. In many cases, the convertible structure is brought in to ensure that the promoter retains the right to buy back the share. Besides, VC may put a condition that promoter has also to sell part of its stake along with the VC. Such a clause is called tag- along clause.

[Q. In Deal Structuring, in many structures to facilitate the exit, the Venture Capital may put a tag-along clause". What do you mean by that clause ? Explain Deal Structuring and Exit Plan to Venture Capital Investment Process.] (4 Marks) Exam Nov 2023

5. **Post Investment Activity** VC nominates its nominee in the board of the company to ensure that Company adheres to certain guidelines like strong MIS, strong budgeting system, strong corporate governance, professional management and achievement of milestones. If milestone has not been met the company has to give explanation to the VC.

6. **Exit plan** Mainly, exit happens in two ways:
   (i) 'Sell to third party(ies)': This sale can be in the form of IPO or Private Placement to other VCs.
   (ii) Promoter would give a buy back commitment at a pre agreed rate (generally between IRR of 18% to 25%). In many deals, the promoter buyback is the first refusal method adopted i.e. the promoter would get the first right of buyback.

Startup India Initiative

or *Q. NIYA Healthcare is a proprietary concern engaged in the manufacture and development of Pharmaceutical products since last five years. To scale up the business operations and increase the present turnover which is hovering around 500 Million, the proprietor decides to convert his existing business into a Private Limited Company. He also wants to get access to various tax benefits, easier compliances under the startup India initiative and get recognized as a startup company.*
Advise whether NIYA Healthcare can be recognized as a startup company in view Of the criteria considered eligible for the startup recognition initiated by the Government of India ? (4 M) Exam N19, N23, RTP N23

Startup India scheme was initiated by the Government of India on 16th of January, 2016.
An entity shall be considered as a Startup:

- Upto a period of 10 years from the date of incorporation/ registration. It could be incorporated as either a Private Limited Company or a Registered Partnership Firm or a Limited Liability Partnership in India.
- Turnover for any of the financial years has not exceeded ₹ 100 crores, and
- Working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model with a high potential of employment generation or wealth creation.
  Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a 'Startup'.

Apart from the support from government, other reasons for major boost & sustainable environment for start-ups are: [Exam May 2024]

(i) The Pool of Talent big pool of talent in india, millions of students graduating every year.
(ii) Cost Effective Workforce compared to other countries, the cost of setting up and running a business is comparatively lower.
(iii) Increasing use of the Internet affordable telecom services, reach to rural areas.
(iv) Technology makes business processes quick, simple and efficient. Increasingly working in artificial intelligence and block chain technologies .
(v) Variety of Funding Options Available bank borrowings, angel investors, venture capitalists, seed funding stage investors, FDI etc.

Succession Planning in Business

RTP May 2024, (4 Marks) Exam Nov 2024

Succession planning is the process of identifying the critical positions within an organization and developing action plans for individuals to assume those positions. A succession plan identifies future need of people with the skills and potential to perform leadership roles. Succession planning is an important priority for family owned businesses as most of them are managed by a non-family leader even though the ownership lies with the family. Taking a holistic view of current and future goals, this type of preparation ensures that the right people are available for the right jobs today and in the years to come. It can also provide a liquidity event, which enables the transfer of ownership in a going concern to rising employees. Succession planning is a good way for companies to ensure that businesses are fully prepared to promote and advance all employees—not just those who are at the management or executive levels.

Why is there a need for succession planning? MTP April 2024

- Risk mitigation If existing leader quits, then searches can take six-nine months for suitable candidate to close. Keeping an organization without leader can invite disruption, uncertainty, conflict and endangers future competitiveness.
- Cause removal If the existing leader is culpable of gross negligence, fraud, willful misconduct, or material breach while discharging duties and has been barred from undertaking further activities by court, arbitral tribunal, management, stakeholders or any other agency.
- Talent pipeline Succession planning keep employees motivated and determined as it can help them obtaining more visibility around career paths expected, which would help in retaining the knowledge bank created by company over a period of time and leverage upon the same.
- Conflict Resolution Mechanism This planning is very helpful in promoting open and transparent communication and settlement of conflicts.
- Aligning In family owned business succession planning helps to align with the culture, vision, direction and values of the business.

Business succession strategy (4 Marks) Exam Sep 2025

Step 1 – Evaluate key leadership positions To evaluate which roles are critical, risk or impact assessment can be performed. Generally, these are such positions which would bring transformation to the entire business or create strategic direction for the organization.

Step 2 – Map competencies required for above positions identify qualifications, behavioral and technical competencies required to perform the role successfully.

Step 3 – Identify competencies of current workforce Identify

(i) possible internal options and need for their training and development

(ii) whether there is a need to search outside the organization.

Step 4 – Bridge Leader In family owned business appointment of an outsider as 'bridge leaders' will help to develop the business and prepare young family members for leadership role.

Challenges In context of Start-up following challenges are faced in implementing Succession Planning.

(1) Founder mindset might be different than the corporate mindset The way founder's brains are wired is different from the way that a traditional corporate manager thinks, and this puts off seasoned corporate leaders from joining even matured start-ups.

(2) Premature for startups to implement business succession Certain startups are at early growth stage and too much of processes would lead to growth slow-down.

(3) Founders are the face of startups One cannot imagine a startup without a founder who initiated the idea and executed it and in his/ her absence succession planning can become difficult.

Portfolio Management

LDR 3 Hrs
LMR 10 Mins

A

Risk & Returns

- Individual security Risk & Returns
- How to select between Stocks
- Portfolio Risk & Returns
- Constructing a Portfolio
- More insights into Risk - Using Z Values
- Portfolio Review
- Classification of Total Risk
- Sharpe Index Model

B

Portfolio Analysis & Decisions

- Portfolio Management Strategy
- Portfolio Performance Evaluation

C

Corporate Beta

Single Security - Risk & Returns

Returns %

If single period (say 1 year horizon)

$$\text{Return\%} = \frac{D_1 + \overbrace{P_1 - P_0}^{\text{Price appreciation}}}{P_0} \times 100$$

here, D_1 means dividend during year 1
P_1 means Price at the end of year 1

Caution Note If No. of shares have changed between Year beginning & Year end (due to corporate events such as Bonus, Stock split etc.) then Use Total Data in this formula to calc Returns%. Don't use Per Share data.

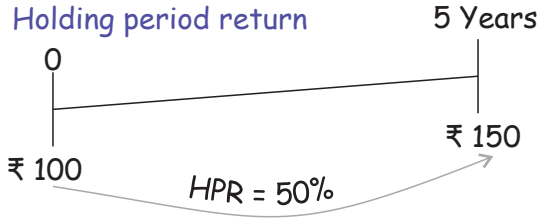
If Multiple Period

1. Arithmetic Mean i.e. Simple Average

$$= \frac{\sum \text{Return}}{n}$$

⊖ Ignores compounding effect

2. Holding period return



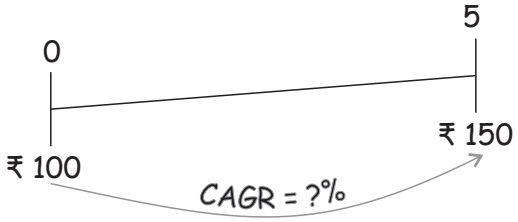
⊖ If two Investments have different holding period then HPR are not comparable. Also ignores compounding effect.

3. Simple Annual Return

$$= \frac{\text{Holding Period Return}}{\text{Holding Period}} = \frac{50\%}{5 \text{ Years}} = 10\% \text{ p.a.}$$

⊖ Holding Period Returns are now comparable but ignores compounding effect.

4. CAGR i.e. Compounded Annual Growth Rate



⊕ Best approach to calc & compare 'Returns over Multiple period'

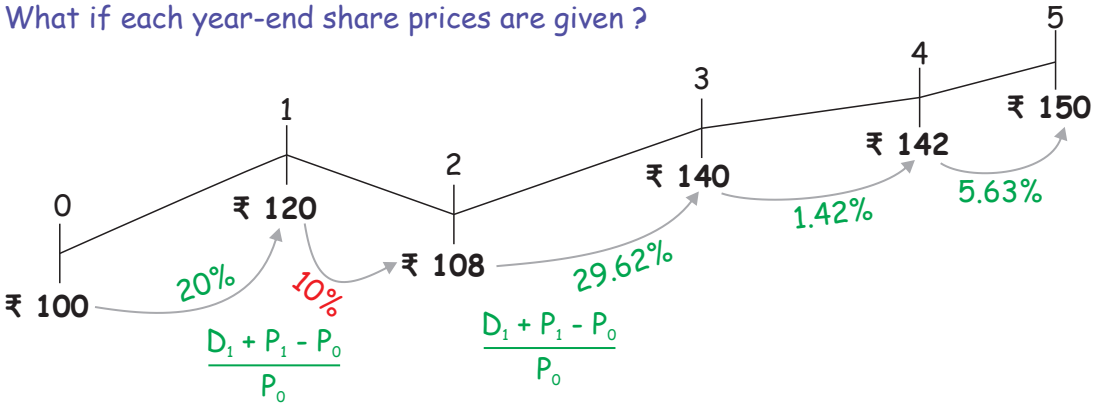
Caution Note But to find Risk (σ) we use only Arithmetic Mean of Returns ($\bar{x}$)

Eg. MP today = 100 | MP after 5 years = 150 | Calc CAGR ?

Alt 1 $FV = PV(1+r)^n$

$\Rightarrow 150 = 100(1+r)^5 \quad \Rightarrow 1.5 = (1+r)^5 \quad \Rightarrow 1.5 = 1+r \quad \Rightarrow 1.0844 = 1+r \quad \therefore r = 8.44\%$

What if each year-end share prices are given ?



Alt 2 Geometric Mean $= \sqrt[n]{(1+r_1)(1+r_2).....(1+r_n)} - 1$

$= \sqrt[5]{1.20 \times 0.90 \times 1.2962 \times 1.0142 \times 1.0563} - 1$

$= 8.44\%$

If co. has paid dividend during the holding period then calculating GM is the only correct way left to calc CAGR. Simply incorporate dividend amount in Returns% of the respective years & calc GM.

Q. Cal Expected return for the next year?

Calculation of Expected Return

Prob (P)	Return (X)	P x X
0.20	20%	4%
0.20	-10%	-2%
0.20	29.62%	5.92%
0.20	1.42%	0.28%
0.20	5.63%	1.13%
Expected Return for the next year		= 9.33%

Although we use Compounded Average to calc past period return but to calc Expected Returns for the next period we use probabilistic average (i.e. Simple Avg in the absence of specific probabilities)

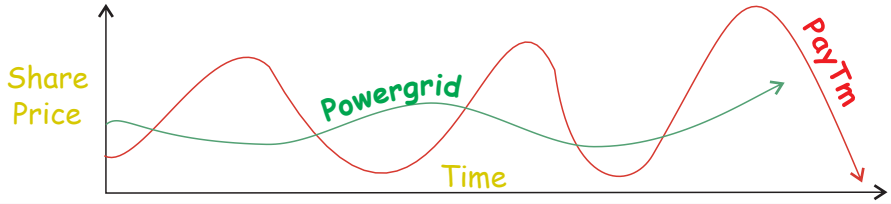
Risk

Deviation from Expected outcome is Risk.

Lesser the deviations, Lesser would be the risk
Higher the deviations, Higher would be the risk

If we can measure the extent of deviation, we have actually measured the Risk.

To measure deviation, we use a statistical concept called as "Standard Deviation".



Which share looks more risky ?

☑ PayTm

☐ Powergrid

How to calc Risk i.e. Std. Deviation ?

Caution Note
This is X - $\bar{X}$. Don't make the mistake of doing Px X - $\bar{X}$

Prob (P)	Return (x)	P x X	$d_x = X - \bar{X}$	d_x^2	pd_x^2
0.30	40%	12%	21	441	132.3
0.20	25%	5%	6	36	7.2
0.40	10%	4%	- 9	81	32.4
0.10	- 20%	-2 %	- 39	1521	152.1
		$\bar{x}$ = 19%		$\sum pd_x^2$ i.e. variance =	324

Caution Note

Don't make the mistake of dividing 19% by 4 because we have already multiplied by Probability

i.e. Avg Return
or Mean Return
or Expected Return

$\sigma = \sqrt{\text{Variance}}$

$\sigma = \sqrt{324}$

σ = 18%

Tutorial Note: Standard Deviation will have the same unit (either % or ₹) as used in Returns column i.e. X column

Stock Selection - Based on Risk & Return considerations

1. If two stocks have same Risk ---> Prefer stock having Higher Return
2. If two have same return ---> Prefer stock having Lower Risk.
3. If one of the stock has both Higher Return as well as lower risk ---> Prefer that stock.
4. If one of the stock has higher return but also has higher risk ---> See example below.

	Vi	Airtel
Expected Return E(r)	25%	15%
Risk	18%	10%

An Aggresive Investor (risk lover/risk seeker) would prefer investing in Vi since it has higher returns%.

A Defensive investor (risk averse) would prefer investing in Airtel since it carries lower risk.

However, a rational investor would base his decision on 'Coefficient of Variation' as calc below. A Risk neutral investor would prefer investing in Airtel since it has lower CV.

Coefficient of variation = $\frac{\text{Risk}}{\text{Return}}$ or $\frac{\sigma}{\bar{X}}$

CV tells us risk being taken to earn every 1% of return
Lower CV is preferred

$CV_{Vi} = \frac{18\%}{25\%} = 0.72$

$CV_{Airtel} = \frac{10\%}{15\%} = 0.667$

Portfolio - Risk & Returns

Return on Portfolio [Rp or μp]

Return on Portfolio is weighted Average Return on individual securities where beginning of the period Market values are the assigned weights.

$$R_p = \Sigma R_i \times W_i$$

Eg.

Investment	MP	n
Airtel	₹ 300	500
TCS	₹ 2000	150

Airtel declared dividend of ₹ 2 per share & ended the year with price of ₹ 350. TCS declared a generous dividend of ₹ 50 per share & trades @ ₹ 2200 at the end of the year. Calc Return on Portfolio ?

$$\text{Return on Airtel} = \frac{D_1 + P_1 - P_0}{P_0} \times 100 = \frac{2 + 350 - 300}{300} \times 100 = 17.33\%$$

$$\text{Return on TCS} = \frac{50 + 2200 - 2000}{2000} \times 100 = 12.5\%$$

Security	Return %	Weight	$R_i \times W_i$
Airtel	17.33%	150/450 = 1/3	5.78%
TCS	12.5%	300/450 = 2/3	8.33%
			R_p = 14.11%

1. Don't make the mistake of using No. of shares or Market Price as Weights. The correct Weights are 'Market Values'.
2. Don't make the mistake of using Year-end Market Values as Weights. The correct Weights while calc returns are Beginning of the period Market Values.

Q. If you continue with above portfolio for one more year during which time Airtel & TCS have paid ₹ 5 & ₹ 40 as dividends respectively and end the year with share prices of ₹ 450 & ₹ 2500 respectively. Calc R_p for the 2nd year?

Solve:

Security	Returns%	Weights	$R_i \times W_i$
Airtel	$\frac{5 + 450 - 350}{350} \times 100 = 30\%$	175 / 505	10.40%
TCS	$\frac{40 + 2500 - 2200}{2200} \times 100 = 15.45\%$	330 / 505	10.10%
			R_p = 20.50%

Q. Calc Avg return p.a. for last 2 yrs.

Use CAGR

Geometric Mean $= \sqrt[2]{(1.1411)(1.2050)} - 1$

$= 17.26\%$

Q. Calc Expected Return for 3rd year

Use probabilistic average

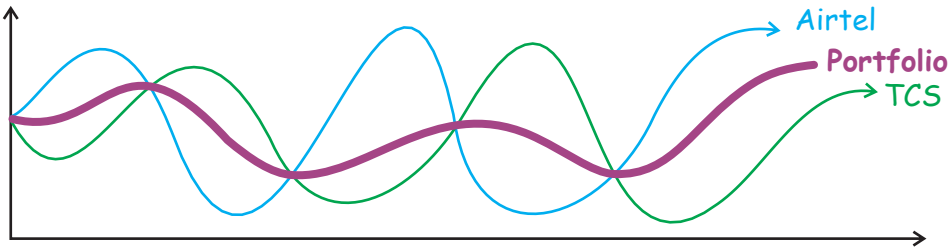
Prob.	Return%	P x R
0.50	14.11%	7.055%
0.50	20.5%	10.25%
	Expected Return	17.31%

Risk of Portfolio [σ_P]

as per Modern Portfolio Theory/ Modern Approach or Harry Markowitz Model or Risk-Return Optimization Approach

~~Risk of Portfolio is weighted avg risk of individual securities~~

Risk of Portfolio is NOT the weighted average risk of individual securities. Instead σ_P is Less than weighted average. This is so because multiple securities in the portfolio tend to offset each others deviation & hence the net effect of deviation at portfolio-level will be less than the W.A.



Risk of Portfolio $\sigma_P = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_B Corr_{AB}}$

$Corr_{ij}$ or r_{ij} or $\rho_{ij} = \frac{Covariance_{ij}}{\sigma_i \sigma_j}$

$Covariance = \Sigma pd_x d_y$

Don't make the mistake of using Return% in Exams, Use Risk% here. Since both data are in % terms hence Students make mistakes here

Eg. Calc Std Dev of Portfolio comprising of two stocks- Airtel & TCS with Weights of 0.30 & 0.70 respectively

Prob (P)	Airtel Return% (x)	TCS Return% (Y)	PxX	PxY	$d_x = X - \bar{X}$	$d_y = Y - \bar{Y}$	$pd_x d_y$	pd_x^2	pd_y^2
0.10	50%	20%	5%	2%	31.75	- 1.75	- 5.56	100.81	0.31
0.20	35%	15%	7%	3%	16.75	- 6.75	- 22.61	56.11	9.11
0.50	15%	30%	7.5%	15%	- 3.25	+ 8.25	- 13.41	5.28	34.03
0.15	- 10%	10%	-1.5%	1.5%	- 28.25	- 11.75	49.79	119.71	20.71
0.05	5%	5%	0.25%	0.25%	- 13.25	- 16.75	11.10	8.78	14.03
			$\bar{X}$ = 18.25%	$\bar{Y}$ = 21.75%			$\Sigma pd_x d_y$ = 19.31	Σpd_x^2 = 290.69	Σpd_y^2 = 78.19
							i.e. Covariance$_{xy}$	i.e. Var$_x$	i.e. Var$_y$

$\sigma_x = \sqrt{290.69} = 17.05\%$

$\sigma_y = \sqrt{78.19} = 8.84\%$

In exams, if prob. is NOT given then assumption (back of the mind) is that Prob are equal. Front calculation will be to simply start "dividing by n" wherever we earlier used to multiply by Prob.

$\bar{X} = \frac{\Sigma x}{n}$ (instead of ΣPxX)

$Variance = \frac{\Sigma d_x^2}{n}$ (instead of ΣPd_x^2)

$Covariance = \frac{\Sigma d_x d_y}{n}$ (instead of $\Sigma Pd_x d_y$)

Tutorial Note

General Points to remember Units of Var, Cov, & σ

Variance	$\%^2$
Covariance	$\%^2$
σ	%

Q. Calc Risk of Portfolio if weight of Airtel is 0.30 ?

$$\text{Correlation}_{AB} = \frac{\text{Covariance}_{AB}}{\sigma_A \sigma_B} = \frac{19.31}{17.05 \times 8.84} = 0.128$$

$$\sigma_P = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_B \text{Corr}_{AB}}$$

$$= \sqrt{(17.05 \times 0.30)^2 + (8.84 \times 0.70)^2 + 2 \times 17.05 \times 0.30 \times 8.84 \times 0.70 \times 0.128}$$

= 8.52%

Verification that risk of portfolio is LESS than W.A.
= 17.05% x 0.30 x + 8.84% x 0.70 = 11.30%

Interpretation of Covariance & Correlation

1. Covariance
   - ✓ Denotes co-movement of two securities i.e. how the two securities will move together.
   - ✓ If Covariance is +ve then the two securities will usually move in the same direction.
   - ✓ If Cov is -ve then the two sec usually tend to move in the opposite direction.
   - ✓ If Cov is +ve the Corr will also be +ve & vice-versa.

2. Correlation is a relative measure of co-movement between two securities.

Correlation	-1	- 0.7	- 0.3	Corr = 0	0.3	0.70	Corr +1
	Strong	Moderate	Weak	Weak	Moderate	Strong	
	-ve	- ve	- ve	+ve Corr	+ve	+ve	

Perfect Negative Correlation

Eg	A	B
E(r) or $\bar{X}$	10%	16%
σ	5%	9%

$\text{Corr}_{AB} = -1$

If in a particular year security A delivers 20% return (which is 10% above the mean or 2σ above the mean) then Corr = -1 implies that sec B will deliver return which return are 2σ below its mean

∴Return on sec B
= 16% - 2x9% = - 2%

Risk of Portfolio will be lowest when corr = - 1 due to greater offsetting effects

Infact, σ_p = W.A. Subtraction of risk of Individual securities.

$\sigma_P = \sigma_A \times w_A - \sigma_B \times w_B$

No Correlation

The securities tend to move independent of each other. Accordingly, Security B's Returns cannot be predicted by looking at sec A's returns or vice - versa.

Perfect Positive Correlation

Eg	A	B
E(r) or $\bar{X}$	10%	16%
σ	5%	9%

$\text{Corr}_{AB} = +1$

If in a particular year security A delivers 20% return (which is 10% above the mean or 2σ above the mean) then Corr = + 1 implies that sec B will deliver also return which are 2σ above its mean return

∴Return on sec B
= 16% + 2x9% = 34%

Risk of Portfolio will be highest when corr = +1 since there will be no offsetting effect.

In fact, σ_p = W.A. summation of risk of Individual securities.

$\sigma_P = \sigma_A \times w_A + \sigma_B \times w_B$

Measuring Risk of Portfolio comprising of more than 2 securities

2 Securities

$$\sigma_P = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_B Corr_{AB}}$$

σ_P formula : $(a + b)^2 = a^2 + b^2 + 2\ ab\ Corr_{AB}$

Decoded: $a = \sigma_A w_A$, $b = \sigma_B w_B$

3 Securities

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab\ Corr_{AB} + 2bc\ Corr_{BC} + 2ca\ Corr_{CA}$$

$$\sigma_P = \sqrt{(\sigma_A w_A)^2 + (\sigma_B w_B)^2 + (\sigma_C w_C)^2 + 2\sigma_A w_A \sigma_B w_B Corr_{AB} + 2\sigma_B w_B \sigma_C w_C Corr_{BC} + 2\sigma_A w_A \sigma_C w_C Corr_{CA}}$$

n Securities

It will be very complicated matter to calc σ_p using above formula approach.

Use Matrix Approach Matrix [Method can also be used for 2, 3 or n securities portfolio]

Variances & Covariance Matrix Approach to calc σ_p Using data from above example

	Weights	0.3	0.7	.	.
Weights	Sec	Airtel (A)	TCS (B)		
0.3	Airtel(A)	290.69	19.31	.	All Non-diagonal cells represent Covariance
0.7	TCS(B)	19.31	78.19	.	.
.		.	.	Co Variances	.
.		.	.	.	.

Diagonal cells represent Variances

$$\sigma_P^2 = (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A\ w_A\ \sigma_B\ w_B\ Corr_{AB}$$

$\sigma_A^2\ w_A^2$ → $Variance_A$; $\sigma_B^2\ w_B^2$ → $Variance_B$; $Cov_{AB} = \sigma_A\ \sigma_B\ Corr_{AB}$ → $2w_A\ w_B\ Cov_{AB}$

$$Corr_{AB} = \frac{Cov_{AB}}{\sigma_A\ \sigma_B}$$

$$\sigma_p = \sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} Cov_{ij}\ w_i\ w_j}$$

Cal^{-n} Process to calc σ_p using matrix on Calculator

1. Start with the data in cell 1 (in our case 290.69)
2. Now multiply it by both the corresponding weights i.e. weight written above the column header & weight written before the row header (in our case 0.3 & 0.3)
3. Put above calculated Number in M+
4. Now repeat steps 1 to 3 for all the remaining cells
5. Now M^R_C & then $\sqrt{}$ Square root to calc σ_p

Exam Tip:

If many securities are given in exam (say 25 securities) then to avoid cumbersome calculations you can look for commonalities (i.e. cells with the same values & same final results) to quicken your calculations.

Constructing a Portfolio

"Author has color coded this page for better understanding. Same scheme has been adopted on various pages throughout this Booklet"

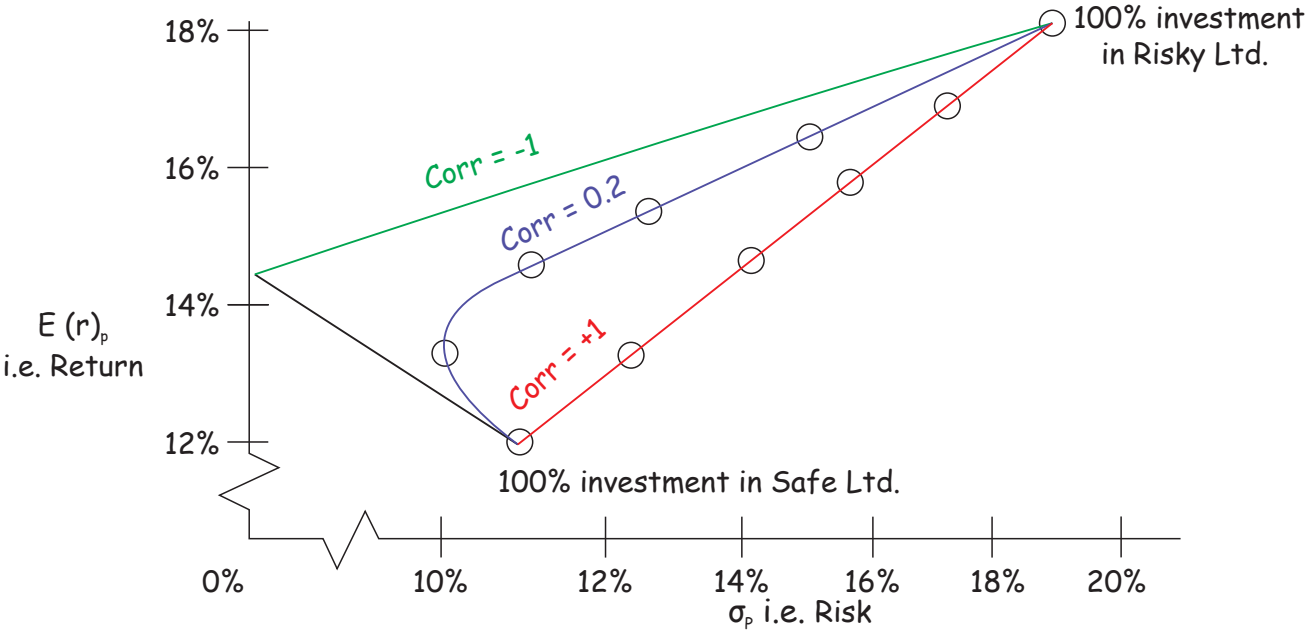
Minimum Variance Portfolio/Minimum Risk Portfolio

Eg

	Safe Ltd.	Risky Ltd.
E(r)	12%	18%
σ	11%	19%

Calculate Return on Portfolio & Risk of Portfolio at various weight combinations if Corr = 0.20, +1, -1

Solve: Weights		Return on portf Rp	Risk of portfolio [σp]		
Safe Ltd.	Risky Ltd.		If = Corr 0.20	If Corr = +1	If Corr = -1
1	0	12%	11%	11%	11%
0.80	0.20	13.2%	10.26%	12.6%	5%
0.60	0.40	14.4%	11.02%	14.2%	1%
0.40	0.60	15.6%	13.01%	15.8%	7%
0.20	0.80	16.8%	15.79%	17.4%	13%
0	1	18%	19%	19%	19%



How to find weight proportion where the risk of the portfolio is minimum?

$$w_X = \frac{\text{Variance}_y - \text{Covariance}_{XY}}{\text{Var}_X + \text{Var}_y - 2\,\text{Cov}_{XY}}$$

Tutorial Note: It's easy to remember in language form:
दूसरे का variance minus एक बार covariance
दोनों का variance minus दो बार covariance

Let's apply above formula in our eg where Corr = 0.20

$$\therefore w_{safe} = \frac{\text{Variance}_{Risky} - \text{Covariance}_{SR}}{\text{Var}_{Safe} + \text{Var}_{Risky} - 2\,\text{Cov}_{SR}} = \frac{361 - 41.80}{121 + 361 - 2 \times 41.80}$$

$\therefore w_{safe} = 0.8012 \sim 0.80$

hence, $W_{Risky} = 1 - 0.80 = 0.20$

Workings

$\sigma_{\text{Safe Ltd.}} = 11\%$ $\quad \therefore$ Var of safe $= 121\%^2$

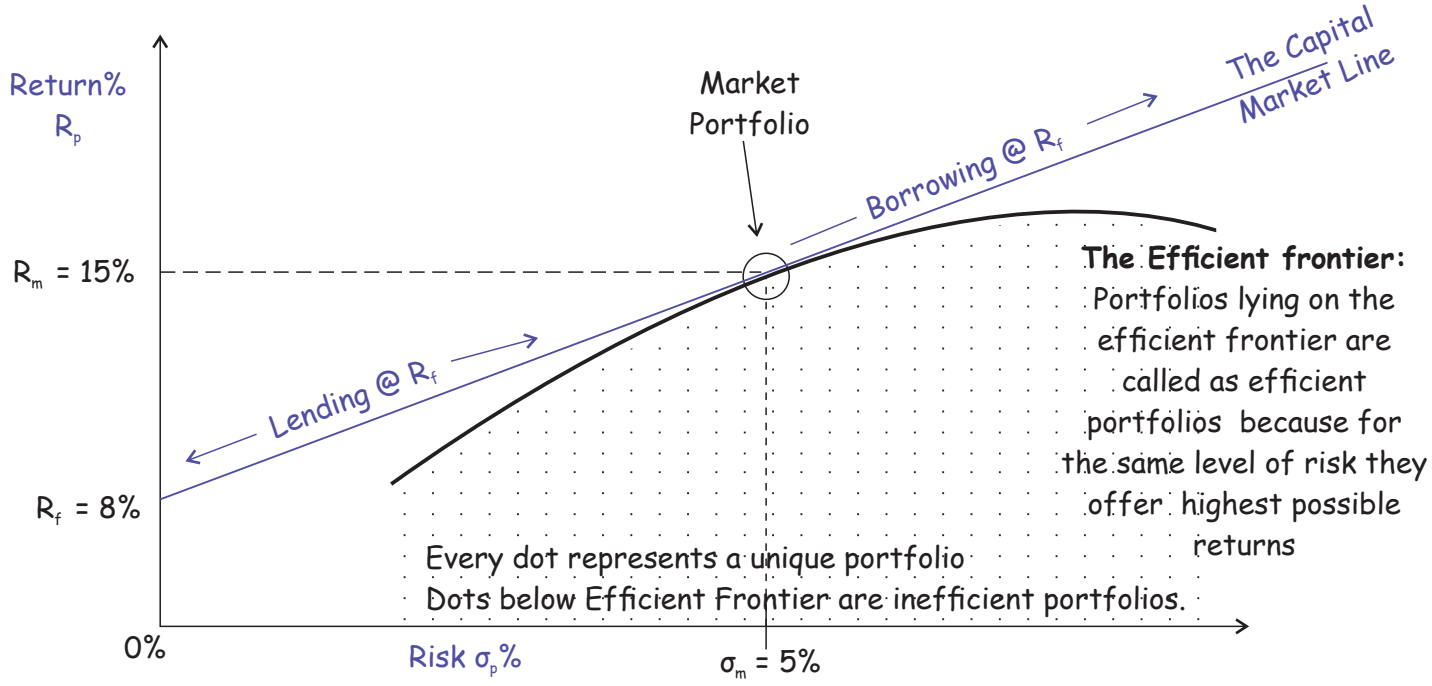
$\sigma_{\text{Risk Ltd.}} = 19\%$ $\quad \therefore$ Var of Risky $= 361\%^2$

$\text{Cov}_{\text{Safe \& Risky}} = \text{Corr}_{SR} \times \sigma_s \times \sigma_R = 0.20 \times 11\% \times 19\% = 41.80\%^2$

Comment: Risk of the Portfolio will be lowest when Safe Ltd & Risky Ltd are included in 80:20 proportion.

The Efficient Frontier

Harry Markowitz Model / Markowitz Portfolio Theory / Modern Theory / Minimum Variance set / Risk-Return Optimization Model



Slope of CML (λ) $\frac{R_m - R_f}{\sigma_m} = \frac{15\% - 8\%}{5\%} = 1.4$ means for taking every 1% risk, market offers 1.4% excess returns

aka Market price of risk

Equation of CML

$$E(r)_p = R_f + \lambda\sigma_p \text{ or } = R_f + \frac{R_m - R_f}{\sigma_m} \times \sigma_p$$

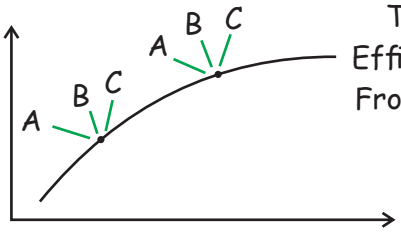
Remember that when you construct a portfolio comprising of:-
(i) Risk free asset
(ii) Risky asset (either a Single security or a Portfolio or an Efficient frontier)
then overall returns & risk of such a combination is always weighted average.

Q. Suppose an investor has ₹ 10 lakhs of his personal funds, how can he construct an efficient portfolio giving expected returns of 20% & what will be the risk of this portfolio. Given R_f = 8%, & R_m = 15% & σ_m = 5%

Solve:
Let x be the proportion of inv in market portfolio
20% = 8% x (1 - x) + 15% x X
0.20 = 0.08 - 0.08x + 0.15x
∴x = 1.7143

Thus, borrow 71.43% of own funds @ Rf i.e. ₹ 714300.
Now, invest total ₹ 1714300 in the market.
∴Risk of above portfolio = 5% x 1.7143 = 8.57%

Corner Theorem/ Critical Line Method



According to corner theorem, there exists a linear relationship between securities forming part of a portfolio lying on the Efficient frontier.
Here linear relationship means degree of Δ in weights b/w any two securities will be in the same proportion.

Example:	Security		
	A	B	C
Portfolio 1 (lying on efficient frontier)	0.40	0.30	0.30
Portfolio 2 (lying on efficient frontier)	0.30	0.50	0.20

Falls by 0.10 (A: 0.40 → 0.30); increases by 0.20 (B: 0.30 → 0.50)

Hence when weight of A drops to 0.20, then weight of B & C can be found as below :

A	B	C	
0.20	0.70	0.10	[Logically]

Exam Presentation Alternatively, above answers could be found using linear equation

$Y = mx + c$

Let's denote W_A (i.e. weight of sec A) by X & W_B by Y.

$0.30 = m \times 0.40 + C$ --- eqⁿ 1

$0.50 = m \times 0.30 + C$ --- eqⁿ 2

$-0.20 = 0.10\,m$

$\therefore m = -2$

Finding the value of c

$\Rightarrow 0.30 = m \times 0.40 + C$

$\Rightarrow 0.30 = -2 \times 0.40 + C$

$\therefore C = 1.10$

Now if weight of sec A becomes 0.20 then weight of sec B will be

$Y = mx + C$

$= -2 \times 0.20 + 1.10$

$= 0.70$

$\therefore W_B = 0.70$

& W_C will be

$W_A + W_B + W_C = 1$

$0.20 + 0.70 + W_C = 1$

$\therefore W_C = 0.10$

What if W_A dropped to 0.05 instead ?

$Y = mx + C$

$= -2 \times 0.25 + 1.10$

$= 1$

$\therefore W_B = 1$

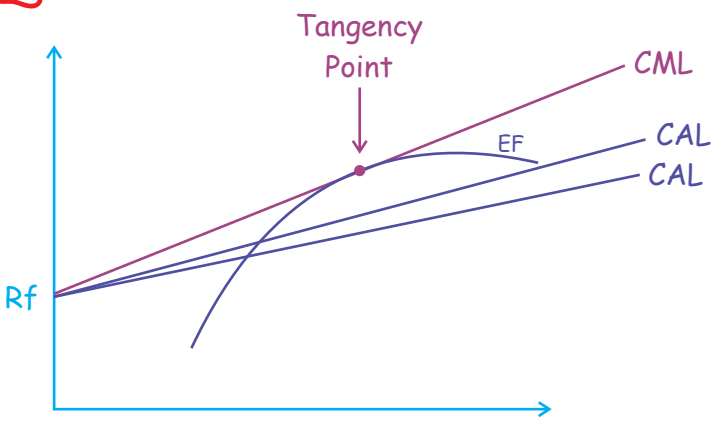
W_C will be - 0.05 as calc below

$W_A + W_B + W_C = 1$

$0.05 + 1 + W_C = 1$

$\therefore W_C = -0.05$

The Capital Allocation line Vs. The Capital market line



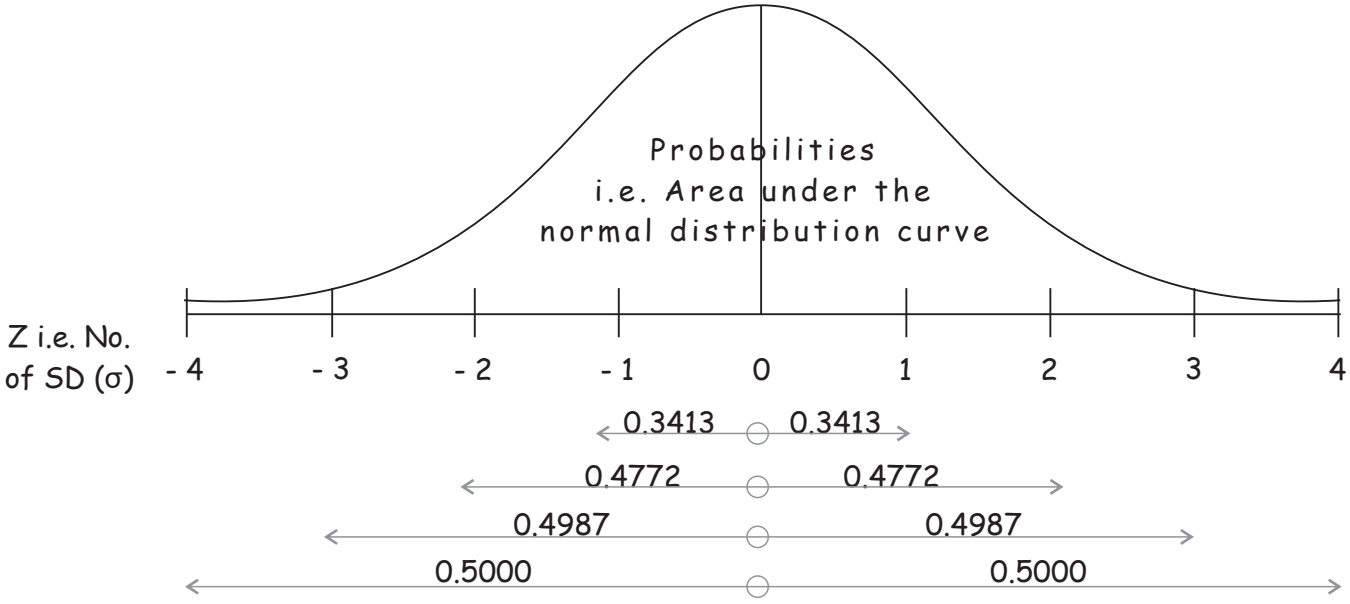
When a Rf asset is combined with any Risky Asset then various possible portfolio combinations are represented by CAL.

When a Rf asset is combined with Tangency Point efficient frontier portfolio i.e. market portfolio then a line that represents various possible portfolio combinations is called as CML .
Hence, CML is a special case of CAL where risky asset used is a market portfolio.
CML is also termed as Optimal CAL.

Probabilistic Interpretation of Risk - Using Z Values

If σ = 8% (say) is there any guarantee I'll not lose more than 8% ? This is Stock market Dear! Here everything is probabilistic !

How to find probabilities/chance of earning return more than/less than a certain percentage ?



$$Z = \frac{X - \bar{X}}{\sigma}$$

here,
X means desired return % against which Z value needs to be found

Example : Infosys

$\bar{X}$ = 15% σ = 6%

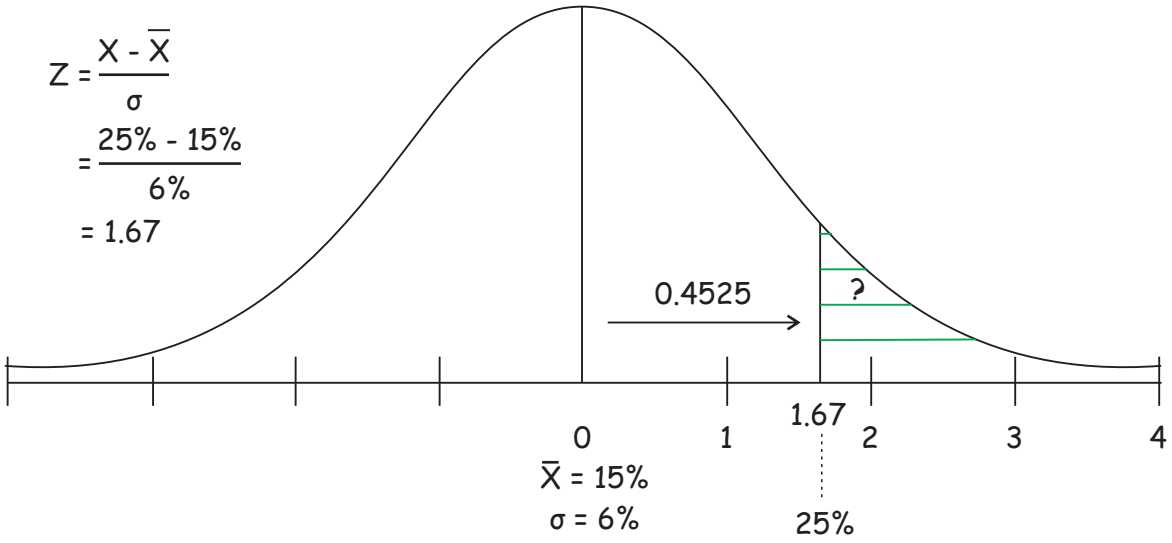
Case (i): What are the chances that return will be more than 25% ?

Solve :

$$Z = \frac{X - \bar{X}}{\sigma}$$

$$= \frac{25\% - 15\%}{6\%}$$

$$= 1.67$$



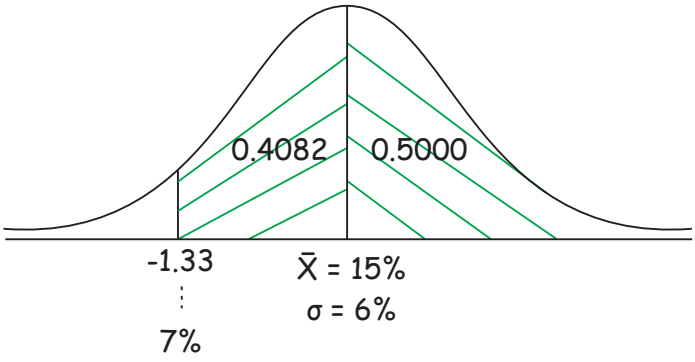
At Z = 1.67, the area in the probability table/normal distribution table (Refer Table given on the last page of this booklet) is 0.4525

Therefore, chances that returns will be more than 25% are 0.50 - 0.4525 = 0.0475 or 4.75%

Case (ii): Chance that return will be at least equal to the Rf of 7%

[Alternative language: Chances that returns will be at least equal to 7%]

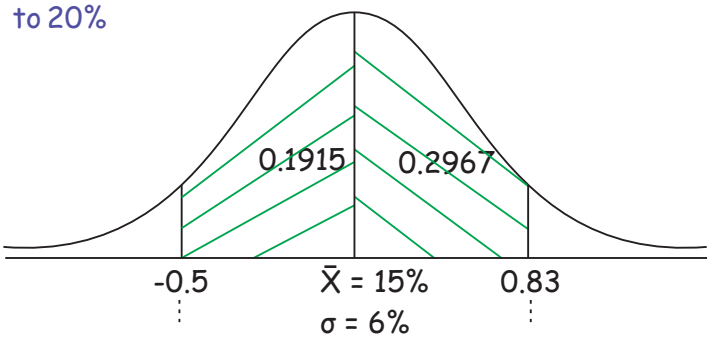
$$Z = \frac{X - \bar{X}}{\sigma} = \frac{7\% - 15\%}{6\%} = -1.33$$



At Z = -1.33, area is 0.4082

Therefore, chance of earning return more than 7% are 0.4082 + 0.50 = 0.9082 or 90.82%

Case (iii): Chances of earning returns between 12% to 20%



12%

At 12%

$$Z = \frac{X - \bar{X}}{\sigma}$$

$$Z = \frac{12\% - 15\%}{6\%}$$

$$Z = -0.5$$

20%

At 20%

$$Z = \frac{20\% - 15\%}{6\%}$$

$$Z = 0.83$$

At Z = 0.83, area is 0.2967

At Z = - 0.5, area is 0.1915

Therefore, chance of earning return b/w 12% to 20% is 0.1915 + 0.2967 = 0.4882 or 48.82%

Three Types of Z tables (Based on starting point from where measurement of area is started)

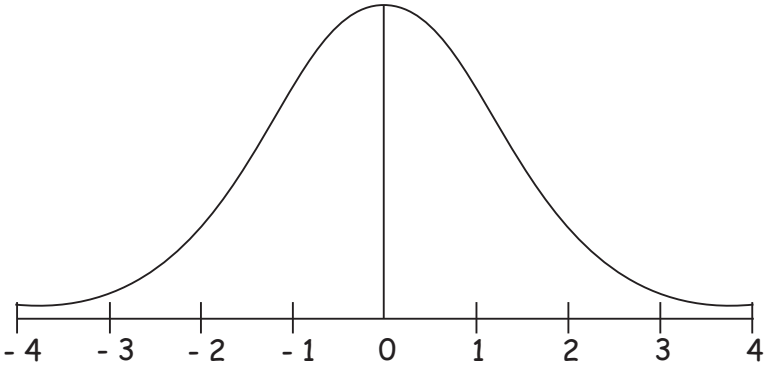


Table Type 1 Measurement of Area starts from centre (i.e. Mean) towards corners

Hint: As Z no increases, area covered also increases

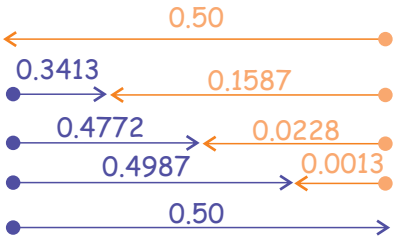
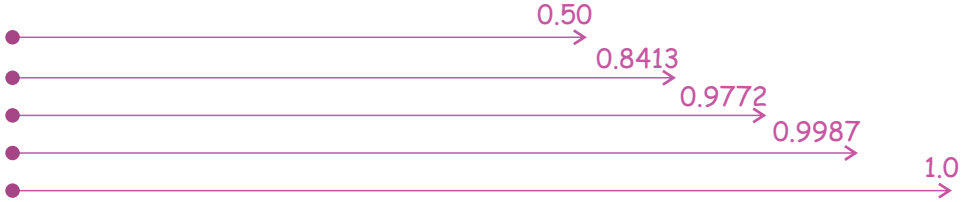


Table Type 2 Measurement of Area starts from corner towards centre

Hint: As Z no increases the area covered decreases

Table Type 3 Measurement of area is done from extreme Left corner and goes till extreme right corner

Hint: Area will exceed 0.50 for all the +ve Z nos.



Portfolio Review

Concept of Dominance

To dominate other securities in the portfolio, a security must have any one of the below properties:

- ✓ For the same level of risk, it has higher returns
- ✓ For the same level of Returns, it has lower risk
- ✓ A Security has both Higher Return & Lower Risk

Example	A	B	C	D	E	F
Expected Returns	12%	11%	12%	18%	16%	24%
Risk	8%	8%	6%	10%	11%	15%
	X [C > A]	X [A > B]			X [D > E]	

Which securities dominate the other securities in the portfolio ?

Solve: B

Between A & B Sec A Dominates Sec B since for the same level of risk, it offers higher return [A > B]

Note: '>' is the Symbol of Dominance

Between A & C Sec C dominates Sec A Since for the same level of return it has lower risk [C > A]

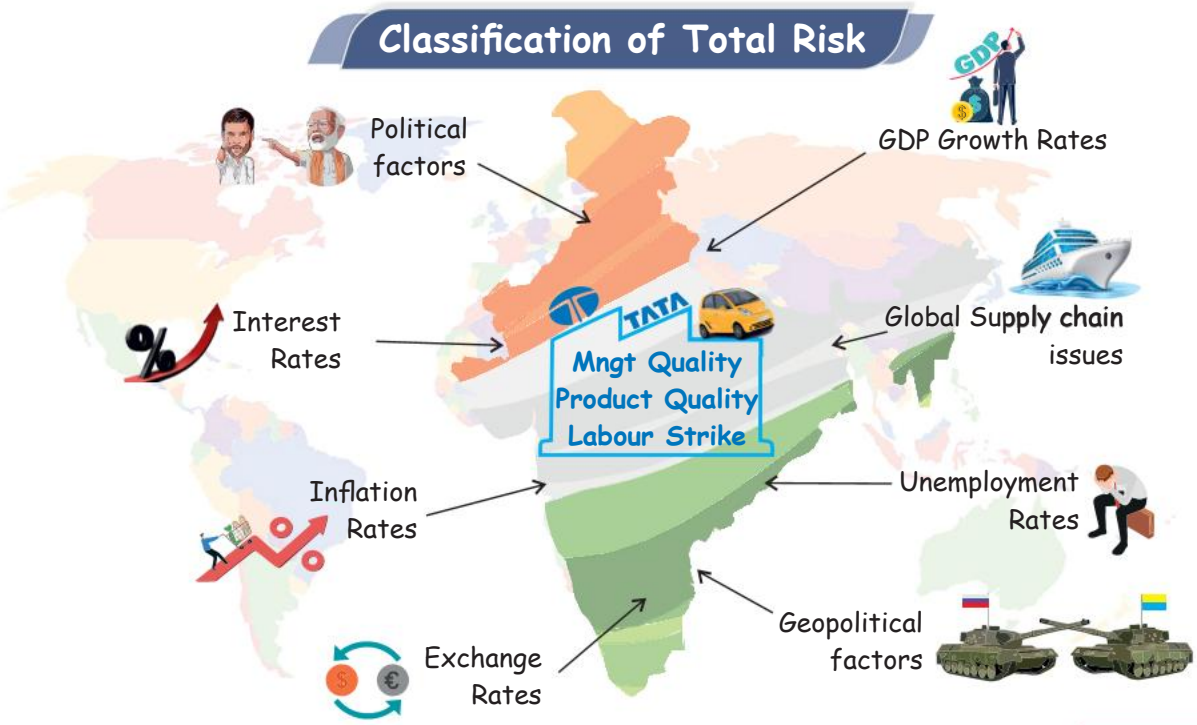
Between D & E Sec D dominates sec E since it has both higher returns as well as lower risk [D > E]

Answer: Sec C, D & F dominates the other securities in the portfolio.

Exam Tip: How do I know whether to apply 'Concept of Dominance' or 'Coefficient of Variation' in a particular Q in exam ?

Hint: If Q asks for selecting more than one securities then apply 'Concept of Dominance'
If Q asks for selecting just one security then use 'Coefficient of Variation'.

Classification of Total Risk



Classification of Total Risk

[Total Risk is measured by calculating 'σ']

Systematic Risk
aka Risk due to External factors or Non-diversifiable Risk or Uncontrollable Risk

[is measured by calculating β]

Unsystematic Risk
aka Risk due to internal factors or Diversifiable Risk or Controllable Risk or Residual risk or Company / Sector Specific Risk

[is measured by calculating ε^2]

Systematic Risk [β]

β is a measure of Systematic Risk. It measures how sensitive a particular stock is with respect to changes in the market.

Tutorial Note:
Beta is never calculated b/w two securities.
β is always calculated b/w a security & Market

Formula to calc β

Correlation Method

Formula 1 $$\beta = \frac{\text{Covariance}_{im}}{\text{Variance}_m}$$

$\because \text{Cov}_{im} = \text{Corr}_{im} \times \sigma_i \times \sigma_m$

Formula 2 $$\beta = \text{Corr}_{im} \times \frac{\sigma_i}{\sigma_m}$$

Regression Method

Formula 3 $$\beta = \frac{\Sigma XY - n\bar{X}\bar{Y}}{\Sigma X^2 - n\bar{X}^2} \text{ or } = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{n\Sigma X^2 - (\Sigma X)^2}$$

here, Return from market is denoted by X
Return from an individual sec is denoted by Y
n means no. of observations

Exam Tip: Formula 3 can be used in exams only when Probabilities are not given

Example

Return on ONGC % (Y)	Return on Market % (X)	$d_x = X - \bar{X}$	$d_y = Y - \bar{Y}$	$d_x d_y$	d_x^2	d_y^2
15%	8%	-5.6	- 6.4	35.84	31.36	40.96
25%	15%	1.4	+ 3.6	5.04	1.96	12.96
- 8%	10%	- 3.6	- 29.4	105.84	12.96	864.36
40%	10%	- 3.6	18.6	- 66.96	12.96	345.96
35%	25%	11.4	13.6	155.04	129.96	184.96
$\Sigma Y = 107\%$	$\Sigma X = 68\%$			$\Sigma d_x d_y = 234.8$	$\Sigma d_x^2 = 189.2$	$\Sigma d_y^2 = 1449.20$

$\bar{Y} = \frac{\Sigma Y}{n} = \frac{107\%}{5} = 21.4\%$

$\bar{X} = \frac{\Sigma X}{n} = \frac{68\%}{5} = 13.6\%$

Cov_{XY} i.e. $\text{Cov}_{im} = \frac{\Sigma d_x d_y}{n} = \frac{234.8}{5} = 46.96$

Variance_X i.e. $\text{Var}_m = \frac{\Sigma d_{X^2}}{n} = \frac{189.2}{5} = 37.84$

$\sigma_m = \sqrt{37.84} = 6.15\%$

Variance_Y i.e. $\text{Var}_i = \frac{\Sigma d_{Y^2}}{n} = \frac{1449.20}{5} = 289.84$

$\sigma_i = \sqrt{289.84} = 17.02\%$

$\text{Corr} = \frac{\text{Cov}_{im}}{\sigma_i \sigma_m} = \frac{46.96}{6.15 \times 17.02} = 0.45$

Caution Note: Don't make the mistake of treating above numbers as covariance & variance directly. First divide them by n to find covariance & variance.

Formula 1

$$\beta = \frac{\text{Covariance}_{im}}{\text{Variance}_{m}} = \frac{46.96}{37.84} = 1.24 \text{ times}$$

Formula 2

$$\beta = \text{Corr}_{im} \times \frac{\sigma_i}{\sigma_m} = 0.45 \times \frac{17.02}{6.15} = 1.24 \text{ times}$$

Formula 3

Y	X	XY	X^2
15%	8%	120	64
25%	15%	375	225
- 8%	10%	- 80	100
40%	10%	400	100
35%	25%	875	625
		$\Sigma XY = 1690$	$\Sigma X^2 = 1114$

$$\beta = \frac{\Sigma XY - n\bar{X}\bar{Y}}{\Sigma X^2 - n\bar{X}^2} = \frac{1690 - 5 \times 13.6 \times 21.4}{1114 - 5 \times (13.6)^2}$$

$$= 1.24 \text{ times}$$

Interpretation of Beta

Movement in index i.e. Market %	Movement in Stock %	β
1% ↓	2% ↓	+ 2 times
3% ↑	1.5% ↑	+ 0.5 times
5% ↑	4% ↓	- 0.8 times

+ / - tells Direction of movement

'Number Times' tells Speed of Movement

Formula 4 (has limited applicability)

$$\beta = \frac{\%\text{ Change in Security Returns}}{\%\text{ Change in Market Returns}} \text{ or } \frac{\text{Return}_1 \text{ of Security} - \text{Return}_2 \text{ of Security}}{\text{Return}_1 \text{ of Market} - \text{Return}_2 \text{ of Market}}$$

Tutorial Note: Formula 4 can be used to calc Beta only when there are 2 data points.

β of market or Index is always 1.
β of cash or Rf security is always 0.

Investment Decisions Using β

If market is expected to be bullish, prefer investing in high beta stock (B > 1). Such stocks are also called as aggressive stocks.

If market is expected to be bearish, prefer investing in Low beta stock (B < 1). Such stocks are also called as Defensive stocks.

Beta of Portfolio [β_p]

β of Portfolio is weighted avg β of individual securities

$\beta_p = \Sigma\beta_i \times W_i$ Weights are "latest Market Values" weights

Caution Note: Do Not make the mistake of using 'No. of share.' or MP' as weights.
The correct approach is to use MP x No. of share = MV as weights

Exam Tip: However, if Q is asking to calc simple avg return of portfolio then β_p must also be calc as simple average of β of each security

How to calc β_p under special circumstances - Borrowing & Short Selling

Own Cash ₹ 500000 invests in

- Reliance ₹ 300000, β = 1.75 times
- R_f ₹ 200000, β = 0 times

Case (i) Calc β_p in the above case?

Solve:

Security	β	MV	W_i	$\beta_i \times W_i$
Reliance	1.75	300000	3/5	1.05
R_f	0	200000	2/5	0
		500000		β_p = 1.05 times

Case (ii) Let's assume that you borrow ₹ 400000 & now invest the full amount of ₹ 900000 in the stock of RIL. Calc β_p?

Solve:

Security	β	MV	W_i	$\beta_i \times w_i$
RIL	1.75	900000	9/5 i.e. 1.8	3.15
Borrowing	0	- 400000	- 4/5 i.e. -0.8	0
		500000	1	β_p = 3.15 times

Borrowing are shown with negative since borrowing is a -ve investment as against R_f Inv which has +ve sign

Case (iii) You have own amount of ₹ 500000 & now you short sell stock of Infy worth ₹ 200000 (having β of 1.2) now you have a total sum of ₹ 700000 that you have invested in Ril calc β_p?

Solve:

Security	β	MV	W_i	$\beta_i \times w_i$
Ril	1.75	700000	7/5 i.e. 1.4	2.45
Infy	1.20	- 200000	- 2/5 i.e. -0.4	-0.48
		500000	1	β_p = 1.97 times

Short selling of shares is also shown as a -ve investment

Observe that in all 3 cases, Net portfolio value is same at ₹ 500000 i.e. equal to Own cash amount. Hence when calculating weights, "Amount invested, Amount of short sales & Amount borrowed", all are divided by investor's own fund amount.

How to calc returns & risk when margin funding is taken (aka an investor has levereged the portfolio)

Q An investor wishes to invest in a portfolio having R_p = 12 % & σ_p = 8 %
Suppose if above portfolio is invested in with margin of 40 % & cost of borrowing is 9% then what will be position.

Solve: Step 1: To find R_p & σ_p in normal way {in the above Q it's already given}

$\Sigma R_i \times W_i$ $\sqrt{}$ Formula or matrix approach

Step 2: Re-express R_p & σ_p

R_p -> Calculate Return on Total amount invested (including borrowed money) but deduct cost of borrowing from returns.

σ_p -> Risk will be calculated on Total amount invested (including borrowed money) & there will be no deduction in risk. We'll bear the risk on both own money and borrowed money

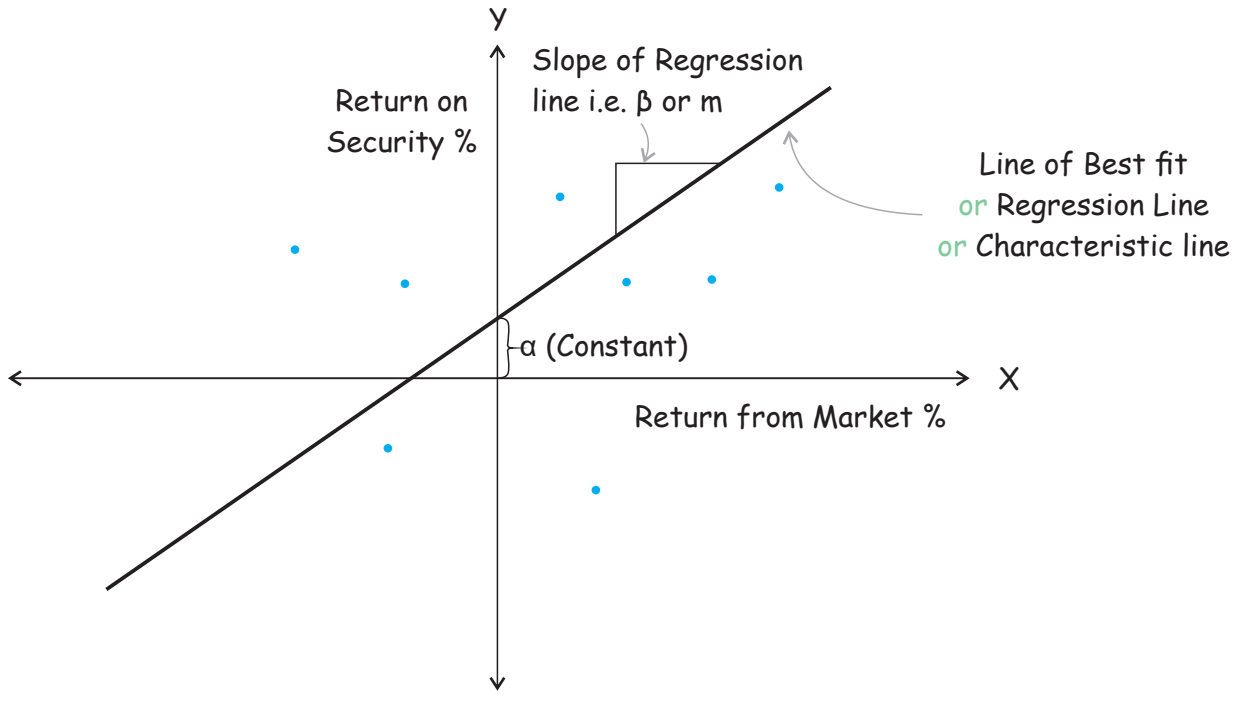
R_p = 12% x 1.40 - 9% x 0.40 = 13.2%

or

12% x 1.40 + (9% x - 0.40) = 13.2%

σ_p = 8% x 1.40 = 11.2 %

Characteristic Line [as per Sharpe Index Model]



Equation of regression Line

Y = m x + c or Y = ax + b

here,

m means Slope of regression line

c means Constant

Characteristic Line Equation

Y = α + βRm

here,

y means Return from sec.

α means Constant i.e. Return from sec. even when Rm = 0%

Eg.

Return from Market% (X)	Return from Sec% (Y)
15%	25%
- 10%	- 15%
5%	40%
22%	18%
30%	50%

Define Characteristic Line eq^{-n} for above security ?

Solve : Steps to calculate characteristic line eq^{-n}

Step 1 : Calculate β using any of the 3 formulas

Step 2: Calculate α using $\bar{Y}$ & $\bar{Rm}$ α so calculated is aka α per Sharpe index model

Step 3: Write Characteristic line eq^{-n}

$Y = \alpha + \beta Rm$

Numeric Numeric

Step 1 : Calc β

MKT % (X)	Sec % (Y)	XY	X^2
15%	25%	375	225
- 10%	- 15%	150	100
5%	40%	200	25
22%	18%	396	484
30%	50%	1500	900
$\Sigma X = 62\%$	$\Sigma Y = 118\%$	$\Sigma XY = 2621$	$\Sigma X^2 = 1734$

$$\bar{X} = \frac{\Sigma X}{n} = \frac{62}{5} = 12.4\%$$

$$\bar{Y} = \frac{\Sigma Y}{n} = \frac{118}{5} = 23.6\%$$

$$\beta = \frac{\Sigma XY - n\bar{X}\bar{Y}}{\Sigma X^2 - n\bar{X}^2} = \frac{2621 - 5 \times 12.4 \times 23.6}{1734 - 5 \times (12.4)^2} = 1.20 \text{ times}$$

Step 2: Calc x

$\bar{Y} = \alpha + \beta \bar{R}_m$

$23.6\% = \alpha + 1.2 \times 12.4\%$

$\therefore \alpha = 8.72\%$

Step 3: Write Characteristic Line Equation

$Y = 8.72\% + 1.2\ R_m$

Tutorial Note: CL can now be used to predict security's returns given Expected return from market for the next year.

Q. Calc Expected return from sec Y if $E(r)_m = 15\%$ for the next year ?

Solve: $Y = 8.72\% + 1.2\ (15\%)$

$= 26.72\%$

Classification of Total Risk of a Single Security

Total VARIANCE σ_i^2

Systematic Variance	Unsystematic Variance (ε^2) [Balancing figure]
Formula 1 $(\beta_i \times \sigma_m)^2$	$\sigma_i^2 - (\beta_i\sigma_m)^2$
Formula 2 $\sigma_i^2 \times r_{im}^2$	$\sigma_i^2 (1 - r_{im}^2)$

$\because \beta = Corr_{im} \times \frac{\sigma_i}{\sigma_m}$

[Total Var - Sys Var $\because \sigma_i^2 - (\sigma_i^2 \times r_{im}^2)$]

r means correlation
r^2 means coefficient of determination

Caution Note
Remember that it is $1 - r^2$
NOT $(1 - r)^2$

here, r^2 means what proportion of Total variance of security is explained by market related factors

$1 - r^2$ means remaining proportion of Total variance that is unexplained by the market & hence attributed to Unsystematic factors

Classification of Total Risk of Portfolio

Total VARIANCE σ_p^2

Systematic Variance	Unsystematic Variance
Formula 1 $(\beta_p\sigma_m)^2$	$\sigma_p^2 - (\beta_p\sigma_m)^2$ as per Harry Markowitz
Formula 2 $\sigma_p^2 \times r_{pm}^2$	$\sigma_p^2 \times (1 - r_{pm}^2)$ as per Harry Markowitz
	$\varepsilon_p^2 = \sum(\varepsilon_i \times w_i)^2$ as per Sharpe model

Derivation: You may recall that

$\sigma_p^2 = (\sigma_A w_A)^2 + (\sigma_B w_B)^2 + 2\sigma_A w_A \sigma_B w_b Corr_{AB}$

On the same lines

$\varepsilon_p^2 = (\varepsilon_A w_A)^2 + (\varepsilon_B w_B)^2 + 2\varepsilon_A w_A \varepsilon_B w_B Corr_{AB}$

here, $Corr_{AB} = 0$

Hence formula reduces down to

$\varepsilon_p^2 = (\varepsilon_A w_A)^2 + (\varepsilon_B w_B)^2$

or

$\varepsilon_p^2 = \sum (\varepsilon_p \times w_i)^2$

Why Corr = 0 ?
Because corr b/w any 2 companies as far as unsystematic factors (i.e. company specific factors) are concerned will be '0'. Therefore, the only source of corr is market-wide factors i.e. systematic factors

Harry Markowitz Vs. Sharpe Model

Harry Markowitz

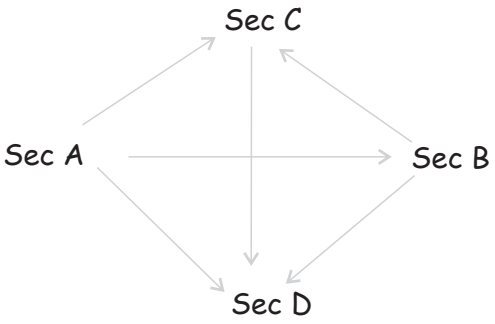
Step1

$\sigma_p = \sqrt{\ldots\ldots\ldots\ldots}$

Step2: Sys var of Portfolio

Step3: Unsys Var of Portfolio (b/f)

Step 1 requires cumbersome cal^{-n} of cov & corr b/w each pair of securities with each other hence $\frac{n(n-1)}{2}$ calculations are required



6 correlations are required

Sharpe Model

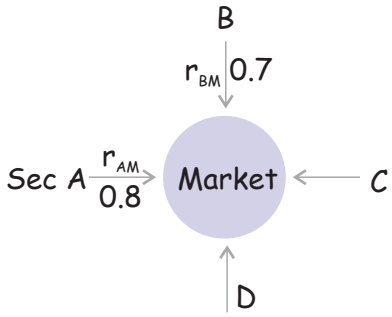
Step3

Total Variance = Sys V + Unsys Vari

Step1: Sys var of Portfolio

Step2: Unsys Var of Portfolio $\sum (\varepsilon_i \times w_i)^2$

It simply requires Corr of an individual sec with market but doesn't require Corr of sec with each other



Corr are calculated only w.r.t. Market. If by chance you need to find Corr & Cov b/w any 2 stocks then below would be the process:

$$r_{AB} = r_{AM} \times r_{BM}$$

because 2 Securities are correlated only through market

$r_{AB} = 0.8 \times 0.7 = 0.56$

Derivation

$r_{ij} = r_{im} \times r_{jm}$

multiply both the sides by $\sigma_i \sigma_j$

$r_{ij} \times \sigma_i \times \sigma_j = r_{im} \times \sigma_i \times r_{jm} \times \sigma_j$

multiply & Divide RHS by σ_m^2

$$\underbrace{r_{ij} \times \sigma_i \times \sigma_j}_{Cov_{ij}} = \underbrace{r_{im} \times \frac{\sigma_i}{\sigma_m}}_{\beta_i} \times \underbrace{r_{im} \times \frac{\sigma_j}{\sigma_m}}_{\beta_j} \times \sigma_m^2$$

Covariance b/w 2 Securities can be calc as : -

$$Cov_{ij} = \beta_i \beta_j \sigma_m^2$$

Expected Return E(r)

मुझे कितना Return मिलेगा

- How much Return can we actually really expect to earn on investment
- E(r) is found by conducting research & analysis on that particular stock by forecasting, Valuation etc.

VS

Required Return Rj

मुझे कितना Return चाहिए

- How much return should we demand from an Investment given the risk involved
- Rj is found using CAPM

Investment Decision Criteria

Situation	Val^{-n}	Action
E(r) > Rj 25% 18%	Undervalued	Buy
E(r) < Rj 12% 18%	Overvalued	Sell
E(r) = Rj 18% 18%	Fairly valued or Correctly valued	Hold

Exam Tip:

Disclaimer : However, ICAI may use these these two terminologies E(r) & Rj interchangeably in exams. But Relax ! there is no need to worry since by reading the Q itself it will be obvious what they actually mean & what to do in Exams ?

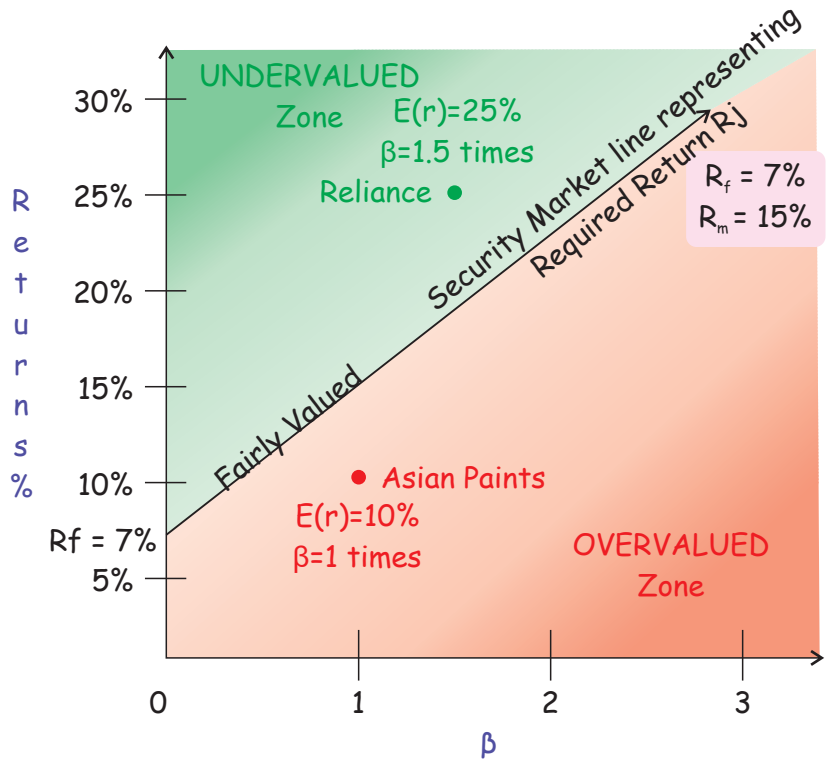
Security Market Line

is a mere graphical representation of CAPM

Market Risk Premium

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

Security Risk premium



Exam Tip:

If Q specifically asks to identify Over/Undervalued stocks by drawing SML graph then only draw SML graph, otherwise use tabular presentation as below

Sec Rj E(r) Valn status

Exam Tip:

If Question is asking to derive/ calculate Security Market Line (SML), then we have to write CAPM Equation without putting values of Required Return & Beta of Security in it as follows :

$$R_j = \underbrace{Rf}_{\text{Numeric value}} + \beta \underbrace{(Rm - Rf)}_{\text{Numeric value}}$$

Components of R_m & R_f

Return from Stock/Stock market (say 15%)

- Risk - free rate (say 7%)
  - Inflation 5%
  - Real Rate of Return on Rf Inv 2% Approx
- Risk Premium (say 8%) → $R_m - R_f$

Tutorial Note: Real return is received as a compensation for delaying the consumption of money

Exam Tip

1. How to determine which stock b/w 2 stocks is riskier ?

when considering them individually
a measure of "Total Risk" should be used
- either σ could be used if want to know riskier in absolute terms
- or σ adjusted for relative magnitude of expected returns i.e. coefficient of variations will be used.

From a portfolio perspective
a measure of "Systematic risk" should be used
- Stock having higher β would be considered risky.

2. If Rm is not directly given in Q then calc Rm

If Market Related Data is given in Q

$$Rm = \left[\frac{\text{Index value}_n - \text{Index value}_{n-1}}{\text{Index value}_{n-1}} \times 100\right] + \text{Market Dividend Yield\%}$$

If Market Related Data is not given in Q but Data related to our portfolio is given in Q

$$Rm = \frac{\text{Total Dividend/ Interest Income on All Securities in our Portfolio} + \text{Total Market Value of All Securities in our Portfolio at End of the Year} - \text{Total Initial Cost / Investment in All Securities in our Portfolio}}{\text{Total Initial Cost / Investment in All securities in our Portfolio}}$$

3. If Data is available only of Expected Return [Required Return] & Beta of 2 securities then to arrive at Rm & Rf construct CAPM Equations for both securities with available data & solve these Equations together

Alpha

means Excess Returns Over & above the Required Rate of Return

α = Actual Return or Expected Return Less Required Return as per CAPM

Alpha Academy
promises to deliver Quality
Education exceeding All Benchmarks

+ve α denotes good performance ; -ve α denotes poor performance

To calculate Portfolio's alpha (α_p) calc weighted average α of individual securities

Exam Tip
There are 2a in our syllabus
a ---> characteristic line
a ---> E(r) vs Rj

By looking at the Question we should be able to identify in Exams that which Alpha is the Q talking about.

Factor Model | Arbitrage Pricing Theory Model [APTM]

is an expanded version of CAPM i.e. $E(r)$ or $R_j = R_f + \beta(R_m - R_f)$

Let's break down β & $R_m - R_f$ into various factors it comprises of:

$$E(r) \text{ or } R_j = R_f + \beta_{Forex}\underbrace{(R_{m\text{-}Forex} - R_f)}_{MRP_{Forex}} + \beta_{Intt\ Rates}\underbrace{(R_{m\text{-}Intt\ rates} - R_f)}_{MRP_{Intt\ rates}} + \beta_{Inflation\ Rates}\underbrace{(R_{m\ -\ Infl.\ Rate} - R_f)}_{MRP_{Infl.\ Rate}} + \ldots\ldots\ldots$$

Symbolically,

$E(r) \text{ or } Rj = \lambda_0 + \beta_{i1}\, 1\, \lambda_1 + \beta_{i2}\, \lambda_2 + \ldots\ldots\ldots\ldots\ldots \beta_{in}\, \lambda_n$

here,
λ_0 means Risk-free rate
λ_1 to λ_n means Market Risk Premium for taking factor 1 to n risk
β_{i1} to β_{in} means Beta on an individual sec w.r.t factor 1 to n^{th} factor risk

APTM or Factor Model Vs. Multi factor Macro economic Model

APTM

$$E(r)_i = R_f + \beta_{i1} \times MRP_1 + \beta_{i2} \times MRP_2 + \ldots . \beta_{in} \times MRP_n$$

Multi factor Macro-economic Model

$$R_i = E(r)_i + \beta_{i1}(\text{Diff. in factor}_1) + \beta_{i2}(\text{Diff. in factor}_2)\ldots.$$

Actual value minus Expected value of Macroeconomic variable

Merged version by ICAI

$$R_i \text{ or } E(r)_i = R_f + \beta_{i1}(\text{Diff. in factor}_1) + \beta_{i2}(\text{Diff. in factor}_2)\ldots.$$

Portfolio Management Strategies / Portfolio Rebalancing Strategies

Active Portfolio Strategy

Formula Plans

- Constant Amount Plan
- Constant Ratio Plan
- Variable Ratio Plan
- Constant Proportion Portfolio Insurance Policy [CPPI]

Passive Portfolio Strategy

- Buy & Hold Strategy

The money you can't afford to loose (ie money equal to floor value) is kept in Rf. Invest the money you can afford to loose (ie money in excess of floor value) in stocks.

Constant Amount Plan [aka Constant Value Plan or Constant Dollar/Rupee Value Plan]

First, Decide a Constant Amount with which we shall remain invested in Equity at all the times,

Eg. Total Amount available = ₹ 15 lakhs and out of which say ₹ 7.5 lakhs will always be kept in Equity. Keep the remaining amount of ₹ 7.5 lakhs in Debt or Rf or Cash.

Now, if stock price goes down and hence the Value of Equity portfolio also goes down, then take out money from Rf Asset and Invest in Equity. On the contrary if stock price goes up and hence the Value of Equity portfolio also goes up, then take out money from Equity and Invest in Rf Asset.

1. How much amount to use at the time of Rebalancing the portfolio ?
   An amount that brings back the Value of Equity to the originally decided Constant Amount (say ,₹ 7.5 lakhs in our case)

2. When to Rebalance the portfolio ?
   An Investor has to set a Trigger for himself, say, whenever Value of Equity falls/ rises by 10% of the Originally decided Constant Equity Amount. Hence, trigger will be ₹ 75000 in our case. Any fall/rise by ₹ 75000 or more will trigger rebalancing action.

Constant Ratio Plan

Same as constant amount plan but instead of setting a constant amount, we decide a Constant Ratio, say 1:1 to be maintained between Equity & Debt/Rf/Cash. Now as Equity Value goes Up/Down, an Investor will trigger the rebalancing action whenever Ratio deviates by a predetermined value, say by 10%. Hence either 0.90:1 or 1.1:1 will trigger rebalancing action in the present case in order to bring the ratio back to 1:1

Variable Ratio Plan

Same as constant ratio plan but Ratio of allocation between Equity & Debt/Rf/Cash is changed depending upon the Stock Price levels. i.e. increasing the allocation % to Equity when Stock prices are going down and vice-versa. Such Variable Ratio will always be given in Q itself.

Format for presentation of above Portfolio Rebalancing Strategies

Date	Share Price	Value of Equity	Value of Rf Inv	Total Value of Portfolio	Equity: Rf Inv Ratio (if applicable)	No. of Shares
	250	750000	750000	1500000	1:1	3000
	225	675000	750000	1425000	...	3000
	Rebalancing Action (assuming Constant Value Plan)	749925 [333 shares @ ₹ 225]	675075	1425000	...	3333
	...	...	...	...	...	...

Constant Proportion Portfolio Insurance / Investment Policy [CPPI]

If an investor has, say, ₹ 5 lakhs & he wants to ensure that his total value of investment shall not fall below, say, ₹ 4.75 lakhs, (₹ 4.75 lakhs is termed as 'Floor value', resulting in a cushion of ₹ 25000) in such situations we apply CPPI method.

What happens in CPPI

When Cushion (Safety Margin) increases then Allocation to Equity increases & vice-versa.

- ✓ Cushion = 'Current Portfolio value' *less* Floor Value
- ✓ 'Floor Value' means The Minimum value that an investor would like to insure at all the time. It is something that an investor has to decide for himself.
- ✓ $\text{Multiplier} = \frac{1}{\text{Max crash \% on any single day}}$
- ✓ Amount To be Kept in equity = Multiplier x Cushion value

Example: You have ₹ 500000 for investment
Floor Value = ₹ 475000
Max Crash % = 12.5%
Decide Initial Inv. in Eq. & Debt as per CPPI.

Solve : $\text{Multiplier} = \frac{1}{\text{Max Crash \%}} = \frac{1}{12.5\%} = 8 \text{ times}$

Cushion Value = Current Portfolio Value - Floor Value
= 500000 - 475000 = 25000 ₹

Amount to be Kept in Eq. = Multiplier x Cushion Value
= 8 x 25000 = ₹ 200000

Inv in Rf/Debt/Cash = ₹ 300000 (bal. fig.)

Q What would be your rebalancing action if next day stock falls by 4%

Solve :

Value of equity	= 200000 less 4% of 200000	= 192000
Current Portfolio Value	= 192000 + 300000	= 492000
Cushion Value	= 492000 - 475000	= 17000
Amount to be kept in equity	= Multiplier x Cushion value = 8 x 17000	= 136000
Amount of stock to be sold & Investment in R_f	= 192000 - 136000	= ₹ 56000
New Value Eq	= 192000 - 56000	= 136000
New Value of R_f	= 300000 + 56000	= 356000

Q What if next day stock moves up by 7%

Solve:

Value of Eq. Inv.	= 136000 plus 7% of 136000	= ₹ 145520
Current value of portfolio	= 145520 + 356000	= 501520
Cushion Value	= 501520 - 475000	= 26520
Amount to be kept in Equity	= 8 x 26520	= ₹ 212160
Amount of stock to be bought	= 212160 - 145520	= 66640
New Value of Equity	= 212160	
& New Value of R_f	= 356000 - 66640	= 289360

Portfolio / Mutual Funds Performance Evaluation

	HDFC MF	SBI Magnum	Market
R_p	25%	22%	R_m = 15%
Risk (σ_p)	10%	7%	σ_m = 5%
β_p	1.4 times	1.1 times	
R_f	8%		

Sharpe Ratio or Reward to Variability Ratio

$$SR = \frac{R_p - R_f}{\sigma_p}$$

HDFC: $= \frac{25\% - 8\%}{10\%} = 1.7$

SBI: $\frac{22\% - 8\%}{7\%} = 2$

Sharpe Ratio tells us How much Excess return over & above R_f is earned for taking every 1% of Total Risk

Decision Criteria Higher the Sharpe Ratio better is the performance

Treynor Ratio or Reward to Volatility Ratio

$$TR = \frac{R_p - R_f}{\beta_p}$$

HDFC: $= \frac{25\% - 8\%}{1.4} = 12.15$

SBI: $\frac{22\% - 8\%}{1.1} = 12.73$

Treynor Ratio tells us how much Excess return over & above R_f is earned for taking every 1 unit of Systematic Risk

Decision Criteria Higher the Treynor Ratio better is the performance.

Jensen's Alpha

α = Actual Return - R_j as per CAPM

HDFC
= 25% - [8% + 1.4 (15% - 8%)]
= +7.2%

SBI
= 22% - [8% + 1.1 (15% - 8%)]
= +6.3%

Jensen's Alpha gives us Excess Return over & above the required rate of return

Decision Criteria Higher the +ve α better is the Performance

Sortino Ratio

$$= \frac{R_p - R_f}{\sigma_d}$$

here, σ_d means Downside deviation of portfolio

Note: Hence only such returns that are below 0% or below the Average rate of return will form part of the deviation.

Decision Criteria Higher the Sortino Ratio better is the performance

Exam Tip:
If Q asks to compare performance of a Security/ Portfolio against market then calc Sharpe & Treynor's ratio of market and compare.

How to identify whether a Portfolio is Well diversified or Poorly diversified?

A Portfolio having higher value of $1-r^2$ is considered as poorly diversified portfolio because

$1-r^2$ explains the proportion of Total Variance that comes from carrying Unsystematic risk.

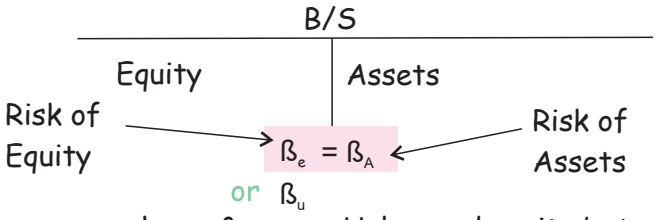
A well diversified portfolio has lower Unsystematic Risk i.e. lower $1-r^2$

A Poorly diversified portfolio has higher Unsystematic Risk i.e. higher $1-r^2$

Corporate Finance / Corporate Beta

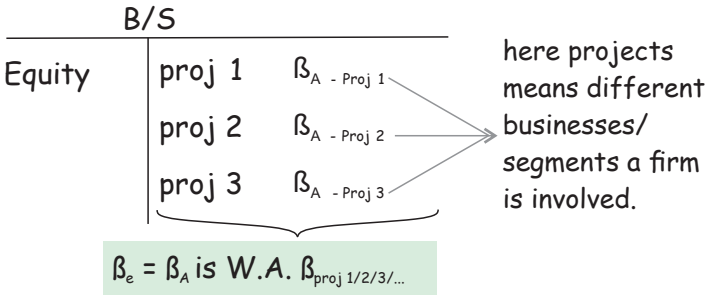
Learning Objective: To learn an alternative approach to calculate β. This approach can be used for private / unlisted companies because β of such companies can't be calculated using the β formulas taught earlier.

Type 1: Unlevered (aka Ungeared) Firm having single project

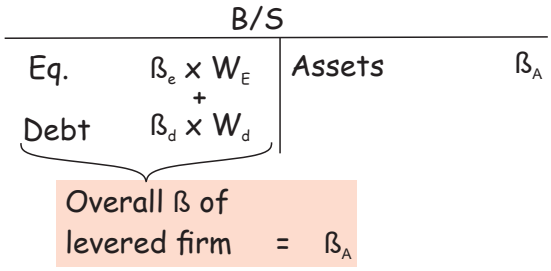


here, $ß_u$ means Unlevered equity beta

Type 2: Unlevered Firm having many project



Type 3: Levered Firm having Single project



When No Taxes exist: β_A = Overall β of levered firm = $\beta_e \times \frac{\text{Equity}}{\text{Equity + Debt}} + \beta_d \times \frac{\text{Debt}}{\text{Equity + Debt}}$

When Taxes exist: β_A = Overall β of levered firm = $\beta_e \times \frac{E}{E + D(1-t)} + \beta_d \times \frac{D(1-t)}{E + D(1-t)}$

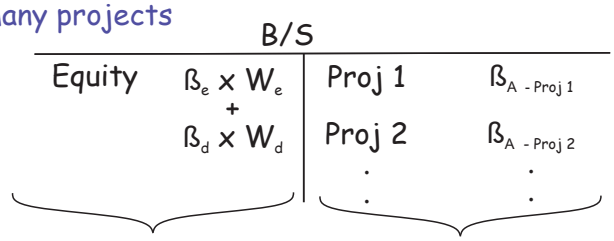
Why D (1-t)?

Because debt carries tax advantage & hence D is replaced by D (1-t)

Doubt: 'Interest on Debt' carries tax advantage, Not Debt ?

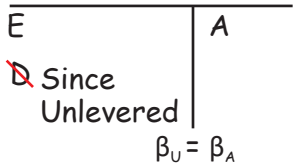
Since Value of Debt is PV of future Intt CFs & such 'Interest' will now be I (1-t), therefore, their PV will also now be equal to D (1-t)

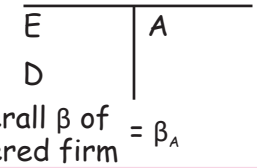
Type 4: Levered Firm with many projects



Exam Tip:

1. β_U i.e Unlevered equity beta is same thing as Overall β of a leveral firm & both of these are same as β_A





2. If Q is silent then $ß_d = 0$ (assumed)
3. If Q doesn't specify whether given ß is ße or Overall ß of Firm eg." Reliance has a beta of 1.5 times " then default assumption is that it is ße of Reliance = 1.5 times.

Type 5: Calculating ß of an Unlisted Firm using ß of a Listed Firm:

Britannia (Listed) [tax rate = 30%]	
Eq $ß_e$=1.60 W_e=0.60	Assets
Debt $ß_d$=0 W_d=0.40	

Step② $ß_A$ = Overall ß = 1.09

Parle (Unlisted) [tax rate = 25 %]	
Eq $ß_e$ = ? W_e = 0.80	Assets
Debt $ß_d$ = 0 W_d = 0.20	Step③ $ß_A$ = 1.09

Since both the companies are in the same risk class

Step① Overall ß of levered firm Birtannia

$$= ß_e \times \frac{E}{E + D(1-t)} + ß_d \times \frac{D(1-t)}{E + D(1-t)}$$

$$= 1.6 \times \frac{0.6}{0.6 + 0.4(1-0.3)} + 0 \times .....$$

$$= 1.09$$

Step④ Overall ß of levered firm Parle = $ß_A$ = 1.09

Step⑤ Overall ß of levered firm

$$= ß_e \times \frac{E}{E + D(1-t)} + ß_d \times \frac{D(1-t)}{E + D(1-t)}$$

$$1.09 = ß_e \times \frac{0.80}{0.8 + 0.2(1-0.25)} + 0 \times .....$$

$$\therefore ß_{e\text{-Parle}} = 1.29$$

Alternative formula

1. $ß_u = ß_{ge} \times \frac{E}{E + D(1-t)}$ This is shortcut formula when $ß_d = 0$

here,

$ß_u$ means Beta of unlevered firm
aka Overall ß of levered firm
$ß_{ge}$ means Beta of geared equity

2. $ß_{ge} = ß_u \times \left(1 + \frac{D(1-t)}{E}\right)$ Derived by rearranging the above formula & applicable only when $ß_d = 0$

$$= 1.09 \times \left(1 + \frac{0.20(1-0.25)}{0.80}\right)$$

$$= 1.29$$

Type 6: Divisional Beta / The Pure play Technique / The Hamada Formula

In case of Conglomerates it becomes difficult to find a comparable company which is into Same multiple businesses & hence Type 5 procedure / concept cannot be applied.

Therefore, under Type 6 we resort to the Concept of 'Divisional Beta' by finding out comparable cos. which are purely playing into just one Segment:

ITC				Step① find divisional ß
E	$ß_e$ = ? Step④	W_e	Tobacco	$ß_{A\text{ - Tobacco}}$
			Paper	$ß_{A\text{ - Paper}}$
D	$ß_d$ = 0	W_d	FMCG	$ß_{A\text{ - FMCG}}$

= Step② Overall $ß_A$ is W.A ß Proj 1/2/3....

Step③ Overall ß of levered firm
= $ß_e \times w_e + ß_d \times w_d$

Comparable co. Godfrey phillips	
$ß_e$ ... x W_E	
$ß_d$ ... x W_d	Overall ß = $ß_A$

Assume tobacco division beta to be same as $ß_A$ of a comparable pure play tobacco company

JK Paper $ß_A$

HUL , Dabur etc. $ß_A$

Sharpe's Optimal Portfolio aka Sharpe's Optimization Framework

This model helps in constructing an Optimal Portfolio having maximum excess returns with minimum risk.

Required Inputs
- Stock Specific : ✓ Expected Return ✓ Beta ✓ Unsystematic Variance
- Market Related: ✓ Risk-free Return ✓ Market Variance

For Concept Explanation Scan QR Code

Steps to construct Optimal Portfolio

Step 1:

Calculate (i) Excess Return to β Ratio (Treynor's Ratio) & (ii) Rankings

$$TR = \frac{R_i - R_f}{\beta}$$

Below is the Format of Table

Security	Expected Return [Ri]	Rf	β	$\frac{R_i - R_f}{\beta}$	Rankings
:	:	:	:	:	:

Step 2:

Prepare (i) Ranked Table in the order of Rankings & (ii) Calc C_i in order to (iii) determine Cut-off denoted by C*

Write σ_m^2 in full number. Don't write in decimal format

$$C_i = \frac{\sigma_m^2 \times \sum_{i=1}^{n} \frac{(R_i - R_f)}{\sigma_{ei}^2} \times \beta}{1 + \sigma_m^2 \times \sum_{i=1}^{n} \frac{\beta_i^2}{\sigma_{ei}^2}}$$

Memorize as:

$$C_i = \frac{\sigma_m^2 \times \text{Something}_1}{1 + \sigma_m^2 \times \text{Something}_2}$$

now memorize Something 1 & Something 2 separately

or

$$\frac{\sigma_m^2 \times \Sigma\text{Column 4}}{1 + \sigma_m^2 \times \Sigma\text{Column 3}}$$

Where,
- σ_m^2 = variance of the market index
- σ_{ei}^2 = variance of a stock's movement that is not associated with the movement of market index i.e. stock's unsystematic risk.

Below is the Format of Table

Security (1)	$\frac{R_i - R_f}{\beta}$ (2)	$\frac{\beta^2}{\sigma_{ei}^2}$ (3)	$\frac{R_i - R_f}{\sigma_{ei}^2} \times \beta$ Col 4 = (2) x (3)	$\sum_{i=1}^{n} \frac{R_i - R_f}{\sigma_{ei}^2} \times \beta$ ΣCol 4	$\sum_{i=1}^{n} \frac{\beta_i^2}{\sigma_{ei}^2}$ ΣCol 3	Ci (as per above formula)
:	:	:	:	:	:	:

Highest C_i value becomes the cut-off point, denoted by C*

All Securities having 'Excess Return to β Ratio' greater than C* will be selected.

Step 3:

(i) Select Securities & (ii) Calculate weights.

All Securities having 'Excess Return to β Ratio' greater than C* will be selected.

$$Z_i = \frac{\beta}{\sigma_{ei}^2}\left(\frac{R_i - R_f}{\beta} - C^*\right)$$

Z_i gives us relative weights that doesn't totals up to 1. Calc x_i to find weights that totals up to 1

$$X_i = \frac{Z_i}{\sum_{i=1}^{n} Z_i}$$

Question 1 Study Material (Similar)

A stock costing $100 pays no dividends. The possible prices that the stock might sell for at year-end and the probability of each are :

Year end Price ($)	90	95	100	110	115
Probability	0.1	0.2	0.4	0.2	0.1

a. What is the expected return on the stock?
b. What is the standard deviation of the expected return?

Solution:

Probability (P)	Returns% (X)	P x X	$dx = X - \bar{X}$	dx^2	pd_x^2
0.10	-10%	-1%	-11.5	132.25	13.225
0.20	-5%	-1%	-6.5	42.25	8.45
0.40	0%	0%	-1.5	2.25	0.90
0.20	10%	2%	8.5	72.25	14.45
0.10	15%	1.5%	13.5	182.25	18.225
	∑PxX i.e. Expected return	1.5%		Variance =	55.25

$\sigma = \sqrt{\text{Variance}}$
$= \sqrt{55.25}$
$= 7.43\%$

Caution Note While calculating Return%, Don't make the mistake of comparing $95 with $90 & then Comparing $100 with $95. The prices given in the Table are Year-end prices & all these prices should be compared with Initial Price of $100.

Question 2 Study Material, RTP May 2023

Following information is available in respect of dividend, market price and market condition after one year.

Market condition	Probability	Market Price ₹	Dividend per share ₹
Good	0.25	115	9
Normal	0.50	107	5
Bad	0.25	97	3

The existing market price of an equity share is ₹ 106 (F.V. Re. 1), which is cum 10% bonus debenture of ₹ 6 each, per share. M/s. X Finance Company Ltd. had offered the buy-back of debentures at face value.

Find out the expected return and variability of returns of the equity shares.

And also advise-Whether to accept buy back offer?

Solution: The Expected Return of the equity share may be found as follows:

Market Condition	Probability	Total Return	Cost (*)	Net Return
Good	0.25	₹ 124	₹ 100	₹ 24
Normal	0.50	₹ 112	₹ 100	₹ 12
Bad	0.25	₹ 100	₹ 100	₹ 0

Expected Return = (24 x 0.25) + (12 x 0.50) + (0 x 0.25) = 12%

The variability of return can be calculated in terms of standard deviation.

Var $= 0.25(24-12)^2 + 0.50(12-12)^2 + 0.25(0-12)^2$

$= 0.25(12)^2 + 0.50(0)^2 + 0.25(-12)^2$

$= 36 + 0 + 36$

SD $= \sqrt{72}$

SD = 8.485 or say 8.49

(*) The present market price of the share is ₹ 106 cum bonus 10% debenture of ₹ 6 each; hence the net cost is ₹ 100 (There is no cash loss or any waiting for refund of debenture amount).

M/s X Finance company has offered the buy back of debenture at face value. There is reasonable 10% rate of interest Compared to expected return 12% from the market. Considering the dividend rate and market Price the creditworthiness of the company seems to be very good. The decision regarding buy-back Should be taken Considering the maturity period and opportunity in the market. Normally, if the maturity period is low say up to 1 year better to wait otherwise to opt buy back option.

Question 3

Study Material, (8 Marks) Exam Nov 06, May 08, Dec 21, RTP May 19, Sep 25

X Co., Ltd., invested on 1.4.2009 in certain equity shares as below:

Name of Co.	No. of shares	Cost (₹)
M Ltd.	1,000 (₹ 100 each)	2,00,000
N Ltd.	500 (₹ 10 each)	1,50,000

In September 2009, 10% dividend was paid out by M Ltd. and in October, 2009, 30% dividend paid out by N Ltd. On 31.3.2010 market quotations showed a value of ₹ 220 and ₹ 290 per share for M Ltd. and N Ltd. respectively.

On 1.4.2010 investment advisors indicate (a) that the dividends from M Ltd. and N Ltd. for the year ending 31.3.2011 are likely to be 20% and 35%, respectively and (b) that the probabilities of market quotations on 31.3.2011 are as below:

Probability factor	Price/share of M Ltd.	Price/share of N Ltd.
0.2	220	290
0.5	250	310
0.3	280	330

You are required to:

(i) Calculate the average return from the portfolio for the year ended 31.3.2010;

(ii) Calculate the expected average return from the portfolio for the year 2010-11; and

(iii) Advise X Co. Ltd., of the comparative risk in the two investments by calculating the standard deviation in each case.

Solution: (Calculation in ₹/share)

Calculation of return on portfolio for 2009 - 10

	M	N
Dividend received during the year	10	3
Capital gain/loss by 31.03.10		
Market value by 31.03.10	220	290
Cost of investment	200	300
Gain/loss	20	(-)10
Yield	30	(-)7
Cost	200	300
% return	15%	(-)2.33%
Weight in the portfolio	57	43
Weighted average return	7.55%	

(Calculation in ₹/share)

Calculation of estimated return for 2010-11

Expected dividend	20	3.5
Capital gain by 31.03.11	33 $\left(\begin{matrix}(220\times0.2)\\+(250\times0.5)\\+(280\times0.3)\end{matrix}\right)$ - 220	22 $\left(\begin{matrix}(290\times0.2)\\+(310\times0.5)\\+(330\times0.3)\end{matrix}\right)$ - 290
Yield	53	25.5
*Market Value 01.04.10	220	290
% return	24.09%	8.79%
*Weight in portfolio (1,000x220): (500x290)	60.3	39.7
Weighted average (Expected) return 18.02%		
(*The market value on 31.03.10 is used as the base for calculating yield for 10-11)		

(i) Average Return from Portfolio for the year ended 31.03.2010 is 7.55%

(ii) Expected Average Return from portfolio for the year 2010 - 11 is 18.02%

(iii) Calculation of Standard deviation

M Ltd.

Exp. market value	Exp. gain	Exp. Div.	Exp. Return (1)	Prob. factor (2)	(1) x (2)	Dev. $(P_M - \overline{P}_M)$	Square of dev. (3)	(2) x (3)
220	0	20	9.09	0.2	1.82	-15.01	225.30	45.06
250	30	20	22.73	0.5	11.37	-1.37	1.88	0.94
280	60	20	36.36	0.3	10.91	12.26	150.31	45.09
					24.10			

Standard deviation (σ_M) = 9.54%

N Ltd.

Exp. market value	Exp. gain	Exp. Div.	Exp. Return (1)	Prob. factor (2)	(1)x (2)	Dev. $(P_N - \overline{P}_N)$	Square of dev. (3)	(2) x (3)
290	0	3.5	1.21	0.2	0.24	-7.58	57.46	11.49
310	20	3.5	8.10	0.5	4.05	-0.69	0.48	0.24
330	40	3.5	15.00	0.3	4.50	6.21	38.56	11.57
					8.79			23.30

Standard Deviation (σ_N) 4.83%

Share of company M Ltd. is more risky as the S.D. is more then company N Ltd.

Question 4 Study Material, RTP Nov 2012, MTP April 2024, MTP May 2025

Suppose that economy A is growing rapidly and you are managing a global equity fund that has so far invested only in developed-country stocks. Now you have decided to add stocks of economy A to your portfolio. The table below shows the expected rates of return, standard deviations, and correlation coefficients (all estimated for the aggregate stock market of developed countries and stock market of Economy A).

	Developed Country Stocks	Stocks of Economy A
Expected rate of return (annualized percent)	10	15
Risk (Annualized Standard Deviation %)	16	30
Correlation Coefficient (ρ)	0.30	

Assuming the risk-free interest rate to be 3%, you are required to determine:

(a) What percentage of your portfolio should you allocate to stocks of Economy A if you want to increase the expected rate of return on your portfolio by 0.5%?

(b) What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?

(c) Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio comparing with investment in developed country's stocks only ?

Solution:

(a) Let the weight of stocks of Economy A is expressed as w, then

$(1-w) \times 10.0 + w \times 15.0 = 10.5$ i.e. $w = 0.1$ or 10%.

(b) Variance of portfolio shall be:

$(0.9)^2 (0.16)^2 + (0.1)^2 (0.30)^2 + 2(0.9)(0.1)(0.16)(0.30)(0.30) = 0.02423$

Standard deviation is $(0.02423)^{1/2} = 0.15565$ or 15.6%.

(c) The Sharpe ratio will improve by approximately 0.04, as shown below:

$$\text{Sharpe Ratio} = \frac{\text{Expected Return - Risk Free Rate of Return}}{\text{Standard Deviation}}$$

Investment only in developed countries: $= \frac{10 - 3}{16} = 0.437$

With inclusion of stocks of Economy A: $= \frac{10.5 - 3}{15.6} = 0.481$

Question 5 Study Material, MTP April 2024 ★

An investor has two portfolios known to be on minimum variance set for a population of three securities A, B and C having below mentioned weights:

	WA	WB	WC
Portfolio X	0.30	0.40	0.30
Portfolio Y	0.20	0.50	0.30

It is supposed that there are no restrictions on short sales.

(i) What would be the weight for each stock for a portfolio constructed by investing ₹ 5,000 in portfolio X and ₹ 3,000 in portfolio Y?

(ii) Suppose the investor invests ₹ 4,000 out of ₹ 8,000 in security A. How he will allocate the balance between security B and C to ensure that his portfolio is on minimum variance set?

Solution:

(i) Investment committed to each security would be:-

	A (₹)	B (₹)	C (₹)	Total (₹)
Portfolio X	1,500	2,000	1,500	5,000
Portfolio Y	600	1,500	900	3,000
Combined Portfolio	**2,100**	**3,500**	**2,400**	**8,000**
Stock weights	0.26	0.44	0.30	

(ii) The equation of critical line takes the following form:-

$W_B = a + bW_A$

Substituting the values of W_A & W_B from portfolio X and Y in above equation, we get

$0.40 = a + 0.30b$, and

$0.50 = a + 0.20b$

Solving above equation we obtain the slope and intercept, a = 070 and b = -1 and thus, the critical line is

$W_B = 0.70 - W_A$

If half of the funds is invested in security A then,

$W_B = 0.70 - 0.50 = 0.20$

Since $W_A + W_B + W_C = 1$

$W_C = 1 - 0.50 - 0.20 = 0.30$

Allocation of funds to security B	= 0.20 x 8,000	₹ 1,600, and
Security C	= 0.30 x 8,000	₹ 2,400

Tutorial Note: If weight of one of the security comes out to be > 1 then some other security will have negative weights meaning short sales.

Question 6

Study Material, RTP Nov 2022, MTP Oct 2022

A Ltd has an expected return of 22% and Standard deviation of 40%. B Ltd. has an expected return of 24% and Standard deviation of 38%. A Ltd. has a beta of 0.86 and B Ltd. a beta of 1.24. The correlation coefficient between the return of A Ltd. and B Ltd. is 0.72. The Standard deviation of the market return is 20%. Suggest:

(i) Is investing in B Ltd. better than investing in A Ltd.?

(ii) If you invest 30% in B Ltd. and 70% in A Ltd., what is your expected rate of return and portfolio Standard deviation?

(iii) What is the market portfolios expected rate of return and how much is the risk-free rate?

(iv) What is the beta of Portfolio if A Ltd's weight is 70% and B Ltd's weight is 30%?

Solution:

(i) A Ltd. has lower returns and higher risk. Therefore, investing in B Ltd. is better than in A Ltd because B ltd. has both higher returns and lower risk. However, investing in both will yield diversification advantage.

(ii) $r_{AB} = .22 \times 0.7 + .24 \times 0.3 = 22.6\%$

$\sigma^2_{AB} = 0.40^2 \times 0.7^2 + 0.38^2 \times 0.3^2 + 2 \times 0.7 \times 0.3 \times 0.72 \times 0.40 \times 0.38 = 0.1374$

$\sigma_{AB} = \sqrt{\sigma^2_{AB}} = \sqrt{.1374} = .37 = 37\%$ *

*Answer = 37.06% is also correct and variation may occur due to approximation.

(iii) $E(r)_a = R_f + \beta (R_m - R_f)$

Sec A $22\% = R_f + 0.86 (R_m - R_f)$ — eqⁿ 1

Sec B $24\% = R_f + 1.24 (R_m - R_f)$ — eq-ⁿ 2

Subtracting eqⁿ 1 from eqⁿ 2

$24\% = R_f + 1.24 (R_m - R_f)$
$22\% = R_f + 0.86 (R_m - R_f)$
- - -
$2\% = 0.38 (R_m - R_f)$
$\therefore (R_m - R_f) = 5.26\%$

$E(r)_a$ i.e. $22\% = R_f + 0.86 (5.26\%)$
$R_f = 17.48\% \sim 17.5\%$
$(R_m - R_f) = 5.26\%$
$(R_m - 17.5\% = 5.26\%$
$\therefore R_m = 22.76\%$

(iv) $\beta_P = \beta_A \times W_A + \beta_B \times W_B$
$= 0.86 \times 0.7 + 1.24 \times 0.3 = 0.974$

Question 7

Study Material, Exam May 2012

A has portfolio having following features:

Security	β	Random Error σ_{ei}	Weight
L	1.60	7	0.25
M	1.15	11	0.30
N	1.40	3	0.25
K	1.00	9	0.20

You are required to find out the risk of the portfolio if the standard deviation of the market index (σ_m) is 18%.

Solution:

As per ICAI Suggested Answer, two alternative solutions are possible, below is one of those alternative solution that we believe is more logical

$\beta_P = \sum_{i=1}^{4} X_i \beta_i = 1.60 \times 0.25 + 1.15 \times 0.30 + 1.40 \times 0.25 + 1.00 \times 0.20$
$= 0.4 + 0.345 + 0.35 + 0.20 = 1.295$

Systematic variance of portfolio = $\beta_p^2 \times \sigma_m^2 = (1.295)^2 (18)^2 = 543.36$

Unsystematic variance of portfolio = $\sum_{i=1}^{4} (\sigma_{ei}^2 \times w_i^2) = (0.25)^2(7)^2 + (0.30)^2(11)^2 + (0.25)^2(3)^2 + (0.20)^2 (9)^2)$
$= 3.0625 + 10.89 + 0.5625 + 3.24$
$= 17.755$

Total variance = Systematic variance + Unsystematic variance = 543.36 + 17.755 =561.115

The Standard Deviation (Risk) of the portfolio = $[561.115]^{1/2} = 23.69\%$

Question 8 Study Material, RTP Nov 2020

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	σ (%)	Correlation with Index, ρ_m
A	20	0.60
B	18	0.95
C	12	0.75

The standard deviation of market portfolio (BSE Sensex) is observed to be 15%.

(i) What is the sensitivity of returns of each stock with respect to the market?

(ii) What are the covariances among the various stocks?

(iii) What would be the risk of portfolio consisting of all the three stocks equally?

(iv) What is the beta of the portfolio consisting of equal investment in each stock?

(v) What is the total, systematic and unsystematic risk of the portfolio in (iv)?

Solution:

(i) Sensitivity of each stock with market is given by its beta.

Standard deviation of market Index = 15%

Variance of market Index = 0.0225

Beta of stocks = $r \times \sigma_i / \sigma_m$ OR $\sigma_i \times r / \sigma_m$

A = 20 x 0.60/15 = 0.80

B = 18 x 0.95/15 = 1.14

C = 12 x 0.75/15 = 0.60

(ii) Covariance between any 2 stock = $\beta_1 \beta_2 \sigma^2_m$

$Cov_{AB} = 0.80 \times 1.14 \times 15^2 = 205.20$

$Cov_{AC} = 0.80 \times 0.60 \times 15^2 = 108$

$Cov_{BC} = 1.14 \times 0.60 \times 15^2 = 153.90$

(iii) **Covariance matrix**

Stock/Beta	0.80	1.14	0.60
A	400.000	205.200	108.000
B	205.200	324.000	153.900
C	108.000	153.900	144.000

Total risk of the equally weighted portfolio (Variance) = $400 (1/3)^2 + 324 (1/3)^2 + 144 (1/3)^2 + 2 (205.20) (1/3)^2 + 2 (108.0) (1/3)^2 + 2 (153.900) (1/3)^2 = 200.244$

(iv) β of equally weighted portfolio = $\beta_P = \sum \beta_i / N = \frac{0.80 + 1.14 + 0.60}{3} = 0.8467$

(v) Systematic Risk $\beta_P^2 \sigma_m^2$ = $(0.8467)^2 (15)^2 = 161.302$

Unsystematic Risk = Total Risk - Systematic Risk

= 200.244 - 161.302

= 38.942

Question 9 Study Material, (8 Marks) Exam May 19 (Similar), RTP May 18, MTP Nov 24, May 25

Following are the details of a portfolio consisting of three shares:

Share	Portfolio Weight	Beta	Expected Return in %	Total Variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:
Covariance (A,B) = 0.030
Covariance (A,C) = 0.020
Covariance (B,C) = 0.040
Calculate the following:

(i) The Portfolio Beta
(ii) Residual Variance of each of the three shares
(iii) Portfolio Variance using Sharpe Index Model [Alt language: Portfolio variance considering co-movemnt between securities due to change in the market index]
(iv) Portfolio Variance (on the basis of modern portfolio theory given by Markowitz) [Alt language: Portfolio variance considering correlation between each pair of securities]

Solution:

(i) Portfolio Beta

$0.20 \times 0.40 + 0.50 \times 0.50 + 0.30 \times 1.10 = 0.66$

(ii) Residual Variance

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$\beta_A^2 \times \sigma_M^2 = (0.40)^2 (0.10)^2 = 0.0016$
$\beta_B^2 \times \sigma_M^2 = (0.50)^2 (0.10)^2 = 0.0025$
$\beta_C^2 \times \sigma_M^2 = (1.10)^2 (0.10)^2 = 0.0121$

Residual variance
A $0.015 - 0.0016 = 0.0134$
B $0.025 - 0.0025 = 0.0225$
C $0.100 - 0.0121 = 0.0879$

(iii) Portfolio Variance using Sharpe Index Model

Systematic Variance of Portfolio = $(0.10)^2 \times (0.66)^2 = 0.004356$
Unsystematic Variance of Portfolio = $0.0134 \times (0.20)^2 + 0.0225 \times (0.50)^2 + 0.0879 \times (0.30)^2 = 0.014072$
Total Variance = $0.00436 + 0.014072 = 0.018428$

(iv) Portfolio Variance on the basis of Markowitz Theory

$= (W_A \times W_A \times \sigma_A^2) + (W_A \times W_B \times Cov_{AB}) + (W_A \times W_C \times Cov_{AC}) + (W_B \times W_A \times Cov_{AB}) + (W_B \times W_B \times \sigma_B^2) + (W_B \times W_C \times Cov_{BC}) + (W_C \times W_A \times Cov_{CA}) + (W_C \times W_B \times Cov_{CB}) + (W_C \times W_C \times \sigma_C^2)$

$= (0.20 \times 0.20 \times 0.015) + (0.20 \times 0.50 \times 0.030) + (0.20 \times 0.30 \times 0.020) + (0.20 \times 0.50 \times 0.030) + (0.50 \times 0.50 \times 0.025) + (0.50 \times 0.30 \times 0.040) + (0.30 \times 0.20 \times 0.020) + (0.30 \times 0.50 \times 0.040) + (0.30 \times 0.30 \times 0.10)$

$= 0.0363$

Question 10 3 Questions Merged | (8 Marks) Exam Nov 2019

The following are risk and return estimates for two stocks:

Stock	Expected return	Beta	Firm specific standard deviation of the expected return
A	14%	0.8	35%
B	18%	1.2	45%

The market index has a standard deviation of 25%.

RBI has closed the latest auction for ₹ 2500 crores of 182-day T-Bills for the lowest bid of 5.7%, although there were bidders at a higher rate of 6.3% also for lots of less than ₹ 10 crores.

Required:

(i) Calculate the standard deviation of expected returns on stocks A & B.

(ii) Which stock is riskier if you are considering them as individual assets (not part of a portfolio) ?

(ii) Suppose a portfolio is to be constructed with the following proportions:

Stock A	0.25
Stock B	0.40
T-bills	0.35

Calculate the expected return, standard deviation of expected return and non-systematic risk (standard deviation) of the portfolio.

Solution:

(i)

Sec	β_i	Sys var $= (\beta_i \times \sigma_m)^2$	Unsys var $(\sigma_{ei})^2$	Total variance	Std. dev.
A	0.8	$(0.8 \times 25)^2 = 400$	$35^2 = 1225$	1625	40.31%
B	1.2	$(1.2 \times 25)^2 = 900$	$45^2 = 2025$	2925	54.08%

(ii) From a portfolio risk perspective, B would be considered the riskier stock because it has a larger Beta(1.2) than A(0.8). When considering each stock individually, a measure of total risk (adjusted for relative magnitude of expected returns) is appropriate. This measure would be the Coefficient of Variation. The CV for A is 2.88 (40.31/14). The CV for B is 3(54.08/18). Stock B has higher CV indicating that B is the riskier of the two securities.

(iii) Two risk-free rates are given. The aggressive approach would be to consider 6.3% while the conservative approach would be to take 5.7%. If we take the moderate value then the simple average of the two i.e. 6% would be considered as Risk-free rate.

Expected return of the Portfolio = (0.25 x 14) + (0.40 x 18) + (0.35 x 6) = 12.8%

Total Risk = Systematic Risk + Unsystematic Risk

Systematic Risk = $\beta_P^2 \sigma_M^2$

$\beta_P = 0.25(0.8) + 0.4(1.2) + 0.35(0) = 0.2 + 0.48 + 0 = 0.68$

Systematic Risk of Portfolio $= \sqrt{(0.68)^2 \times (25)^2} = \sqrt{289}$

Non-systematic Risk of Portfolio

$= (0.25)^2 \times (35)^2 + (0.40)^2 \times (45)^2 + 0 = 76.56 + 324 = \sqrt{400.56}$

Total Risk $= \sqrt{289 + 400.56} = 26.26\%$

Question 11

Study Material

Ramesh wants to invest in stock market. He has got the following information about individual securities:

Security	Expected Return	Beta	σ^2_{ei}
A	15	1.5	40
B	12	2	20
C	10	2.5	30
D	09	1	10
E	08	1.2	20
F	14	1.5	30

Market index variance is 10 percent and the risk-free rate of return is 7%. What should be the optimum portfolio assuming no short sales?

Solution: Securities need to be ranked on the basis of excess return to beta ratio from highest to the lowest.

Security	R_i	βi	$R_i - R_f$	$\frac{R_i - R_f}{\beta_i}$	Rankings
A	15	1.5	8	5.33	1
B	12	2	5	2.5	3
C	10	2.5	3	1.2	5
D	9	1	2	2	4
E	8	1.2	1	0.83	6
F	14	1.5	7	4.67	2

Ranked Table:

Security	$R_i - R_f$	β_i	σ^2_{ei}	$\frac{(R_i - R_f) \times \beta_i}{\sigma^2_{ei}}$	$\sum_{i=1}^{N} \frac{(R_i - R_f) \times \beta_i}{\sigma^2_{ei}}$	$\frac{\beta_i^2}{\sigma^2_{ei}}$	$\sum_{i=1}^{N} \frac{\beta_i^2}{\sigma^2_{ei}}$	C_i
A	8	1.5	40	0.30	0.30	0.056	0.056	1.923
F	7	1.5	30	0.35	0.65	0.075	0.131	2.814
B	5	2	20	0.50	1.15	0.20	0.311	2.668
D	2	1	10	0.20	1.35	0.10	0.431	2.542
C	3	2.5	30	0.25	1.60	0.208	0.639	2.165
E	1	1.2	20	0.06	1.66	0.072	0.711	2.047

$C_A = 10 \times 0.30 / [1 + (10 \times 0.056)] = 1.923$

$C_F = 10 \times 0.65 / [1 + (10 \times 0.0131)] = 2.814$

$C_B = 10 \times 1.15 / [1 + (10 \times 0.331)] = 2.668$

$C_D = 10 \times 1.35 / [1 + (10 \times 0.431)] = 2.542$

$C_C = 10 \times 1.60 / [1 + (10 \times 0.639)] = 2.165$

$C_E = 10 \times 1.66 / [1 + (10 \times 0.7111)] = 2.047$

Cut off point is 2.814

$$Z_i = \frac{\beta_i}{\sigma^2 ei}\left[\frac{(R_i - R_f)}{\beta_i} - C\right]$$

$$Z_A = \frac{1.5}{40}(5.33 - 2.814) = 0.09435$$

$$Z_F = \frac{1.5}{30}(4.67 - 2.814) = 0.0928$$

X_A = 0.09435 / [0.09435 + 0.0928] = 50.41%

X_F = 0.0928 / [0.09435 + 0.0928] = 49.59%

Funds to be invested in security A & F are 50.41% and 49.59% respectively.

Question 12 Study Material, (8 Marks) Exam May 2022, RTP Nov 2013

The following information is available with respect of Jaykay Ltd.

Year	Jay Kay Limited		Market		Return on govt. bonds %
	Average share price (₹)	DPS (₹)	Average Index	Dividend yield (%)	
2022	242	20	1812	4	6
2023	279	25	1950	5	5
2024	305	30	2258	6	4
2025	322	35	2220	7	5

Compute Beta value of the company at the end of 2025. what is your observation ?

Solution:

(1) Computation of Beta value

Calculation of returns

$$\text{Return} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Year	Returns
2022 - 2023	$\frac{25 + (279 - 242)}{242} \times 100 = 25.62\%$
2023 - 2024	$\frac{30 + (305 - 279)}{279} \times 100 = 20.07\%$
2024 - 2025	$\frac{305 + (322 - 305)}{305} \times 100 = 17.05\%$

Calculation of Returns from market index

Year	% of index appreciation	Dividend yield %	Total Return %
2022 - 2023	$\frac{1950 - 1812}{1812} \times 100 = 7.62\%$	5%	12.62%
2023 - 2024	$\frac{2258 - 1950}{1950} \times 100 = 15.79\%$	6%	21.79%
2024 - 2025	$\frac{2220 - 2258}{2258} \times 100 = (-)\ 1.68\%$	7%	5.32%

Computation of Beta

Year	X	Y	XY	Y^2
2022 - 2023	25.62	12.62	323.32	159.26
2023 - 2024	20.07	21.79	437.33	474.80
2024 - 2025	17.05	5.32	90.71	28.30
	62.74	**39.73**	**851.36**	**662.36**

$$\bar{X} = \frac{62.74}{3} = 20.91, \bar{Y} = \frac{39.73}{3} = 13.24$$

$$\beta = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum Y^2 - n\bar{Y}^2} = \frac{851.36 - 830.55}{662.36 - 525.89} = \frac{20.81}{136.47} = 0.15$$

Tutorial Note: ICAI has denoted Market by Y hence they have changed denominator accordingly. There will be no change in Numerator.

(2) Observation Based on the beta value of the company and the analysis of returns, it can be concluded that changes in the return on share of Jaykay Ltd. are less affected by changes in market returns.

Question 13 MTP April 2024 Series 2

Your client is holding the following securities:

Particulars of Securities	Cost ₹	Dividends/ Interest ₹	Market price at the end of holding period ₹	Beta
Equity Shares:				
G Ltd.	20,000	1,450	19,600	0.6
S Ltd.	30,000	1,000	30,400	0.8
B Ltd.	28,000	1,400	32,000	0.6
GOI Bonds	72,000	5,060	71,980	0.01

Evaluate:

(i) Risk free rate of return.

(ii) Expected rate of return of each security (except GOI Bond), using the Capital Asset Pricing Model (CAPM).

Note: (1) Use weighted average Beta in calculations.
(2) Round off calculations upto 3 decimal points.

Solution:

Particulars of Securities	Cost ₹	Market Price	Capital gain	Dividends/ Interest
G Ltd.	20,000	19,600	-400	1,450
S Ltd.	30,000	30,400	400	1,000
B Ltd.	28,000	32,000	4,000	1,400
GOI Bonds	72,000	71,980	-20	5,060
Total	1,50,000	1,53,980	3,980	8,910

(i) Risk free return [Return on Govt. Security (GOI Bond)]

$$\frac{5,060 + (72,000 - 71,980)}{72,000} = 7\%$$

(ii) Weighted Average of Beta

$$0.6 \times 19,600/1,53,980 + 0.8 \times 30,400/1,53,980 + 0.60 \times 32,000/1,53,980 + 0.01 \times 71,980/1,53,980$$

$$= 0.076 + 0.158 + 0.125 + 0.005 = 0.364$$

Average Return on Portfolio

(8,910 + 3,980) / 1,50,000 x 100% = 8.593%

Market Return

$8.593\% = 7\% + (R_m - 7\%) \times 0.364$

$R_m = 11.376\%$

Expected Rate of Return for each security is

Rate of Return $= R_f + \beta (R_m - R_f)$

G Ltd. $= 7.000\% + 0.6 (11.376\% - 7.000\%) = 9.626\%$

S Ltd. $= 7.000\% + 0.8 (11.376\% - 7.000\%) = 10.501\%$

B Ltd. $= 7.000\% + 0.6 (11.376\% - 7.000\%) = 9.626\%$

Question 14

4 Questions Merged | Study Material

The following information is available in respect of Security X

Equilibrium Return	15%
Market Return	15%
7% Treasury Bond Trading at	$ 140
Covariance of Market Return and Security Return	225%
Coefficient of Correlation	0.75

You are required to

(a) determine the Standard Deviation of Market Return and Security Return

(b) suppose an Investor has ₹ 1,00,000 of his personal funds, then how he would construct his portfolio with Security X so as to achieve expected return of 20% and what will be risk of this portfolio.

(c) suppose an investor is invested in Security X with margin of 40% and cost of borrowing is 8% then what will be the position.

(d) If the risk premium on the market goes up by 2.50% points, what would be the revised expected return on the stock based on CAPM ?

Solution: (a) First we shall compute the β of Security X.

$$\text{Risk Free Rate} = \frac{\text{Coupon Payment}}{\text{Current Market Price}} = \frac{7}{140} = 5\%$$

Assuming equilibrium return to be equal to CAPM return then:

$15\% = R_f + \beta_x (Rm - Rf)$

$15\% = 5\% + \beta_x (15\% - 5\%)$

$B_x = 1$

or it can also be computed as follows:

$$\frac{R_m}{R_s} = \frac{15\%}{15\%} = 1$$

(i) Standard Deviation of Market Return

$$\beta_x = \frac{Cov_{x,m}}{\sigma^2_m} = \frac{225\%}{\sigma^2_m} = 1$$

$\sigma^2_m = 225$

$\sigma_m = 15\%$

(ii) Standard Deviation of Security Return

$$\beta_x = \frac{\sigma_x}{\sigma_m} \times \rho_{xm} = \frac{\sigma_x}{15} \times 0.75 = 1$$

$$\sigma_x = \frac{15}{0.75} = 20\%$$

(b) Let Y be the proportion of investment in X then investment in risk-free securities will be (1-Y),
then 20% = 15%xY + 5%x(1-Y)
or 0.20 = 0.15Y + 0.05 - 0.05Y
or Y = 1.5 or 150%

Thus, borrow 50% of owned fund at risk free rate of interest of 5% which comes to ₹ 50000.

Now invest total fund of ₹ 150000 in Security X.

Risk of above Portfolio = 20% x 1.5 + 0% x -0.5 = 30%.

(c) Where Security X is margined out 40% with cost of borrowing at 8% the position of Expected Return and risk will be as follows:

R_p = 15% x 1.4 + 8% x (-0.4) = 17.8%

Risk of above Portfolio = 20% x 1.4 + 0% x -0.4 = 28%.

(d) Return from Market goes up by 2.5% points i.e. 15% + 2.5% = 17.5%
Expected Return based on CAPM (R_j) = 5% + 1(17.5% - 5%) = 17.5%

Question 15

Study Material, Practice Manual, (8 Marks) N 14, M 18, MTP M 19, MTP N 23, M 25

The risk free rate of return Rf is 9 percent. The expected rate of return on the market portfolio Rm is 13 percent. The expected rate of growth for the dividend of Platinum Ltd. is 7 percent. The last dividend paid on the equity stock of Platinum Ltd was ₹ 2.00. The beta of Platinum Ltd. equity stock is 1.2.

(i) What is the equilibrium price of the equity stock of Platinum Ltd.?

(ii) How would the equilibrium price change when

- The inflation premium increases by 2 percent?
- The expected growth rate increases by 3 percent?
- The beta of Platinum Ltd. equity rises to 1.3?

Tutorial Note: In RTP M25, ICAI has replaced first two "?" by "and" Hence , the only correct answer will be ₹ 35.48

Solution: (i) Equilibrium price of Equity using CAPM

= 9% + 1.2(13% - 9%) = 13.8%

$$P = \frac{D1}{K_e - g} = \frac{2.00\ (1.07)}{0.138 - 0.07} = \frac{2.14}{0.068} = ₹\ 31.47$$

(ii) New Equilibrium price of Equity using CAPM

= 11% + 1.3 (15% - 11%) = 16.20%

$$P = \frac{D1}{K_e - g} = \frac{2.00\ (1.10)}{0.162 - 0.10} = ₹\ 35.48$$

Alternatively, if all the factors are taken separately then solution will be as follows:

(i) Inflation Premium increase by 2%. This raises Rx to 15.80%. Hence;
new equilibrium price will be:

$$= \frac{2.00\ (1.07)}{0.158 - 0.07} = ₹\ 24.32$$

(ii) Expected Growth rate increases by 3%. Hence, revised growth rate stands at 10%:

$$= \frac{2.00\ (1.10)}{0.138 - 0.10} = ₹\ 57.89$$

(iii) Beta rises to 1.3. Hence, revised cost of equity shall be:

= 9% + 1.3(13% - 9%) = 14.2%

As a result, New Equilibrium price shall be:

$$P = \frac{D1}{K_e - g} = \frac{2.00\ (1.07)}{0.142 - 0.07} = \frac{2.14}{0.068} = ₹\ 29.72$$

Question 16 Study Material (Similar), Practice Manual, RTP May 18, MTP Oct 19, Exam Nov 23

Expected returns on two stocks against BSE SENSEX returns are given in the following table under two scenarios - bullish and bearish :

Market Return	Scenario - 1: Bullish Case	Scenario - 2: Bearish Case
BSE Sensex	25%	-5%
Stock R	32%	-4%
Stock Z	18%	-3%

You are required to calculate :

(i) The Betas of two stocks R and Z.

(ii) Expected return on each stock, if the likelihood of market achieving Scenario-I is thrice the likelihood of the market achieving Scenario-2.

(iii) The Security Market Line (SML), if the risk free rate is 8% and likelihood of the market return achieving the bullish base returns of 25% is thrice that of achieving -5% returns.

(iv) The Alphas of the two stocks based on Sharpe Index Model.

Solution: (i) The Betas of two stocks:

Stock R = (32% + 4%)/(25% + 5%) = 1.2 Stock Z = (18% + 3%)/(25% + 5%) = 0.70

Alternatively, it can also be solved by using the Characteristic Line Relationship as follows:

$R_s = \alpha + \beta R_m$ Where, α = Alpha β = Beta R_m = Market Return

For Stock R

$32\% = \alpha + \beta(25\%)$
$-4\% = \alpha + \beta(-5\%)$
$36\% = \beta(30\%)$
$\beta = 1.2$

For Stock Z

$18\% = \alpha + \beta(25\%)$
$-3\% = \alpha + \beta(-5\%)$
$21\% = \beta(30\%)$
$\beta = 0.70$

Alternatively, Beta can also be calculated as follows:

Basic Calculation for stock R

(R_R)	$\overline{R_R}$	$R_R - \overline{R_R}$	$(R_R - \overline{R_R})^2$	(R_m)	$\overline{R_M}$	$R_m - \overline{R_M}$	$(R_m - \overline{R_M})^2$	$(R_R - \overline{R_R})(R_m - \overline{R_M})$
32%	14%	18%	324	25%	10%	15%	225	270
-4%	14%	-18%	324	-5%	10%	-15%	225	270
Total			648				450	540

Basic Calculation for stock Z

(R_z)	$\overline{R_z}$	$R_z - \overline{R_z}$	$(R_z - \overline{R_z})^2$	(R_m)	$\overline{R_M}$	$R_m - \overline{R_M}$	$(R_m - \overline{R_M})^2$	$(R_z - \overline{R_z})(R_m - \overline{R_M})$
18%	7.5%	10.5%	110.25	25%	10%	15%	225	157.50
-3%	7.5%	-10.5%	110.25	-5%	10%	-15%	225	157.50
Total			220.50				450	315

Co- Variance (R, M) = 540/2=270 Co- Variance (Z, M) = 315/2=157.50 $(\sigma_M)^2$ =450/2 = 225

Beta of stocks R & Z

$$\text{Beta (R)} = \frac{\text{Cov. (R, M)}}{\sigma_M^2} = 270/225 = 1.2 \qquad \text{Beta (Z)} = \frac{\text{Cov. (R, Z)}}{\sigma_M^2} = 157.5/225 = 0.7$$

(ii) Expected returns of the two stocks:
Stock R - 0.75 x 32% - 0.25 x 4% = 23%
Stock Z - 0.75 x 18% - 0.25 x 3% = 12.75%

(iii) Expected return of market portfolio = 0.75 x 25% + 0.25% x (-5%) = 17.50%
∴ Market risk prem. = 17.50% - 8.00% = 9.5%
∴ SML is, required return = 8.00% + βi 9.5%

(iv) Alpha for two stocks

Required Return for Stock R
$E(R) = \alpha_R + \beta R_M$
Accordingly
$23\% = \alpha_R + 1.20 \times 17.50\%$
$\alpha_R = 2\%$

Required Return for Stock Z
$E(Z) = \alpha_Z + \beta R_M$
Accordingly
$12.75\% = \alpha_Z + 0.70 \times 17.50\%$
$\alpha_Z = 0.5\%$

Question 17 Study Material, (8 Marks) Exam Nov 18(Similar), Practice Manual, MTP May 21, Nov 24, Sep 25

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two factor model.

(i) If Mr. X has ₹ 1,00,000 to invest and sells short ₹ 50,000 of security B and purchases ₹ 1,50,000 of security A what is the sensitivity of Mr. X's portfolio to the two factors?

(ii) If Mr. X borrows ₹ 1,00,000 at the risk free rate and invests the amount he borrows along with the original amount of ₹ 1,00,000 in security A and B in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors?

(iii) What is the expected return premium of factor 2?

(iv) Suppose Mr. Y, one of the friend of Mr. X says the expected return premium of factor 1 is zero. Do you agree with this statement.

Solution: (i) Caln of $ß_p$ for both the factors

Security	Factor ß		MV	W_i	$ß_{i1} x W_i$	$ß_{i2} x W_i$
	Factor 1($ß_{i1}$)	factor 2($ß_{i2}$)				
A	0.80	0.60	150000	1.5	1.20	0.90
B	1.50	1.20	-50000	-0.5	-0.75	-0.60
			100000	1	$ß_{p-1}$ = 0.45	$ß_{p-2}$ = 0.30

(ii) Caln of $ß_p$ for both the factors

Security	Factor ß		MV	W_i	$ß_{i1} x W_i$	$ß_{i2} x W_i$
	Factor 1($ß_{i1}$)	factor 2($ß_{i2}$)				
A	0.80	0.60	300000	3	2.4	1.8
B	1.50	1.20	-100000	-1	-1.5	-1.2
Borrowings	0	0	-100000	-1	0	0
			100000	1	= 0.90	= 0.60

(iii) As per factor model: Expected Return = Risk free Rate of Return + Risk Premium

Let λ_1 and λ_2 are the value of Factor 1 & Factor 2 respectively.

$E(r) = \lambda_0 + ß_{p-1}\lambda_1 + ß_{p-2}\lambda_2$

Sec A: $15 = 10 + 0.80\lambda_1 + 0.6\lambda_2$ eq^n 1

Sec B: $20 = 10 + 1.5\lambda_1 + 1.2\lambda_2$ eq^n 2

Multiplying eq-^{n} 1 by 1.5 & eq-^{n} 2 by 0.8 & subtracting eq-n from each other:

$$22.5 = 15 + 1.2\lambda_1 + 0.9\lambda_2$$
$$16 = 8 + 1.2\lambda_1 + 0.96\lambda_2$$
$$6.5 = 7 - 0.06\lambda_2$$

$0.06\lambda_2 = 0.50$ $\therefore$ Risk Premium (λ_2) = 8.33%

(iv) Substituting value of $\lambda_2 = 8.33\%$ in eq^n 1 $15 = 10 + 0.80\lambda_1 + 0.60(8.33)$

On solving equation, the value of $\lambda_1 = 0$.

Yes, Mr. Y is correct in his observation

Question 18

Study Material (Similar), MTP Nov 2018 (Similar), (8 Marks) Exam Nov 2023

An investor has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock Market are also given below :

Category	Weight in Market Index	Factor 1 (Inflation)			Factor 2 (Stock Market)		
		Beta 1	Expected Value in %	Actual Value in %	Beta 2	Expected Value in %	Actual Value in %
Small Cap	20%	1.20	6.70	6.70	0.80	10.00	10.50
Medium Cap	30%	1.75	4.50	6.00	0.90	7.00	8.00
Large Cap	15%	1.30	6.75	8.00	1.165	9.00	10.00
Flexi Cap	35%	1.70	7.00	6.50	0.85	8.85	9.75

Risk Free Rate of Interest is 7.50%.

Round off to 2 decimal.

You are required to calculate :

(i) Expected return on the market index for both the factors.

(ii) Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario)

(iii) Expected return on the market index under Arbitrage Pricing Theory, if the composition of the Portfolio is changed to 25% equally in all four categories.

(iv) Which alternative (Existing or Changed) will be more profitable ?

Solution:

(i) Expected Return on Market Index for Both factors

Factor 1

= 0.20 x 6.70% + 0.30 x 4.50% + 0.15 x 6.75% + 0.35 x 7.00%

= 1.34% + 1.35% + 1.01% + 2.45% = 6.15%

Factor 2

= 0.20 x 10% + 0.30 x 7% + 0.15 x 9% + 0.35 x 8.85%

= 2% + 2.10% + 1.35% + 3.10% = 8.55%

(ii) Calculation of expected Return on the Market index under Arbitrage Pricing Theory (Existing Scenario):

	Factor 1 (Inflation)				
Category	**Beta (a)**	**Actual value (b) (%)**	**Expected value (c) (%)**	**Difference (b) - (c) = (d) (%)**	**Beta x Diff. (e)**
Small Cap	1.20	6.70	6.70	0.00	0.00
Medium Cap	1.75	6.00	4.50	1.50	2.63
Large Cap	1.30	8.00	6.75	1.25	1.63
Flexi cap	1.70	6.50	7.00	(0.50)	(0.85)

Table Continued	Factor 2 (Stock Market)					
Category	**Beta (f)**	**Actual value (g) (%)**	**Expected value (h) (%)**	**Difference (g)-(h)=(i) (%)**	**Beta x Diff. (j)**	**Total (e)+(j)=(k)**
Small Cap	0.80	10.50	10.00	0.50	0.40	0.40
Medium Cap	0.90	8.00	7.00	1.00	0.90	3.53
Large Cap	1.165	10.00	9.00	1.00	1.17	2.80
Flexi cap	0.85	9.75	8.85	0.90	0.77	(0.08)

Table Continued

Category	Weight in market index (1)	Total Beta x Diff (2)	Expected Return (2 x 1 = 3)
Small Cap	20%	0.40	0.08
Medium Cap	30%	3.53	1.06
Large Cap	15%	2.80	0.42
Flexi cap	35%	(0.08)	(0.03)
Total			1.53
Add: Risk Free Rate of Interest			7.50
Expected Return (%)			9.03

(iii) Expected Return on the Market Index under Arbitrage Pricing Theory under changed scenario:

Category	Weight in market index (1)	Total Beta x Diff (2)	Expected Return (2 x 1 = 3)
Small Cap	25%	0.40	0.10
Medium Cap	25%	3.53	0.88
Large Cap	25%	2.80	0.70
Flexi cap	25%	(0.08)	(0.02)
Total			1.66
Add: Risk Free Rate of Interest			7.50
Expected Return (%)			9.16

(iv) As per the above calculation, the investors by investing 25% equally in all four categories, is profitable compared to the existing composition. As the proposed composition gives rate of return of 9.16% per annuam when compared to the existing return of the present portfolio which is 9.03%.

Question 19 (8 Marks) Exam May 2023

Mr. Potential has made investments in two mutual funds. The following information is available :

Mutual Fund	Smart	Growth
Jensen Alpha	1.10%	1.50%
Treynor's Ratio	0.0714	0.0775
Actual Return	8.50%	9.10%
Risk Premium	4%	

You are required to calculate :

(i) Beta (β) for both the funds

(ii) Risk free Rate

(iii) Security Market Line

Solution:

	Smart	Growth
Jensen Alpha	0.011	0.015
Treynor's Ratio	0.0714	0.0775
Actual Return	0.085	0.091
Risk Premium	0.04	0.04

Jensen Alpha = Actual Return - E(r)

Treynor's Ratio = $\frac{E(r) - Rf}{\beta}$

E(r) = Actual Return – Jensen Alpha

For Smart:

$0.04\beta_S = 0.074 - R_f$ (1)

$0.0714\beta_S = 0.085 - R_f$. (2)

On solving (1) and (2), we get $\beta_S = 0.35$ and $R_f = 0.06$

For Growth:

$0.04\beta_G = 0.076 - R_f$ (3)

$0.0775\beta_G = 0.091 - R_f$ (4)

On solving (3) and (4), we get $\beta_G = 0.40$ and $R_f = 0.06$

(i) Beta of Smart Mutual Fund is 0.35 and Growth Mutual Fund is 0.40.

(ii) Risk free Rate = 6%

(iii) Security Market Line for Smart = $0.06 + 0.04\beta$

Security Market Line for Growth = $0.06 + 0.04\beta$

Alternative Solution: In case students have assumed Risk Premium as Equity Risk Premium of respective securities.

Working Notes:

(i) Smart

Jensen Alpha = 0.011

Actual Return = 0.085

Thus, expected return (as per CAPM) = 0.074

Accordingly, Risk Free Rate of Return:

$0.074 = R_f + 0.04$

$R_f = 0.034$

Treynor's Ratio = 0.0714

$0.0714 = \frac{0.085 - 0.034}{\beta_S}$

$\beta_S = 0.714$

Market Risk Premium = $\frac{0.04}{0.714} = 0.056$

Security Market Line for Smart $= 0.034 + 0.056\beta_S$

(ii) Growth

Jensen Alpha = 0.015

Actual Return = 0.091

Thus, expected return (as per CAPM) = 0.076

Accordingly, Risk Free Rate of Return:

$0.076 = R_f + 0.04$

Rf = 0.036

Treynor's Ratio = 0.0775

$0.0775 = \frac{0.091 - 0.036}{\beta_G}$

$\beta_G = 0.710$

Market Risk Premium = $\frac{0.04}{0.710} = 0.056$

Security Market Line for Growth $= 0.036 + 0.056\beta_G$

Question 20 (8 Marks) Exam Nov 2024

A Portfolio Manager (PM) has three mutual funds in his portfolio. Following are the details of these three mutual funds :

Particulars	Growth fund	Balanced fund	Regular fund	Market
Average Return (%)	7.5	6.3	5.4	
Variance				50.41
Sharpe Ratio	-0.15	- 0.36	-0.48	
Treynor's Ratio	-2	-3	-4.80	

The yield on 182 days Treasury bill is 9 per cent per annum.

You are required to calculate

(i) Variance of the Funds (ii) Coefficient of Determination of the Funds

Solution: (i) Variance of different Funds can be calculated by using Sharpe Ratio as follows:

Let σ_G , σ_B , σ_R be the Standard Deviation of Growth Fund, Balanced Fund, Regular Fund. Accordingly

(a) Growth Fund

$$-0.15 = \frac{7.50 - 9.00}{\sigma_G}$$

$\sigma_G = 10$

Hence the variance of Growth Fund $(\sigma_G)^2 = 100$

(b) Balanced Fund

$$-0.36 = \frac{6.30 - 9.00}{\sigma_B}$$

$\sigma_B = 7.50$

Hence the variance of Growth Fund $(\sigma_B)^2 = 56.25$

(c) Regular Fund

$$-0.48 = \frac{5.40 - 9.00}{\sigma_R}$$

$\sigma_R = 7.50$

Hence the variance of Growth Fund $(\sigma_R)^2 = 56.25$

(ii) To determine the Coefficient of Determination we need the Coefficient of Correlation which can be determined by computing β using the Treynor Ratio as follows:

(a) Growth Fund

Let β_G be the Beta of Growth Fund. Accordingly

$$-2 = \frac{7.50 - 9.00}{\beta_G}$$

$\beta_G = 0.75$

$$\text{Since Beta} = \frac{\sigma_G Corr_{G,M}}{\sigma_M}$$

and $\sigma_G = 10$ and $\sigma_M = \sqrt{50.41} = 7.1$

$$\text{Hence } 0.75 = \frac{10\ Corr_{G,M}}{7.10}$$

$Corr_{G,M} = 0.5325$ or 0.53 and Coefficient of Determination of Growth Fund

$= (0.5325)^2 = 0.2836$ or $(0.53)^2 = 0.28$

(b) Balanced Fund

Let β_B be the Beta of Balanced Fund. Accordingly

$$-3 = \frac{6.30 - 9.00}{\beta_B}$$

$\beta_B = 0.90$

$$\text{Since Beta} = \frac{\sigma_B Corr_{B,M}}{\sigma_M}$$

and $\sigma_B = 7.50$ and $\sigma_M = \sqrt{50.41} = 7.1$

$$\text{Hence } 0.90 = \frac{7.50 Corr_{B,M}}{7.10}$$

$Corr_{B,M} = 0.852$ or 0.85 and Coefficient of Determination of Balanced Fund

$= (0.852)^2 = 0.7259$ or $(0.85)^2 = 0.73$

(c) Regular Fund

Let β_R be the Beta of Regular Fund. Accordingly

$$-4.80 = \frac{5.40 - 9.00}{\beta_R}$$

$\beta_R = 0.75$

$$\text{Since Beta} = \frac{\sigma_R Corr_{R,M}}{\sigma_M}$$

and $\sigma_R = 7.50$ and $\sigma_R = \sqrt{50.41} = 7.1$

$$\text{Hence } 0.75 = \frac{7.50 Corr_{R,M}}{7.10}$$

$Corr_{R,M} = 0.71$ and Coefficient of Determination of Regular Fund

$= (0.71)^2 = 0.5041$ or 0.50

Question 21 Study Material

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and the ending NAVs of the fund he constructed for the last 10 months are given below:

Month	Ending NAV (₹/unit)	Month	Ending NAV (₹/unit)
December 2008	40.00	May 2009	37.00
January 2009	25.00	June 2009	42.00
February 2009	36.00	July 2009	43.00
March 2009	32.00	August 2009	50.00
April 2009	38.00	September 2009	52.00

Assume Sunidhi had invested a notional amount of ₹ 2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

You are required to determine the value of the portfolio for each level of NAV following the Constant Ratio Plan.

Solution: **Constant Ratio Plan:**

Stock Portfolio NAV (₹)	Value of buy-hold strategy (₹)	Value of Conservative Portfolio (₹)	Value of aggressive Portfolio (₹)	Total Value of Constant Ratio Plan (₹)	Revaluation Action	Total No. of units in aggressive portfolio
40.00	2,00,000	1,00,000	1,00,000	2,00,000	-	2500
25.00	1,25,000	1,00,000	62,500	1,62,500	-	2500
	1,25,000	81,250	81,250	1,62,500	Buy 750 units	3250
36.00	1,80,000	81,250	1,17,000	1,98,250	-	3250
	1,80,000	99,125	99,125	1,98,250	Sell 496.53 units	2753.47
32.00	1,60,000	99,125	88,111.04	1,87,236.04	-	2753.47
38.00	1,90,000	99,125	1,04,631.86	2,03,756.86	-	2753.47
	1,90,000	1,01,878,.50	1,01,878.43	2,03,756.86	Sell 72.46 units	2681.01
37.00	1,85,000	1,01,878.50	99,197.37	2,01,075.87	-	2681.01
42.00	2,10,000	1,01,878.50	1,12,602.42	2,14,480.92	-	2681.01
43.00	2,15,000	1,01,878.50	1,15,283.43	2,17,161.93	-	2681.01
50.00	2,50,000	1,01,878.50	1,34,050.50	2,35,929	-	2681.01
	2,50,000	1,17,964.50	1,17,964.50	2,35,929	Sell 321.72 units	2359.29
52.00	2,60,000	1,17,964.50	1,22,683.08	2,40,647.58	-	2359.29

Hence, the ending value of the mechanical strategy is ₹ 2,40,647.58 and buy & hold strategy is ₹ 2,60,000.

Tutorial Note: For rebalancing, ICAI has compared Current NAV Vs. Last month NAV. Correct concept is to compare Current NAV vs. Last rebalancing NAV. Nonethless , we suggest following ICAI's solution in exams

Question 22 MTP Series 2 Nov 2023, Exam May 2012 (Similar), RTP Nov 2023 (Similar)

Indira has a fund of ₹ 3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. She has 3 close friends who have advised following different strategies:

(i) Buy and Hold strategy (ii) Constant Ratio (iii) CPPI

Suppose she immediately starts with investment in Bonds (non-fluctuating) and Equity and decides to rebalance her portfolio after each 10 days and to invest in Nifty as equity component changes in tandem with that of Nifty. Further, Bond has no Beta.

As on date (i.e. beginning of month) Nifty is 5326 and minimum Nifty within a month can be most be 4793.40. If she chooses CPPI she will use "2" as the multiplier. If she chooses Constant Ratio plan she will maintain the ratio of 60:40 in Equity and Bonds respectively. Further, portfolio will be rebalanced each time Nifty is changed by 5% as compared to the previous Nifty.

You are required to evaluate Portfolio Position of Indira under each of the Strategies suggested by her friends and highlight the course of action to be taken if in the coming month after a gap of 10 days Nifty happened:

(1) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.

(2) 10 days further from the above date if the NIFTY touches 5539.04.

Solution :

(i) Under Buy and Hold Strategy

(1) Maximum decline in one month = $\frac{5326 - 4793.40}{5326} \times 100 = 10\ \%$

Floor Value = 3,00,000 × (1 - 0.10) = ₹ 2,70,000

Under this strategy investor invests an amount equal to floor value in non-fluctuating assets (Bonds). Thus, Indira will invest ₹ 2,70,000 in Bonds and the remaining ₹ 30,000 in equity.

(2) After 10 days

Value of equity = 30,000 × 5122.96/5326	=	₹ 28,856
Value of Bonds		₹ 2,70,000
Total value of portfolio	=	₹ 2,98,856

(3) After another 10 days

Value of equity = 28,856 × 5539.04/5122.96	=	₹ 31,200
Value of Bonds		₹ 2,70,000
Total value of portfolio	=	₹ 3,01,200

(ii) Under CPPI

(1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (3,00,000 – 2,70,000) = ₹ 60,000

Indira may invest ₹ 60,000 in equity and balance in bonds.

(2) After 10 days

Value of equity = 60,000 x 5122.96/5326	=	₹57,713
Value of bonds	=	₹2,40,000
Total value of portfolio	=	₹2,97,713

$$\text{Change in Investment (\%)} = \frac{(60{,}000 - 57{,}713)}{60{,}000} = 3.81\ \%$$

As the change in investment is less than 5%, Indira will not rebalance the portfolio.

(3) After another 10 days

Value of equity = 57,713 x 5539.04/5122.96	=	₹62,400
Value of bonds	=	₹2,40,000
Total value of portfolio	=	₹3,02,000

$$\text{Change in Investment (\%)} = \frac{(62{,}400 - 57{,}713)}{57{,}713} = 8.12\ \%$$

As the change in investment is more than 5%, Indira will rebalance the portfolio.

Investment in equity	= Multiplier x (Portfolio value – Floor value)		
	= 2 (3,02,400 – 2,70,000)	=	₹64,800

Revised Portfolio:

Equity		=	₹64,800
Bonds	= ₹3,02,400 – ₹64,800	=	₹2,37,600

The investor should off-load ₹2,400 of bonds and divert to Equity.

(iii) Under Constant Ratio Strategy

(1) The ratio to be maintained is given as 60:40. Thus, Indira will invest ₹ 1,80,000 in equity and ₹ 120,000 in bonds.

(2) After 10 days

Value of equity = 1,80,000 × 5122.96/5326	=	₹1,73,138
Value of Bonds		₹1,20,000
Total value of portfolio	=	₹2,93,138

$$\text{Change in Investment (\%)} = \frac{(1{,}80{,}000 - 1{,}73{,}138)}{1{,}80{,}000} = 3.81\ \%$$

As the change in investment is less than 5%, Indira will not rebalance the portfolio.

(3) After another 10 days

Value of equity = 1,73,138 × 5539.04/5122.96	=	₹1,87,200
Value of Bonds		₹1,20,000
Total value of portfolio	=	₹3,07,200

$$\text{Change in Investment (\%)} = \frac{(1{,}87{,}200 - 1{,}73{,}138)}{1{,}73{,}138} = 8.12\ \%$$

As the change in investment is more than 5%, Indira will rebalance the portfolio.

Revised Portfolio:

$$\text{Equity} = \frac{60}{60 + 40} \times 3{,}07{,}200 = ₹\ 1{,}84{,}320$$

Bonds = ₹3,07,200 – ₹1,84,320 = ₹1,22,880

The investor should off-load ₹2,880 of Equity and divert to Bonds.

Question 23 Study Material, (8 Marks) Exam Nov 2016, RTP Nov 2020, MTP March 2024

Mr. Abhishek is interested in investing ₹ 2,00,000 for which he is considering following three alternatives:

(i) Invest ₹ 2,00,000 in Mutual Fund X (MFX)
(ii) Invest ₹ 2,00,000 in Mutual Fund Y (MFY)
(iii) Invest ₹ 1,20,000 in Mutual Fund X (MFX) and ₹ 80,000 in Mutual Fund Y (MFY)

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	MFX	MFY	Market Mix
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
Market Mix	3.370	2.800	3.100

You are required to calculate,

(i) variance of return from MFX, MFY and market return,
(ii) portfolio return, beta, portfolio variance and portfolio standard deviation,
(iii) expected return, systematic risk and unsystematic risk; and
(iv) Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Solution:

(i) Variance of Returns

$$Corr_{i,j} = \frac{Cov\ (i, j)}{\sigma_i\ \sigma_j}$$

Accordingly, for MFX

$$1 = \frac{Cov\ (X, X)}{\sigma_X\ \sigma_X}$$

$$\sigma^2_X = 4.800$$

Accordingly, for MFY

$$1 = \frac{Cov\ (Y, Y)}{\sigma_Y\ \sigma_Y}$$

$$\sigma^2_Y = 4.250$$

Accordingly, for Market Return

$$1 = \frac{Cov\ (M, M)}{\sigma_M\ \sigma_M}$$

$$\sigma^2_M = 3.100$$

Alternatively, by referring diagonally the given Table, these values can be identified as follows :

Variance X= 4.800

Variance Y= 4.250

Variance Mix = 3.100

(ii) Portfolio return, beta, variance and standard deviation

Weight of MFX in portfolio = $\frac{1,20,000}{2,00,000}$ = 0.60

Weight of MFY in portfolio = $\frac{80,000}{2,00,000}$ = 0.40

Accordingly, Portfolio Return

0.60 x 15% + 0.40 x 14% = 14.60%

Beta of each Fund

$$\beta = \frac{\text{Cov (Fund, Market)}}{\text{Variance of Market}} \qquad \beta_X = \frac{3.370}{3.100} = 1.087 \qquad \beta_Y = \frac{2.800}{3.100} = 0.903$$

Portfolio Beta

$0.60 \times 1.087 + 0.40 \times 0.903 = 1.013$

Portfolio Variance

$$\sigma^2_{XY} = W^2_X \sigma^2_X + W^2_Y \sigma^2_Y + 2W_X W_Y Cov_{X,Y}$$
$$= (0.60)^2 (4.800) + (0.40)^2 (4.250) + 2(0.60)(0.40)(4.300)$$
$$= 4.472$$

Or Portfolio Standard Deviation

$\sigma_{XY} = \sqrt{4.472} = 2.115$

(iii) Expected Return, Systematic and Unsystematic Risk

Portfolio Return = 10% + 1.0134 (12% – 10%) = 12.03%
MF X Return = 10% + 1.087 (12% – 10%) = 12.17%
MF Y Return = 10% + 0.903 (12% – 10%) = 11.806%
Systematic Risk = $\beta^2 \sigma^2$

Accordingly,
Systematic Risk of MFX = $(1.087)^2 \times 3.10 = 3.663$
Systematic Risk of MFY = $(0.903)^2 \times 3.10 = 2.528$
Systematic Risk of Portfolio = $(1.013)^2 \times 3.10 = 3.181$
Unsystematic Risk = Total Risk – Systematic Risk

Accordingly,
Unsystematic Risk of MFX = 4.80 – 3.663 = 1.137
Unsystematic Risk of MFY = 4.250 – 2.528 = 1.722
Unsystematic Risk of Portfolio = 4.472 – 3.181 = 1.291

(iv) Sharpe and Treynor Ratios and Alpha

Sharpe Ratio

$$MFX = \frac{15\% - 10\%}{\sqrt{4.800}} = 2.282 \qquad MFX = \frac{14\% - 10\%}{\sqrt{4.250}} = 1.94 \qquad Portfolio = \frac{14.6\% - 10\%}{2.115} = 2.175$$

Treynor Ratio

$$MFX = \frac{15\% - 10\%}{1.087} = 4.60 \qquad MFX = \frac{14\% - 10\%}{0.903} = 4.43 \qquad Portfolio = \frac{14.6\% - 10\%}{1.0134} = 4.54$$

Alpha

MFX = 15% - 12.17% = 2.83%
MFY = 14% - 11.81% = 2.19%
Portfolio = 14.6% - 12.03% = 2.57%

Risk Management

LDR ½ Hr
LMR 5 Mins

VaR [Value at Risk]

VaR is a measure of risk of investment. Given the normal market condition in a set of period, say, one day, it estimates how much an investment might lose. This investment can be a portfolio, capital investment or foreign exchange etc., VaR answers two basic questions -

(i) What is worst case scenario ? (ii) What will be the loss ?

There are two ingredients required before we calculate VaR

- ✓ Time frame — Eg. Daily VaR , Weekly VaR, Monthly VaR, Semi Annual VaR, Annual VaR etc. Other things being constant higher the time frame higher would be Value-at-Risk
- ✓ Confidence level — i.e. probabilities. Eg. generally we calc 1% VaR, 5% VaR, 10% VaR.

Interpretation of VAR

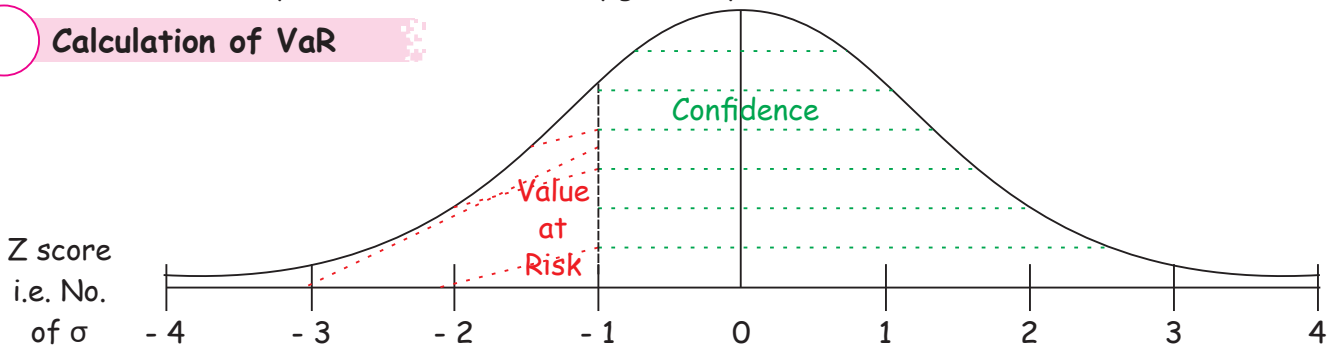
Let's say 5% Daily VaR = $ 40,000

There are 2 correct interpretations :-

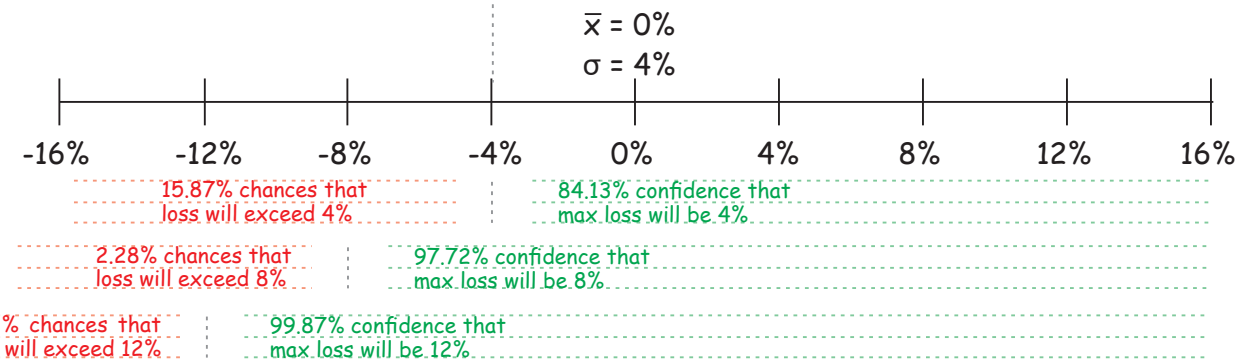
(1) There is a 95% confidence that on any given day maximum loss would be $40000.

(2) There is only a 5 % chance that on any given day losses could be even more than $ 40000

Calculation of VaR



Tutorial Note: Mean return (μ) is generally assumed as 0% while calculating VaR (reason being VaR is calculated for shorter time frames e.g. Daily, Weekly and in shorterm mean return is ~ 0%)

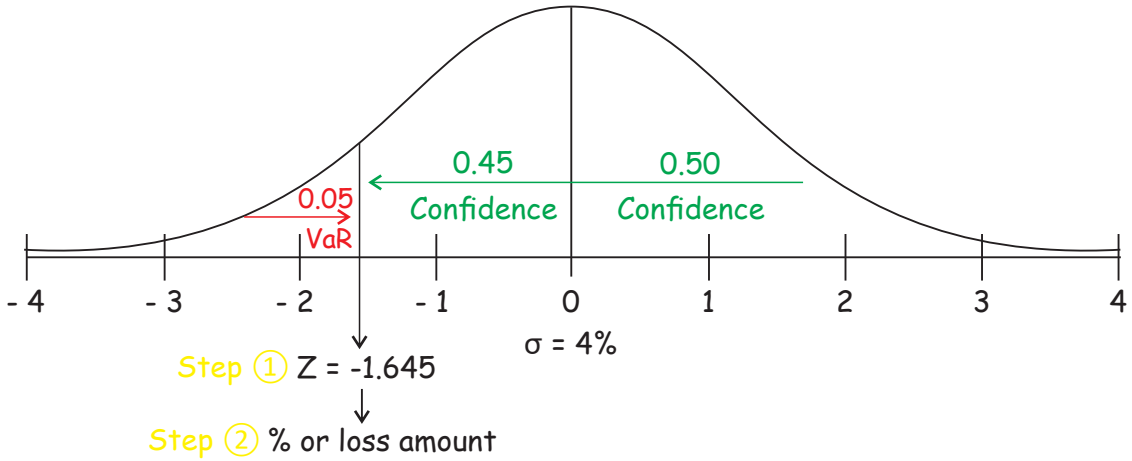


Calculating VaR is exactly reverse process of what we have studied in portfolio management

In Portfolio Management : Return % Given ⟶ Calculating corresponding Z ⟶ Find area / Probability

In Risk Management : Area / Prob / Confidence / VaR is given ⟶ Find corresponding Z ⟶ Calc return % or Max loss amount

Example Calc 5% Daily VaR if σ = 4%, Amount invested = ₹ 1,00,000



Step 1: Find Z score corresponding to the given confidence / probability. eg 5% VaR translates into 95% confidence

It is corresponding to the area of 0.45, the Z no. is -1.645 (refer Normal Distribution curve table)

At 95% probability z = 1.645 [by looking at the probability table (0.45)]

Step 2: Calc VaR

$\text{Max loss or } VaR_t = \text{Investment amount} \times \sigma_d\% \times \sqrt{t} \times Z \text{ score}$

to convert volatility/ Deviation% in to ₹ terms

to stretch daily risk to the desired time-frame risk

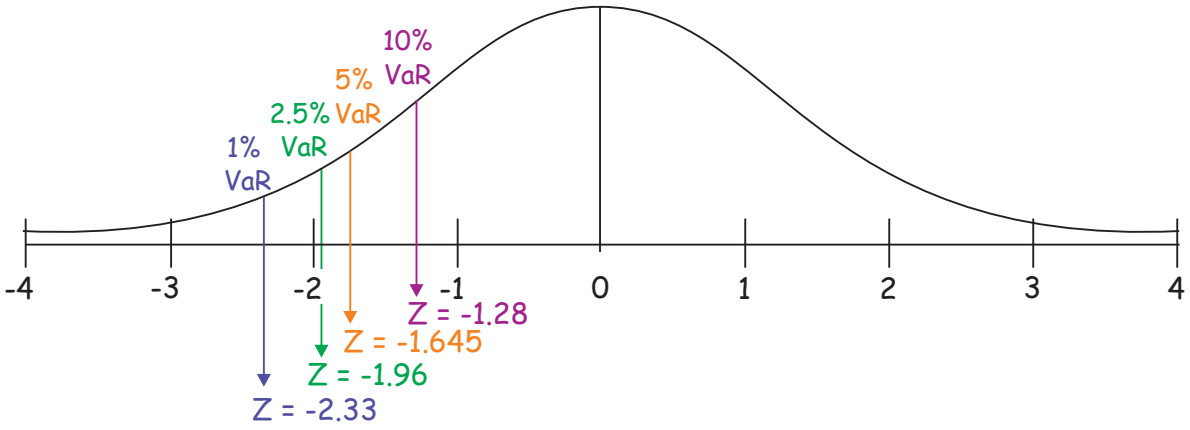
here,
σ_d % means daily std deviation of a security or portfolio
t means no. of days for which VaR/ Max loss needs to be calculated

$\text{Max Loss or VaR} = ₹\,1,00,000 \times 4\% \times \sqrt{1} \times 1.645$
$= ₹\,6580$

Step 3: Interpretation of VaR

On any day we are 95% confident that loss will not exceed ₹ 6580.
There is a 5% chance that losses may exceed ₹ 6580 on any particular day.

Let's remember some Standard Z nos. corresponding to standard VaR %



Example: A trader at Goldman sachs is analysing a trading opportunity & plans to place an order worth $20,00,000

The Daily standard deviation of the position is $80000. Maximum tolerance limit of loss for this trader can be $ 150000 on daily basis with 99% confidence. Calculate 1% daily VAR

Solve :

Step 1 At 1% probability of loss, (ie at 99% confidence level) corresponding z no is -2.33

Step 2 Max Loss $= \sigma_d \times \sqrt{t} \times z$

$= 80000 \times \sqrt{1} \times 2.33 = \$186400$

hence, 1% daily VaR is $ 186400

Caution Note:
Always pay attention to time frame of σ before calculating VaR

Step 3 Interpretation of VaR

- 1% daily VaR of $186400 means on any given day there is a 99% confidence that losses will not exceed $186400
- On other hand there is a just 1% chance that losses might exceed $186400

Decision: Since VaR ($ 186400) exceeds tolerance limit ($ 150000) ∴ order could not be placed . In this case trader may cut down the position size

Q Calc maximum position size that a trader can place order for ?

Using Unitary Method / Cross Multiplication

VaR		Position
∵ $186400	-	$ 20,00,000
∴ $ 150000	-	?

$$\left[\frac{₹\ 1,50,000 \times \$\ 20,00,000}{\$\ 1,86,400}\right] = \$\ 16,09,442$$

How to convert VaR from One time frame ⇌ Another time frame

$VaR_t = VaR_d \times \sqrt{t}$ or $\sigma_t = \sigma_d \times \sqrt{t}$

here, t means desired time frame at which VaR needs to be converted. eg. to calc 20 days VaR using 1 Day VaR, the value of $\sqrt{t}$ will be $\sqrt{20}$.

Standard no. of trading days (if Q is silent)

1 Week = 5 | 1 Month = 20 | Semi-annual = 125 | Annual = 250 or 252 (prefer)

Eg. If daily VaR is $10000. Calc Weekly, Monthly & Annual (250 days) VaR ?

Weekly VaR $= \$ 10000 \times \sqrt{5} = \$ 22361$

Monthly VaR $= \$ 10000 \times \sqrt{20} = \$ 44721$

Annual VaR $= \$ 10000 \times \sqrt{250} = \$ 158114$

How to change the confidence level of VaR

Concept: Use Unitary Method i.e. Cross multiplication on corresponding Z no.

Eg. 1% Daily VaR = $ 30000
Calc 5% Daily VaR ?

Solve: At 1% daily VaR Z score is - 2.33
& at 5% daily VaR Z score is - 1.645

Z score		VaR
∵ 2.33	→	$ 30000
∴ 1.645	→	? = $ 21180

Caution Note
Cross multiplication is applied on corresponding Z nos. Don't make the mistake of applying cross multiplication directly between Var%

Question 1

2 Questions Merged, Study Material, (4 Marks) Exam Nov 19, MTP May 25

Consider a portfolio consisting of a ₹ 200,00,000 investment in share XYZ and a ₹ 200,00,000 investment in share ABC. The daily standard deviation of both shares is 1% and that the coefficient of correlation between them is 0.3. You are required to determine the 10- day 99% value at risk for the portfolio?
Also find out the benefit of diversification in terms of VaR .

Solution: The standard deviation of the daily change in the investment in each asset is ₹ 2,00,000 i.e. 2 lakhs. The variance of the portfolio's daily change is

$$V = 2^2 + 2^2 + 2 \times 0.3 \times 2 \times 2 = 10.4$$

σ (Standard Deviation) = 10.4 = ₹ 3.22 lakhs

Accordingly, the standard deviation of the 10-day change is
₹ 3.22 lakhs $\times \sqrt{10}$ = ₹ 10.18 lakh

From the Normal Table we see that z score for 1% is 2.33. This means that 1% of a normal distribution lies more than 2.33 standard deviations below the mean. The 10-day 99 percent value at risk is therefore

2.33 × ₹ 10.18 lakh = ₹ 23.72 lakh

Benefit of diversification

Daily σ_{XYZ} & σ_{ABC} = ₹ 200000 each
10 days σ_{XYZ} & σ_{ABC} = ₹ 200000 $\times \sqrt{10}$ = ₹ 632455 each
10 days 99% VaR = 2.33 x ₹ 632455 x 2 stocks
= ₹ 29.47 lakh

∴ Benefit of diversification in terms of VaR = ₹ 29.47 lakh - 23.72 lakh = ₹ 5.75 lakh

Question 2

(8 Marks) Exam May 2023, MTP Nov 2024, RTP May 2025

Mr. Bull is a rational risk taker. He takes his position in a single stock for 4 days in a week. He does not take a position on Friday to avoid weekend effect and takes position only for four days in a week i.e. Monday to Thursday. He transfers the amount on Monday morning and withdraws the balance on Friday morning. He desires to make a maximum investment where Value At Risk (VAR) should not exceed the balance lying in his bank account. The position by his manager, as per standing instructions, is taken on the free balance lying in the bank account in the morning on each Monday.

On Monday morning (before opening of the capital market) he has transferred an amount of ₹ 11 crore to his bank account. A fixed deposit also matured on this Monday. The maturity amount of ₹ 63,42,560 was also credited to his account by the bank in the morning of the Monday. However, Mr. Bull received the intimation of the same in the evening. The bank needs a minimum 1,000 all the time. The value of Z score, at the required confidence level of 99 percent is 2.33.
The other information with respect to stocks X and Y, which are under consideration for this week, is as under:

X		Y	
Return	Probability	Return	Probability
6	0.10	4	0.10
7	0.25	6	0.20
8	0.30	8	0.40
9	0.25	10	0.20
10	0.10	12	0.10

You are required to recommend a single stock, where maximum investment can be made.

Solution: Working Notes:

(1) Security X

Return (1)	Prob. (2)	(1) x (2)	Dev.	Dev.^{2}	Dev.^{2} x Prob.
6	0.10	0.60	-2	4	0.40
7	0.25	1.75	1	1	0.25
8	0.30	2.40	0	0	0
9	0.25	2.25	1	1	0.25
10	0.10	1.00	2	4	0.40
		8.00			1.30

Expected Return (R_x) = 8.00%
Variance (σ^2_x) = 1.30
Standard Deviation (σ_x) = $\sqrt{1.30}$ = **1.14**

(2) Security Y

Return (1)	Prob. (2)	(1) x (2)	Dev.	Dev.^{2}	Dev.^{2} x Prob.
4	0.10	0.40	-4	16	1.60
6	0.20	1.20	-2	4	0.80
8	0.40	3.20	0	0	0
10	0.20	2.00	2	4	0.80
12	0.10	1.20	4	16	1.60
		8.00			4.80

Expected Return (R_Y) = 8.00%
Variance (σ^2_Y) = 4.80
Standard Deviation (σ_Y) = $\sqrt{4.80}$ = 2.19

	No. of days	X	Y
Amount Transferred		₹ 110000000	₹ 110000000
Maturity Proceeds of Fixed Deposit		₹ 6342560	₹ 6342560
Amount available in bank account		₹ 116342560	₹ 116342560
Minimum balance to be kept		₹ 1000	₹ 1000
Available amount which can be used for potential investment for 4 days		₹ 116341560	₹ 116341560
Maximum loss for 4 days at 99% level	4	₹ 116341560	₹ 116341560
Maximum loss for 1 day at 99% level = Maximum loss for 4 days /$\sqrt{\text{No. of days}}$ = 116341560 /$\sqrt{4}$	1	₹ 58170780	₹ 58170780
Z Score at 99% level		2.33	2.33
Volatility in terms of ₹ (Maximum Loss/Z Score at 99% Level)		₹ 24966000	₹ 24966000
Standard Deviation		0.0114	0.0219
Maximum Investment (Volatility in terms of ₹ / SD)		₹ 2190000000	₹ 1140000000

Recommendation: Position should be taken in X.

Mutual Funds

Terminologies

LDR 1 Hr
LMR 5 Mins

NAV [Net Assets Value]

Total NAV = Market Value of All assets *less* Outside liabilities

$$NAV_{Pu} = \frac{\text{MV of All Assets less Outside liabilities}}{\text{No. of units outstanding}}$$

➢ Format to calculate closing NAV using closing balances

Particulars	₹
Market Value of Investments - Equity, Fixed Income Securities etc	xxx
Other Assets	xxx
Receivables e.g. Dividend receivable	xxx
Accrued Income e.g. Intt Accrued	xxx
Closing Cash & Bank Balance	xxx
Total MV of all Assets	xxx
Less: Outside Liabilities	
Accrued/Outstanding Expenses	(xxx)
Other Payables/ Liabilities eg. amount payable on shares	(xxx)
Total NAV of the scheme	xxx

How to Calc Closing Cash & Bank Bal (if reqd)	
Opening Cash Balance	xxx
+ Issue Proceeds *less* Initial Expenses	Inflow
+ Proceeds from sale of securities	Inflow
+ Interest/Dividend Income received	Inflow
+ Amount recd on issue of new units	Inflow
(-) Purchase of Securities	Outflow
(-) Operating Expenses Paid in cash	Outflow
(-) Realized earnings distribution • Dividend Income distribution • Capital Gain distribution	Outflow Outflow Outflow
(-) Units repurchased by mutual fund during the period	Outflow
Closing Balance	xxx

Caution Note

'Expenses Accrued' are deducted as outside liabilities but 'Expenses Paid during the period' are not Outside liabilities

➢ Format to calculate Closing NAV using Opening NAV

	Opening Value of Net Asset (Opening Units x Opening NAV)	xxx
Add:	Portfolio Value Appreciation during the period	xxx
	Amount recd on Issue of units (Issue Price x No. of units issued)	xxx
	Income of given Months in Current Period eg Dividends	xxx
	Amount received from sale of securities	xxx
Less:	Units Repurchased (Repurchase Price x No. of units repurchased)	(xxx)
	Income Distributed	(xxx)
	Amount paid for purchase of securities	(xxx)
	Closing Net Assets Value	xxx
	÷ Closing No. of Units	xxx
	NAV pu	₹ xx.xx

Expense Ratio or Management Expense Ratio (MER)

It is the %age of Assets of MF that were spent to operate a MF
It includes Operating expenses such as Office Exps, Rent, Staff, Salary, Management & advisory fee, Travel Costs & consultancy fees etc.
It excludes Brokerage Cost for Trading the Portfolio

$$\text{Expense Ratio} = \frac{\text{Total Expenses}}{\text{Average Total NAV}} \times 100 \text{ or } \frac{\text{Expenses per unit}}{(NAV_0 + NAV_1)/2} \times 100$$

Return on MF [From an investor's/ Unit-holder's point of view]

$$\text{Return\%} = \frac{D_1 + CG_1 + NAV_1 - NAV_0}{NAV_0} \times 100$$

here, D_1 means Dividend Distributions
CG_1 means Capital Gains Distributions

To calc Annualized Return, further add $\times \frac{\text{"12"}}{n}$ or $\times \frac{\text{"365"}}{n}$ to the above formula

Further, No. of days count will be inclusive of both entry date & exit date

Exam Tip. When annualization should be done by no. of days / months ?

If investment horizon is < 1 year

- If investment& redemption dates are given → Annualize by $\frac{365}{n}$
- If dates are not given → Annualize by $\frac{12}{n}$

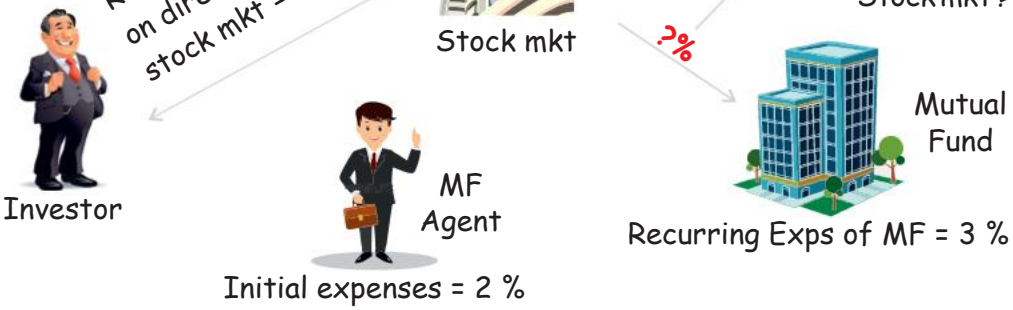
If investment horizon is > 1 year → Annualize by $\frac{12}{n}$

Even if dates are given simply ignore the dates in this case provided dates are either first or last date of respective months.
If Intermediate dates in the month are given then we have to use No. of days.

Tutorial Note:
Above rule is followed by ICAI 99% of the times, but not 100% of the times !

Return to be earned by a MF to match Investor's expectations

Example



Calculate Return to be earned by a MF to provide same income as Investor could have earned directly from Stock mkt ?

$$\text{Solve } R_2 = \frac{R_1}{1 - \text{Initial exps \%}} + \text{Recurring exps\%}$$

$$= \frac{17\%}{1 - 0.02} + 3\% \qquad = 17.35\% + 3\% \qquad = 20.35\%$$

here,
R_1 means return earned by an investor on his direct investment
R_2 means return to be earned by a MF

Various Types of MF Plans

Growth Plan

Return comes only in the form of price appreciation i.e. NAV will keep on increasing. Hence,
(i) NO Dividends Payout
(ii) NO Bonus Issues
(iii) Number of units remain same

Dividend plan

Dividend Plan

MF will declare dividends & investors will receive it in their bank accounts

Dividend Reinvestment Plan

MF will declare dividends but the same will be reinvested at the then prevailing NAV & hence addl. no. of units will be issued.

Bonus plan

MF declares bonus units at regular intervals. hence Number of units increases. with time.

Dividend reinvestment plan working

MF Inv. A
₹ 50000
☑ Dividend Plan
☐ Div Reinv Plan

MF Inv. B
₹ 50000
☐ Dividend Plan
☑ Div Reinv Plan

MF - Balance Sheet

			NAV_{pu}
Beginning			
Unit Capital (FV = ₹ 10) n = 10000 units issued	100000	Inv in shares	100000 → ₹ 10_{pu}
During the period			
		+ Portfolio value Appreciation (Unrealized)	18000 → ₹ 11.8_{pu}
		+ Income received (Div. & Cap gain)	5000 → ₹ 12.3_{pu}
End of the period			
		Less : Dividend declared	(5000)
		Ex - Div Total NAV	118000 → ₹ 11.8_{pu}
		Add: Dividend Reinv.	2500
		Total NAV after Div Reinv	120500 → ₹ 11.8_{pu}

₹ 2500 dividend to Mr. A

No. of units issued on div. reinv. = 211.86 units [₹ 2500 ÷ 11.8]

10211.86 units outstanding

Return to MF Inv A

$$R\% = \frac{D_1 + CG_1 + NAV_1 - NAV_0}{NAV_0}$$

$$= \frac{0.50 + 11.8 - 10}{10}$$

= 23%

Return to MF Inv B

$$= \frac{0 + (11.8 \times 5211.86) - (10 \times 5000)}{(10 \times 5000 \text{ units})} \times 100$$

= 23%

Observations :

1. Dividend is always reinvested at Ex-div NAV_{pu}
2. Even after div. reinv , NAV_{PU} remains the same
3. Return% earned by MF Inv A & B will be the same immediately after payment of dividends. However, for futures periods, total returns (absolute) may differ for the two investors.
   Disclaimer: If Q says Div. Reinv at Avg NAV (not Ex-div NAV) then Return for the two investors will differ.

Format for solving Practical Question of Dividend Reinvestment Scheme

Date	Opening units	Dividend (%)	Dividend Reinvested (in ₹)	NAV pu	New Units on Reinv	Closing Units
	(a)		(b)	(c)	(d) = (b÷c)	(e) = (a+d)
Investment Date	xx					
Dividend Payment Dates	xx	xx	xx	xx	xx	xx

Format for Solving Practical Question of Bonus Scheme

Date	Opening Units	Bonus Ratio	Bonus Units	Closing Units
			Total Closing Units	
			x NAV p u	
			Total Redemption Value	

Entry load & Exit load

Entry load
aka Front - end load
aka Sales load
means charges at the time when an Investor purchases MF Units

vs.

Exit load
aka Back - end load
aka Purchase load
Charges at the time when an Investor sells/ redeems MF Units

Example: An investor invest ₹ 10,000 in a MF having unit price of ₹ 78.

Sale price / Issue Price of MF units by a MF = NAV (1 + Front end load %)
= ₹ 78 (1 + say 2%)
= ₹ 79.56 i.e. 1256.91 units issued

or

Purchase Price of MF units by an investor

OR

$$= \frac{NAV}{1 - \text{Front end load \%}}$$

$$= \frac{₹\ 78}{1 - 0.02}$$

= ₹ 79.59 i.e. 1256.44 units issued

Purchase price / Redemption price of MF units by a MF = NAV (1 - exit load %)
= 78 (1 - say 3%)
= ₹ 75.66

or

Redemption Price /Sale Price of MF units by an investor

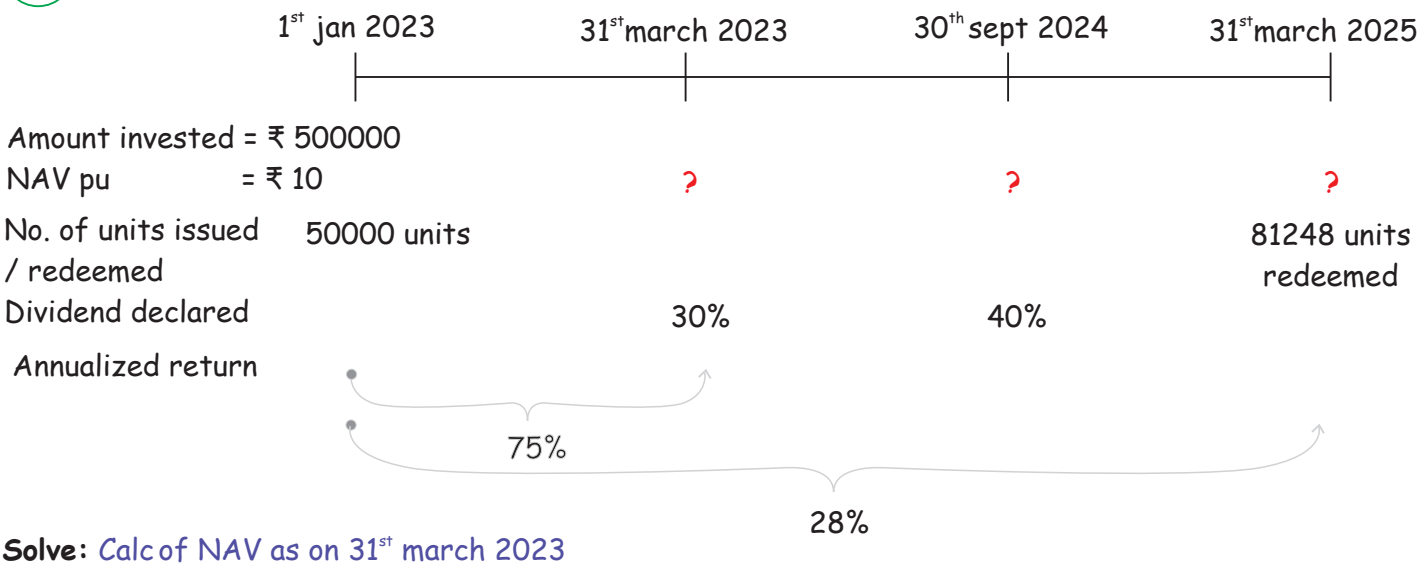
OR

$$= \frac{NAV}{1 + \text{Exit load \%}}$$

$$= \frac{₹\ 78}{1 + 0.02} = ₹\ 76.47$$

Total Amt recd on redemption = ₹ 75.66 or ₹ 76.47 x No. of units held

Reverse calculation of NAV



Solve: Calc of NAV as on 31st march 2023

$$\text{Annualized return \%} = \frac{D_1 + CG_1 + NAV_1 - NAV_0}{NAV_0} \times 100 \times \frac{12}{n}$$

$$75 = \frac{3 + 0 + NAV_1 - 10}{10} \times 100 \times \frac{12}{3}$$

$$\therefore NAV_1 = ₹\ 8.875$$

$$\text{Addl. units issued on div. reinvestment} = \frac{₹\ 10 \times 30\% \times 50000 \text{ units}}{8.875} = 16901.41 \text{ units}$$

∴Total no. of units o/s as on 31st march 2023
= 50000 + 16901.41 units = 66901.41 units

Calc of NAV as on 30th sept. 2024

Total dividend amount = ₹ 10 x 40% x 66901.41 units
= ₹ 267605.64

Addl. units issued on reinv. of dividend = 81248 units - 66901.41 units = 14346.59 units

$$\therefore NAV = \frac{₹\ 267605.64}{14346.59 \text{ units}} = ₹\ 18.65$$

Calc of NAV as on 31st march 2025

$$\text{Annualized return \%} = \frac{NAV_1 - NAV_0}{NAV_0} \times 100 \times \frac{12}{n}$$

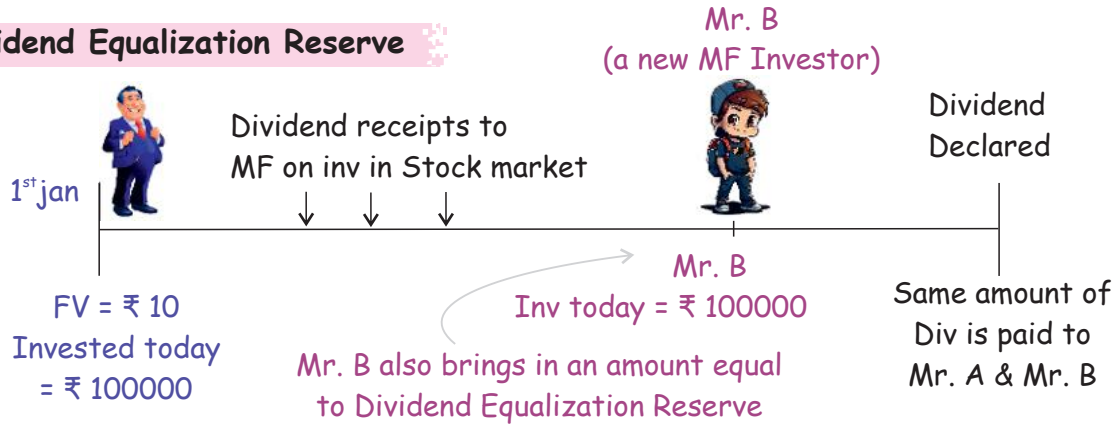
Caution Note: Here we'll use total data instead of per unit because No. of units are different at beginning & at the end

$$28 = \frac{NAV_1 \text{ pu} \times 81248 \text{ units} - 500000}{500000} \times 100 \times \frac{12}{27}$$

$$\therefore NAV_1 = 10.03$$

Caution Note:
Don't include D_1 & CG_1 in this formula because such div. have been reinvested & hence would come as part of increased no. of units in total NAV_1. By mistake if we still write D_1 then it will be double counting of such returns

Dividend Equalization Reserve



New MF Investor Mr. B should ideally be Not entitled to any share of income of MF that arose before his entry. However, at the end of each distribution period, MF still allocates the same amount of dividend to each unit holder irrespective of their investment date.

To Compensate for the above an Equalization Payment is added to the Cost of each unit.

How much amount is recovered pu / paid pu to an Incoming/Outgoing MF Investor ?

Calculation of Issue Price	
Opening NAV_{PU}	
Add: Entry Load @ say 2%	
Total	
Add: Dividend Equalization amt	
Issue Price	xx

i.e. Amount a New MF Investor pays

Caln of Repurchase/Redemption Price	
Opening NAV	
Less: Exit Load @ say 2%	
Total	
Add: Dividend Equalization amt	
Redemption Price	xx

Entry/Exit load% is not charged on the amt recd/paid in the name of Dividend Equalization Reserve

Calculation of Income available for Distribution of MF

	Units	Income Per Unit	Total Income (say, ₹ lakhs)
Income of 1st Month	xx [Op units]	xx	xx
Add: Dividend Equalisation received on Issue @ above p.u. income	xx [Units Issued]	xx	xx
Total	xx	xx	xx
Add: Income of 2nd month	-	xx	xx
Let's suppose we have Redemption in this mnth	xx	xx	xx
Less: Dividend Equalisation Paid on repurchase of units @ above p.u. income	(xx) [units repurchased]	(xx)	(xx)
Total	xx	xx	xx
Add: Income of 3rd month	-	xx	xx
Total	xx	xx	xx
Less: Dividend Distributed at the end of 3rd month	-	(xx)	(xx)
	xx	xx	xx

Hedge Funds / Portfolio mngt. service - fee structure

Fee Structure : 1/20

Fixed fee @1% as a % of AUM

Incentive based fee @20% Sharing in profits

If high water-mark provision is applicable, then it means Commission. i.e. incentive based fee could be charged only after crossing last highest value of the portfolio

Active Returns [aka Tracking Difference]

is the Average of difference in Returns from MF as compared to the Returns from Benchmark Index.

Active Returns = R_P less R_B

Tracking Error

can be defined as the divergence or deviation of a fund's returns from the Benchmark it is following.

$$TE = \sqrt{\frac{\Sigma (d - \bar{d})^2}{n - 1}}$$

here,
d = Differential return (Return on mutual fund - Return on benchmark)
$\bar{d}$ = Average differential return
n = No. of observation

Information Ratio

Active Returns earned per unit of Tracking Error

$$= \frac{\text{Average Active Returns}}{\text{Tracking Error}}$$

Example

R_P	R_B	$d = R_P - R_B$	$d - \bar{d}$	$(d - \bar{d})^2$
5.8%	4.5%	1.3%	0.04%	...
8%	7%	1%	- 0.26%	...
7%	10%	- 3%	- 4.26%	...
2%	- 1%	3%	1.74%	...
10%	6%	4%	2.74%	...
		Σd = 6.3% or ΣAR		28.752

Avg Active Return $(\bar{d}) = \frac{6.3\%}{5} = 1.26\%$

Tracking Error $= \sqrt{\frac{\Sigma (d - \bar{d})^2}{n - 1}}$

$= \sqrt{\frac{28.752}{5 - 1}}$

$= \sqrt{7.188} = 2.68\%$

Information ratio $= \frac{1.26\%}{2.68\%} = 0.47$

Question 1

(8 Marks), Exam May 2014

Based on following data, estimate Net Asset Value on per unit basis of a Regular Income Scheme of a Mutual Fund:

	₹ Lakhs
Listed shares at cost (ex-dividend)	40.00
Cash in hand	2.76
Bonds and Debentures at cost	8.96
Of these, Bonds not listed and quoted	2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amounts payable on shares	13.54
Expenditure accrued	1.76

Current Realizable Value of Fixed Income Securities of Face Value of ₹ 100 is ₹ 96.50.

Number of Units (₹ 10 Face Value each): 2,75,000

All the Listed Equity Shares were purchased at a time when Market Portfolio Index was 12,500. On NAV date, the Market Portfolio Index is at 19,975.

There has been a diminution of 15% in Unlisted Bonds and Debentures Valuation.

Listed Bonds and Debentures carry a Market Value of ₹ 7.5 Lakhs, on NAV date.

Operating Expenses paid during the year amounted to ₹ 2.24 Lakhs.

Solution: Calculation of NAV

Particulars	Adjusted Value ₹ lakhs
Equity Shares	63.920
Cash in hand	2.760
Bonds and debentures not listed	2.125
Bonds and debentures listed	7.500
Dividends accrued	1.950
Fixed income securities	9.409
Sub total assets (A)	87.664
Less: Liabilities	
Amount payable on shares	13.54
Expenditure accrued	1.76
Sub total liabilities (B)	15.30
Net Assets Value (A) – (B)	72.364
No. of units	2,75,000
NAV per unit (₹ 72.364 lakhs / 2,75,000)	₹ 26.3142

Tutorial Note: Operating Expenses of ₹ 2.24 lakhs paid during the year are not relevant for calculation of NAV.

Question 2

2 Questions Merged | Study Material, (5M) Exam N04, M15, N16, July 21

A has invested in three Mutual Fund Schemes as per details below:

	MF A	MF B	MF C
Date of investment	01.12.2009	01.01.2010	01.03.2010
Amount of investment	₹ 50,000	₹ 1,00,000	₹ 50,000
Net Asset Value (NAV) at entry date	₹ 10.50	₹ 10	₹ 10
Dividend received upto 31.03.2010	₹ 950	₹ 1,500	Nil
NAV as at 31.03.2010	₹ 10.40	₹ 10.10	₹ 9.80

Required:
What is the effective yield on per annum basis in respect of each of the three schemes to Mr. A upto 31.03.2010?
Provide a brief comment on the course of action he should take for future period.
What if in above Q, "Date of investment" is NOT given. Instead Effective Yield % as calculated above is given.
What if in above Q, "NAV at entry date" is NOT given. Instead Effective Yield % as calculated above is given.

Solution: Calc of Effective Yield on Per Annum Basis in Respect of Three mutual fund schemes up to 31.03.2010

	Particulars	MF A	MF B	MF C
1	Investment (₹)	50000	100000	50000
2	Unit NAV at entry date	10.50	10	10
3	Nos. of Units (Investment / NAV at entry date)	4761.905	10000	5000
4	Unit NAV at 31.03.2010 (₹)	10.40	10.10	9.80
5	Total NAV 31.03.2010 (₹)	49523.81	101000	49000
6	Increase / Decrease of NAV (5 - 1) (₹) i.e. Capital Yield	(476.19)	1000	(1000)
7	Dividend Received (₹)	950	1500	Nil
8	Total yield (Capital Yield + Dividend Yield)	473.81	2500	(1000)
9	Number of Days	121	90	31
10	Effective Yield (% p.a) [(Total Yield / Investment) x (365 / No of days) x 100]	2.858%	10.139%	(-) 23.55%

Comment: Since the effective yield in scheme C is negative and that of scheme A is much lower than scheme B, it is advised that Mr K should redeem the investments in scheme A and scheme C and the proceeds should be invested in scheme B in the next period.

Calculation of No. of Days Investment Held

	MF 'X'	MF 'Y'	MF 'Z'
Initial Investment (₹)	50000	100000	50000
Yield (₹)	473.81	2500	(1000)
Yield (%)	0.9476%	2.5%	-2%
Period of Holding (Days)	$\frac{0.9476}{2.858}$ x 365 = 121 days	$\frac{2.5}{10.139}$ x 365 = 90 days	$\frac{-2}{-23.55}$ x 365 = 31 days
Date of Original Investment	01.12.2009 [31.03.10 *less* 121 days]	01.01.2010	01.03.2010

Calculation of NAV at entry date

	MF 'X'	MF 'Y'	MF 'Z'
Total amt avlbl on 31.03.2010	₹ 50473.72 [₹ 50,000 x (1+0.009476)]	₹ 1,02,500 [₹ 1,00,000 x (1+0.025)]	₹ 49,000 [₹ 50,000 x (1-0.02)]
Less: Dividend received	950	1500	Nil
Total NAV as on 31.03.2010	49,523.72	1,01,000	49,000
÷ NAV pu	10.40	10.10	9.8
No. of units at the beginning	4761.90	10,000	5000
NAV at entry date	₹ 50,000/ 4761.90 = ₹ 10.50	₹ 1,00,000/ 10,000 = ₹ 10	₹ 50,000/ 5000 = ₹ 10

Question 3

Study Material, (8 Marks) Exam May 06, Nov 18, Sep 25, MTP Sep 22, Nov 23

A Mutual Fund having 300 units has shown its NAV of ₹ 8.75 and ₹ 9.45 at the beginning and at the end of the year respectively. The Mutual Fund has given two options:

a. Pay ₹ 0.75 per unit as dividend and ₹ 0.60 per unit as a capital gain, or
b. These distributions are to be reinvested at an average NAV of ₹ 8.65 per unit.

What difference it would make in terms of return available and which option is preferable?

Solution:

Option 1: When Dividend and Capital Gain are paid:

Calculation of monthly return on the mutual funds:

$$r = \frac{(NAV_t - NAV_{t-1}) + I_t + CG_t}{NAV_{t-1}} \times 100 = \frac{(₹\ 9.45 - ₹\ 8.75) + ₹\ 0.75 + ₹\ 0.60}{8.75} \times 100 = \frac{0.70 + 1.35}{8.75} = 23.43\%$$

Option 2: When Dividend and Capital Gain are reinvested:

If all dividends and capital gain are reinvested into additional units at ₹ 8.65 per unit the position would be.

Total amount reinvested = ₹ 1.35 x 300 = ₹ 405

$$\text{Additional units added} = \frac{₹\ 405}{8.65} = 46.82 \text{ units}$$

Value of units at the end = 346.82 units x ₹ 9.45 = ₹ 3277.45

Price paid for 300 units at the beginning = (300 x ₹ 8.75) = ₹ 2,625

Return = (₹ 3277.45 - ₹ 2625)/ ₹ 2625 = 24.85%

Conclusion : Since the holding period reward is more in percentage terms in Option 2 i.e. Reinvestment of distributions at an average NAV of ₹ 8.65 per unit this option is preferable.

Question 4

Study Material, RTP May 2018, Exam Nov 2005, Nov 2019

Sun Moon Mutual Fund (Approved Mutual Fund) sponsored open-ended equity oriented scheme "Chankya Opportunity Fund". There were three plans viz. 'A' – Dividend Re-Investment Plan, 'B' – Bonus Plan & 'C' – Growth Plan.

At the time of Initial Public Offer on 1.4.1995, Mr. Anand, Mr. Bacchan & Mrs. Charu, three investors invested ₹ 1,00,000 each and chosen 'B', 'C', 'A' Plan respectively.

The History of the Fund is as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value Per unit (F.V. ₹ 10)		
			Plan A	Plan B	Plan C
28.07.1999	20		30.70	31.40	33.42
31.03.2000	70	5:4	58.42	31.05	70.05
31.10.2003	40		42.18	25.02	56.15
15.03.2004	25		46.45	29.10	64.28
31.03.2004		1:3	42.18	20.05	60.12
24.03.2005	40	1:4	48.10	19.95	72.40
31.07.2005			53.75	22.98	82.07

On 31st July all three investors redeemed all the balance units.

Calculate annual rate of return to each of the investors.

Consider:

1. Long-term Capital Gain is exempt from Income-tax.
2. Short-term Capital Gain is subject to 10% Income-tax.
3. Security Transaction Tax 0.2 per cent only on sale/ redemption of units.
4. Ignore Education Cess

Solution: (i) Return of Mrs. Charu invested in Plan A (Dividend Reinvestment) (Amount in ₹)

Date	Investment	Dividend payout (%)	Dividend Re-invested (Closing Units X Face value of ₹ 10 X Dividend Payout %)	NAV	Units	Closing Unit Balance Σ Units
01.04.1995	1,00,000.00			10.00	10,000.00	10,000.00
28.07.1999		20	20,000.00	30.70	651.47	10,651.47
31.03.2000		70	74,560.29	58.42	1,276.28	11,927.75
31.10.2003		40	47,711.00	42.18	1,131.13	13,058.88
15.03.2004		25	32,647.20	46.45	702.85	13,761.73
24.03.2005		40	55,046.92	48.10	1,144.43	14,906.16

Redemption value 14,906.16 × 53.75	8,01,206.10
Less: Security Transaction Tax (STT) is 0.2%	1,602.41
Net amount received	7,99,603.69
Less: STCG tax @ 10% on 1,144.43 (53.75* – 48.10) = 6,466	646.60
Net of tax	7,98,957.09
Less: Investment	1,00,000.00
	6,98,957.09

*As per income Tax Act, no deduction of STT shall be allowed in computation of capital gain

Annual average return (%) $\frac{6,98,957.09}{1,00,000} \times \frac{12}{124} \times 100 = 67.64\%$

(ii) Return of Mr. Anand invested in Plan B – (Bonus) (Amount in ₹)

Date	Units	Bonus units	Total Balance	NAV per unit
01.04.1995	10,000		10,000	10
31.03.2000		12,500	22,500	31.05
31.03.2004		7,500	30,000	20.05
24.03.2005		7,500	37,500	19.95

Redemption value 37,500 × 22.98	8,61,750.00
Less: Security Transaction Tax (STT) is 0.2%	1,723.50
Net amount received	8,60,026.50
Less: Short term capital gain tax @ 10% [7,500 × (22.98 – 0*) = 172350]	17235
Net of tax	842791.5
Less: Investment	1,00,000.00
Net gain	7,42,791.50

* As per Income Tax Act, Cost of Bonus units is taken as zero

Annual average return (%) $\frac{7,42,791.50}{1,00,000} \times \frac{12}{124} \times 100 = 71.88\%$

(iii) Return of Mr. Bacchan invested in Plan C – (Growth)

Redemption value 10,000 × 82.07	8,20,700.00
Less: Security Transaction Tax (S.T.T) is .2%	1,641.40
Net amount received	8,19,058.60
Less: Short term capital gain tax @ 10%	0.00
Net of tax	8,19,058.60
Less: Investment	1,00,000.00
Net gain	7,19,058.60

Annual average return (%)

$\frac{7,19,058}{1,00,000} \times \frac{12}{124} \times 100 = 69.59\%$

Question 5 (10 Marks) Exam Nov 2020, May 2023, RTP May 2023

M/S. Corpus an AMC, on 1.04.2015 has floated two schemes viz. Dividend Plan and Bonus Plan. Mr. X, investor has invested in both the schemes. The following details (except the issue price) are available:

			NAV	
Date	Dividend (%)	Bonus Ratio	Dividend Plan	Bonus Plan
1.04.2015			?	?
31.12.2016		1:4 (One unit on 4 units held)	47	40
31.03.2017	12		48	42
31.03.2018	10		50	39
31.12.2018		1:5 (One unit on 5 units held)	46	43
31.03.2019	15		45	42
31.03.2020	-		49	44

Additional details

Investment (₹)	₹ 9,20,000	₹ 10,00,000
Average Profit (₹)	₹ 27,748.60	
Average Yield (%)		6.40

You are required to calculate the issue price of both the schemes as on 1.04.2015.

Solution: (i) Dividend Plan

(a)	Average Annual gain over a period of 5 Years	₹ 27748.60
(b)	Total gain over a period of 5 years (a*5)	₹ 138743
(c)	Initial Investment	₹ 920000
(d)	Total value of investment (b + c)	₹ 1058743
(e)	NAV as on 31.3.2020	₹ 49
(f)	Number of units at the end of the period as on 31.03.2019 (d/e)	21607

	1	2	3	4 = (2 * 3)	5	$6 = \frac{(1+4)}{(4+5)}$	7
Period	Units held	Rate	Unit value	Dividend	NAV	New Units*	Balance Units Pre-Dividend
31.03.2019	21607	0.15	10	1.5	45	697	20910
31.03.2018	20910	0.1	10	1	50	410	20500
31.03.2017	20500	0.12	10	1.2	48	500	20000

Issue Price as on 01.04.2015 Investment 920000/ Units purchased 20000 (c/i) = ₹ 46

*Let the units issued be X

X = (Closing Units/NAV + Dividend) x Dividend

(ii) Bonus Plan

(a) Average Yield	0.064
(b) Investment	₹ 1000000
(c) Gain over a period of 5 years (a*b*5)	₹ 320000
(d) Market Value as on 31.03.2019 (b + c)	₹ 1320000
(e) NAV as on 31.03.2020	₹ 44
(f) Total units as on 31.03.2020 (d/e)	30000
(g) No of units as on 31.03.2018 Pre bonus = 30000*5/ (5 + 1)	25000
(h) No of units as on 31.12.2016 Pre bonus = 25000*4/ (4 + 1)	20000
(i) Issue Price as on 01.04.2015 Investment 1000000/ Units purchased 20000 (b/h)	₹ 50

Question 6 (8 Marks) Exam May 2022, MTP Sep 2025

Mr. D had invested in three mutual funds (MF) as per the following details:

Particulars	MF 'A'	MF 'B'	MF 'C'
Amount of Investment	2,00,000	5,00,000	4,00,000
NAV at the time of purchase	10.00	25.00	20.00
Dividend Yield up to 31.03.2022	3%	5%	4%
NAV as on 31.03.2022	10.50	22.80	20.80
Annualized Yield as on 31.03.2022	9.733%	-11.185%	15%

Assume 1 Year = 365 Days.

Mr. D has misplaced the documents of his investments.

You are required to help Mr. D to find out the following:

(i) Number of units allotted in each scheme,

(ii) Value of his investments as on 31.03.2022,

(iii) Holding period of his investments in number of days as on 31.03.2022

(iv) Dates of original investments

(v) Total Return on investments, (Alt terminology: Total Yield)

(vi) Assuming past performance of all three schemes will continue for next one year, what action the investor should take? What will be the expected return for the next one year after the above action?

(vii) Will your answer as above point no. (vi) changes if the Mutual fund charges exit load of 5% if the investment is redeemed within one year? If so, advise the investor what and when the action to be taken to optimise the returns.

Solution:

(i) Number of Units in each Scheme

MF 'A'	₹ 2,00,000 / ₹ 10.00	= 20,000
MF 'B'	₹ 5,00,000 / ₹ 25.00	= 20,000
MF 'C'	₹ 4,00,000 / ₹ 20.00	= 20,000

(ii) Value of Investment on 31.03.2022

MF 'A'	= 20,000 x ₹ 10.50	₹ 2,10,000
MF 'B'	= 20,000 x ₹ 22.80	₹ 4,56,000
MF 'C'	= 20,000 x ₹ 20.80	₹ 4,16,000
Total		**₹ 10,82,000**

(iii) Yield on each Fund

	Capital Yield	Dividend Yield	Total	Yield (%)
MF 'A'	₹ 2,10,000 - ₹ 2,00,000 = ₹ 10,000	₹ 6,000	₹ 16,000.00	8.00
MF 'B'	₹ 4,56,000 - ₹ 5,00,000 = - ₹ 44,000	₹ 25,000	- ₹ 19,000.00	-3.80
MF 'C'	₹ 4,16,000 - ₹ 4,00,000 = ₹ 16,000	₹ 16,000	₹ 32,000.00	8.00
Total			₹ 29,000.00	

No. of Days Investment Held

	MF 'A'	MF 'B'	MF 'C'
Period of Holding (Days)	$\frac{8.00}{9.733}$ x 365 = 300 Days	$\frac{-3.80}{-11.185}$ x 365 = 124 Days	$\frac{8.00}{15.00}$ x 365 = 195 Days

(iv) Date of Original Investment 05.06.21 28.11.21 18.09.21

Alternatively, following dates can also be considered

Date of Original Investment 04.06.21 27.11.21 17.09.21

(v) Total Yield = $\frac{₹ 29,000}{₹ 11,00,000}$ x 100 = 2.636%

(vi) If past of all three schemes will continue for next one year, the investor should redeem the units of MFs 'A' and 'B' and invest the proceeds in MF 'C'. The expected return next will be 15%.

(vii) If the Mutual funds are charging exit load of 5%, if investment is redeemed within one year, then investor should get redeemed units of MF 'B' now and units of MF 'A' after 65 days.

Question 7 Study Material, (8 Marks) Exam Nov 15, Jan 21, May 25, MTP N18, N24, M25, RTP M22

On 1st April, an open ended scheme of mutual fund had 300 lakh units outstanding with Net Assets Value (NAV) of ₹ 18.75. At the end of April, it issued 6 lakh units at opening NAV plus 2% load, adjusted for dividend equalization. At the end of May, 3 Lakh units were repurchased at opening NAV less 2% exit load adjusted for dividend equalization. At the end of June, 70% of its available income was distributed.

In respect of April-June quarter, the following additional information are available:

	₹ in lakh
Portfolio Value appreciation	425.47
Income for April	22.950
Income for May	34.425
Income for June	45.450

You are required to calculate

(i) Income available for distribution; (Alt language in SM Ed 2026: Income available after distribution of dividend)

(ii) Issue price at the end of April;

(iii) repurchase price at the end of May; and

(iv) net asset value (NAV) as on 30th June.

Solution: (i) Calculation of Income available for Distribution/ Calculation of income available after distribution of dividend

	Units (Lakh)	Per Unit (₹)	Total (₹ In lakh)
Income from April	300	0.0765	22.950
Add: Dividend equalization collected on issue	6	0.0765	0.4590
	306	0.0765	23.4090
Add: Income from May		0.1125	34.4250
	306	0.1890	57.8340
Less: Dividend equalization paid on repurchase	3	0.1890	(0.5670)
	303	0.1890	57.2670
Add: Income from June		0.1500	45.4500
	303	0.3390	102.717
Less: Dividend Paid		0.2373	(71.9019)
	303	0.1017	30.8151

(ii) Calculation of Issue Price at the end of April

	₹
Opening NAV	18.750
Add: Entry Load 2% of ₹ 18.750	0.375
	19.125
Add: Dividend Equalization collected on Issue Price	0.0765
	19.2015

(iii) Calc of Repurchase Price at the end of May

	₹
Opening NAV	18.750
Less: Exit Load 2% of ₹ 18.750	(0.375)
	18.375
Add: Dividend Equalization paid on Issue Price	0.1890
	18.564

(iv) Closing NAV

		₹ (Lakh)
Opening Net Asset Value (₹ 18.75 x 300)		5625.0000
Portfolio Value Appreciation		425.4700
Issue of Fresh Units (6 x 19.2015)		115.2090
Income Received (22.950 + 34.425 + 45.450)		102.8250
		6268.504
Less: Units repurchased (3 x 18.564)	-55.692	
Income Distributed	-71.9019	
		(-127.5939)
Closing Net Asset Value		6140.9101
Closing Units (300 + 6 – 3) lakh		303 lakh
Closing NAV as on 30th June		₹ 20.2670

Question 8 (8 Marks) Exam May 2015, Dec 21, RTP May 2019, Nov 2020, May 2024

There are two Mutual Funds viz. D Mutual Fund Ltd. and K Mutual Fund Ltd. Each having close ended equity schemes.

NAV as on 31-12-2023 of equity schemes of D Mutual Fund Ltd. is ₹ 70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Ltd. is ₹ 62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particulars	Equity Schemes	
	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Sharpe Ratio	2	3.3
Treynor Ratio	15	15
Standard Deviation	11.25	5

There is no change in portfolios during the next month and annual average cost is ₹ 3 per unit for the schemes of both the Mutual Funds.

If Share Market goes down by 5% within a month, calculate expected NAV after a month for the schemes of both the Mutual Funds.

For calculation, consider 12 months in a year and ignore number of days for particular month.

Solution: Working Notes:

(i) Decomposition of Funds in Equity and Cash Components

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
NAV on 31.12.23	₹ 70.71	₹ 62.50
% of Equity	99%	96%
Equity element in NAV	₹ 70	₹ 60
Cash element in NAV	₹ 0.71	₹ 2.50

(ii) Calculation Beta

(a) D Mutual Fund Ltd.

$$\text{Sharpe Ratio} = 2 = \frac{E(R) - R_f}{\sigma_D} = \frac{E(R) - R_f}{11.25}$$

$E(R) - R_f = 22.50$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_D} = \frac{16.50}{\beta_D}$$

$\beta_D = 22.50/15 = 1.50$

(b) K Mutual Fund Ltd.

$$\text{Sharpe Ratio} = 3.3 = \frac{E(R) - R_f}{\sigma_K} = \frac{E(R) - R_f}{5}$$

$E(R) - R_f = 16.50$

$$\text{Treynor Ratio} = 15 = \frac{E(R) - R_f}{\beta_K} = \frac{16.50}{\beta_K}$$

$\beta_K = 16.50/15 = 1.10$

(iii) Decrease in the Value of Equity

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Market goes down by	5.00%	5.00%
Beta	1.50	1.10
Equity component goes down	7.50%	5.50%

(iv) Balance of Cash after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Cash in Hand on 31.12.23	₹ 0.71	₹ 2.50
Less: Exp. Per month	₹ 0.25	₹ 0.25
Balance after 1 month	₹ 0.46	₹ 2.25

NAV after 1 month

	D Mutual Fund Ltd.	K Mutual Fund Ltd.
Value of Equity after 1 month		
70 x (1 – 0.075)	₹ 64.75	-
60 x (1 – 0.055)	-	₹ 56.70
Cash Balance	0.46	2.25
	65.21	58.95

Question 9

2 Q Merged | (8 M) Exam May 2022, May 2013, RTP Nov 2022, MTP May 2021, Study Material

A mutual fund made an issue of New Fund Offer (NFO) on 01/01/2021 of 30.00 Lakh Units of ₹ 10 each. Relevant initial expenses involved were ₹ 12 lakhs. It made the following investments:

Particulars	(₹)
25,000 Equity Shares of XYZ Ltd., ₹ 100 each @ ₹ 320	80,00,000
Other portfolio stocks	₹ 1,85,00,000
5% Government Securities	4,00,000
10% NCDs Unlisted	5,00,000
8% Listed Debentures	10,00,000

During the year, dividends of ₹ 8.00 lakhs were received on equity shares. Interest on all types of debt securities were received.

XYZ Ltd., on 15th December 2021 in its AGM declared the interim dividend of 10% and bonus shares at 1:10 with the record date of 28th December 2021.

On 31st December 2021 equity shares of XYZ ltd. were appreciated by 15% [Alt language: Equity shares quoted at 368%] while listed debentures were quoted at 20% premium. The market value of other portfolio stocks was ₹ 198 lakhs.

In addition to above, during the year it disposed off the other portfolio stocks costing ₹ 60 lakhs for ₹ 63 lakhs and used the proceeds in purchasing securities for ₹ 56 lakhs.

(i) Find out the NAV per unit as on 31st December given that the operating expenses during the year amounted to ₹ 11,00,000 of which 10% was in arrears.

(ii) Find out the NAV, if the MF had distributed 80% of the realized earnings during the year to the investors.

(iii) If you are the investor, find out what is the annualised return you have got.

Solution: (i) In order to find out the NAV, the cash balance at the end of the year is calculated as follows

Particulars	₹
Cash balance in the beginning (₹ 300 lakhs – ₹ 12 lakhs)	2,88,00,000
Less: Investment in the beginning	2,84,00,000
Dividend Received	8,00,000
Interest on 5% Govt. Securities	20,000
Interest on 10% NCDs	50,000
Interest on 8% Debentures	80,000
Interim Dividend	2,50,000
	23,00,000
Add: Proceeds from sale of securities	63,00,000
Less: Cost of securities purchased	56,00,000
Less: Operating expenses [11,00,000 less 10%]	9,90,000
Net cash balance at the end	13,10,000

Calculation of NAV	₹
Cash Balance	13,10,000
5% Govt. Securities (at par)	4,00,000
27,500 equity shares @ ₹ 368 each	1,01,20,000
Other portfolio stocks	1,98,00,000
10% NCDs (Unlisted) at cost	5,00,000
8% Debentures @ 120%	12,00,000
Total Assets	3,33,30,000
Less: Arrears of expenses	1,10,000
Closing Net Assets	3,32,20,000
No. of Units	30,00,000
NAV per Unit	₹ 11.0733

(ii) Calculation of NAV, if dividend is paid –

Closing Net Assets	₹ 3,32,20,000
Less: Capital gain distributed [3,00,000 x 80%]	2,40,000
Less: Income and Dividend distributed [(10,50,000 + 1,50,000) x 80%]	9,60,000
Net Assets	3,20,20,000
No. of Units	30,00,000
NAV per unit	₹ 10.6733

(iii) Annualised Return

$$= \frac{11.0733 - 10.00}{10.00} \times 100 = 10.73\%$$

Or

$$= \frac{0.32 + 0.08 + 10.6733 - 10}{10} \times 100 = 10.73\%$$

Question 10 (8 Marks) MTP Oct 2022, MTP Nov 2023

(i) M/s. Strong an AMC has floated a dividend bonus plan on 1st April, 2016 at a certain net asset value (NAV). The fund has a robust growth and has declared a bonus of 1:5 (1 bonus unit for 5 right units held) on 30th September, 2017 and a second bonus of 1:4 (1 bonus unit for 4 right units held) on 30th September 2019. The fund, as on 31st March 2021, has generated an average yield of 17.5%.

Mr. Optimistic has made an investment of ₹ 16 lakhs in the plan before the declaration of the first bonus and remain invested thereafter.

The following information is also available :

Date	01.04.2016	30.09.2017	30.09.2019	31.03.2021
NAV (₹)	?	85	92	100

CALCULATE the opening NAV, which is required by Mr. Optimistic to calculate the capital appreciation.

(ii) The Asset Management Company of the mutual fund (MF) has declared a dividend of 9.98% on the units under the dividend reinvestment plan for the year ended 31st March, 2021. The investors are issued additional units for the dividend at the rate of closing Net Asset Value (NAV) for the year as per the conditions of the scheme.

The closing NAV was ₹ 24.95 as on 31st March, 2021. An investor Mr. X who is having 20,800 units at the year-end has made an investment in the units before the declaration of the dividend and at the rate of opening NAV plus an entry load of ₹ 0.04. The NAV has appreciated by 25% during the year.

Assume the face value of the unit as ₹ 10.00.

CALCULATE:

(1) Opening NAV,

(2) Number of the units purchased,

(3) Original amount of the investment.

Solution:

(i)

Particulars	
(a) Amount invested by Mr. Optimistic as on 01/04/2016	₹ 16,00,000
(b) Gain during 5 years (16,00,000 x 17.5% x 5 years)	₹ 14,00,000
(c) Value of investment as on 31/03/2021 (a + b)	₹ 30,00,000
(d) NAV as on 31/03/2021	₹ 100 per Unit
(e) Total number of units as on 31/03/2021 (c / d)	30000 Units
Total units before second bonus = 30,000 x 4/5	24000 Units
Total units before first bonus = 24,000 x 5/6	20000 Units
NAV as on 01/04/2016 = 16,00,000/ 20000	₹ 80 per Unit

(ii) (1) Let N be the opening NAV, then
N (1 + 0.25) = ₹ 24.95
N = ₹ 19.96
i.e., beginning NAV = ₹ 19.96

(2) Let X be the number of units purchased
Then ending units = 20,800
Accordingly,

$$20800 = X + \frac{0.998X}{24.95}$$

$$20800 = \frac{24.95X+0.998X}{24.95}$$

X = 20000

Thus, number of units to be purchased = 20,000

(3) Original amount of investment

Initial NAV	₹ 19.96
Entry Load	₹ 0.04
	₹ 20.00
Number of funds purchased	20,000
Amount of investment	₹ 4,00,000

Question 12 Study Material, RTP May 2011, Practice Manual, MTP April 2024

ANP Plan, a hedge fund currently has assets of ₹ 20 crore, CA, X, the manager of fund charges fee of 0.10% of portfolio asset. In addition to it he charges incentive fee of 2%. The incentive will be linked to gross return each year in excess of the portfolio maximum value since the inception of fund. The maximum value the fund achieved so far since inception of fund about one and half year was ₹ 21 crores.

You are required to
(i) Evaluate the benchmark return to make Mr. A eligible for incentive fee
(ii) Compute the fee payable to CA. X, if return on the fund this year turns out to be
(a) 29%, (b) 4.5%, (c) -1.8%

Solution:
(i) Benchmark Return = (21 crore - 20 crore) / 20 crore x 100 = 5%
(ii)

(a) If return is 29%

Fixed fee (A) 0.10% of ₹ 20 crore	₹ 2,00,000
New Fund Value (1.29 x ₹ 20 crore)	₹ 25.80 crore
Excess Value of best achieved (25.8 crore – 21.0 crore)	₹ 4.80 crore
Incentive Fee (2% of 4.80 crores) (B)	₹ 9,60,000
Total Fee (A) + (B)	₹ 11,60,000

(b) If return is 4.5%

Fixed (A) 0.10% of ₹ .20 crore	₹ 2,00,000
New Fund Value (1.045 x ₹ 20 crore)	₹ 20.90 crore
Excess Value of best achieved (20.90 crore - 21.00 crore)	(₹ 0.10 crore)
Incentive Fee (as does not exceed best achieved) (B)	Nil
Total Fee (A) + (B)	2,00,000

(c) If return is (-1.8%)
No incentive only fixed fee of ₹ 2,00,000 will be paid

Management of Bonds Portfolio

LDR 1 ½ Hrs
LMR 10 Mins

A Valuation of Bonds | B Types of Yield | C Convertible Bonds/ Preference Shares | D Bond Refunding Decisions | E Types of Risk | F Measurement of Risk - Duration & Volatility | G Bonds Immunization

Valuation of bond

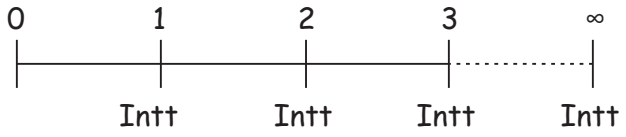
aka Intrinsic Value | True Value | Equilibrium Price

Fair value of Bond today is the 'Present value of Interest & Redemption value' discounted at required rate of return

required rate of return is the Yield% on similar risky bonds in the market.

Caution Note: It is not the Coupon rate%. It is Yield% ie. YTM% on similar risky bonds in the market

If Irredeemable Bond



$$\text{Fair Value} = \frac{\text{Interest}}{\text{Reqd return \%}}$$

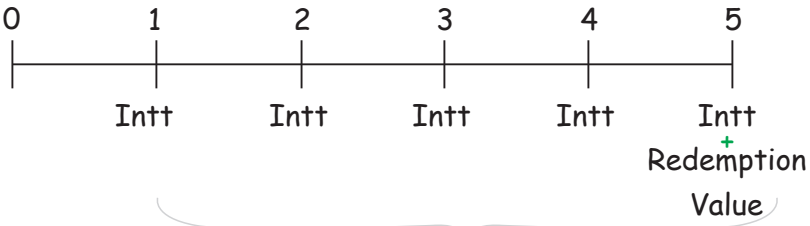
[Imagine PVP = A/r]

If Zero Coupon Coupon

$$\text{Fair Value} = \frac{\text{Redemption Value}}{(1+r)^n}$$

[Imagine Discounting a Single Sum of Money]

If Redeemable Bonds



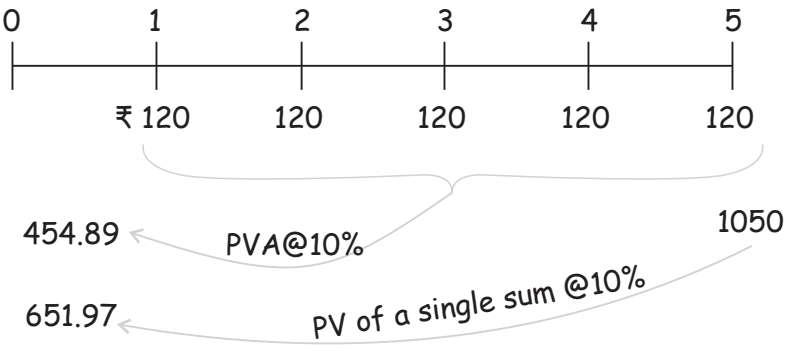
Fair Value
= Interest x $PVAF_{(@\ r\%,\ n\ periods)}$ + Redemption value x $PVF_{(@\ r\%,\ nth\ period)}$

Eg. Eicher Motors

Coupon rate	=	12%
Face value/ Par value/ Nominal value	=	₹ 1000
Life	=	5 years
Market Price	=	₹ 1200 [i.e. Bond is selling at 120% of Par]

Redeemable at 5% premium over par value. Calc fair value if reqd. rate of return is 10%

Solve:



Fair value of Bond = ₹ 1106.86 ~ 1107

Exam presentation

Year	Cash flows	PV @ 10%
1 - 5	Interest = 120	454.89
5	Redemption value = 1050	651.97
	Fair Price =	₹ 1106.86 ~ 1107

or

Fair Value = Interest x $PVAF_{(@\ r\%,\ n\ periods)}$ + Redemption Value x $PVF_{(@\ r\%,\ nth\ period)}$

= ₹ 120 x $PVAF_{(@\ 10\%,\ 5\ years)}$ + ₹ 1050 x $PVF_{(@\ 10\%,\ 5th\ year)}$

= ₹ 1106.86 ~ 1107

Q. Should you buy the bond ?

Answer: No, because Actual price (₹ 1200) > Fair price (₹ 1107) hence bond is Overvalued.

Q. If you still wish to buy above bond @ ₹ 1200 what rate of return will you earn?

Answer: Definitely less than 10% but exactly how much return % !

Concept: Use IRR

		By Trial & Error	
Year	CF's	PV @ 8%	PV @ 7%
1-5	120		
5	1050		
	PV_I =	1193	1241
	PV_O =	(1200)	(1200)
	NPV =	(7)	+41

Using interpolation:

$$= LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}}(HR - LR)$$

$$= 7\% + \frac{41}{41 - (-7)}(8\% - 7\%)$$

= 7.85%

Points to Remember

1. If Face Value of Bond is not given then assume it as ₹ 100 or ₹ 1000 as appropriate.
2. If Redemption Price is not given then assume redemption at Par (irrespective of whether Issue is at a premium or discount)
3. If Bond makes semi-annual coupon payments, then
   - Convert Annual coupon rate to Semi-annual rate [by dividing it by 2]
   - Convert Discounting rate to Semi-annual rate [by dividing it by 2]
   - Convert No. of yrs to maturity to No. of semi-annual periods [by multiplying it by 2]

4. If Spot Yield Curve is given (i.e. spot rates) (i.e. different Yield Rates corresponding to diff. No. of years), then each Cash Flow is discounted with a separate discounting rate corresponding to that much time period. eg Yr3 cashflow is discounted at S_3 for 3 years, yr 4 cashflow is discounted at S_4 for 4 years.

Example: Face Value of the Bond = ₹ 1000 ; Coupon = 12% ; Life = 3 years

Spot Yield Curve rates are:

Year		
	1	10%
	2	10.50%
	3	11%

Calculate Fair Value of the Bond ?

Solve:

$$V_0 = \frac{120}{(1.10)^1} + \frac{120}{(1.105)^2} + \frac{120}{(1.11)^3} + \frac{1000}{(1.11)^3}$$

$$= ₹\ 1026.30$$

Vs.

If Forward Interest Rates are given - Then CF's needs to be discounted with multiple discounting rates for the respective years. - Covered in topic - 'Interest Rate Derivatives'

5. When Bond Beta is given - How to calc Expected Price with the help of Intrinsic Value

Expected Price = Intrinsic Value of Bond i.e. V_0 x Beta of Bond

Example: Fair Value of the Bond = ₹ 1026.30; Beta of Bond = 1.02 times

∴ Expected Price = ₹ 1026.30 x 1.02 = ₹ 1046.83

6. If life of Bond or Preference share is not given in the Q then it is assumed to be infinite.

7. Role of compounding frequencies

Make it a habit to respect compounding frequencies

How to change compounding frequency ?

Use ER NR Formula

NR means Nominal rate i.e. Any rate whose Comp freq. ≠ Annual. Hence, comp semi-ann, comp qtrly, comp monthly etc. are all NR

ER means Effective rate. Any rate which has "Compounding freq. = Annual i.e. __% pa comp annually is called as effective rate

$$ER = \left(1 + \frac{NR}{m}\right)^m - 1$$

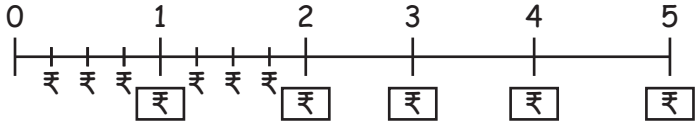
m means No. of compounding in a year.

hence, Compounding Qtrly means m = 4

Compounding monthly means m = 12

Compounding semi-ann means m = 2

Discounting an Annuity

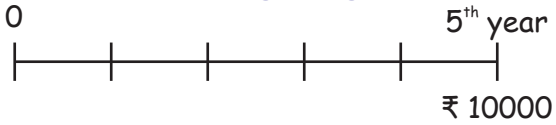


Before discounting an Annuity, make sure Freq. of Discounting rate matches with Freq. of Annuity Cf's

If Freq. ≠ , then use ER NR Formula to first match the frequency & then go for discounting

If Q doesn't define frequency of disc rate in the Q (& this is the most probable scenario in the exam) then simply assume that freq. of disc rate is already same as freq. of CF i.e. if cf's are qtrly then assume that given disc. rate is already comp qtrly. Hence, there will be no need to apply ER NR formula

Discounting a single sum



Unlike an Annuity (an Annuity can be discounted only with such a disc. rate whose frequency matches with freq. of Cf's), a single sum can be discounted with disc. rate of any frequency

Example Calc PV as on today if disc. rate is

(a) 12% pa comp annually

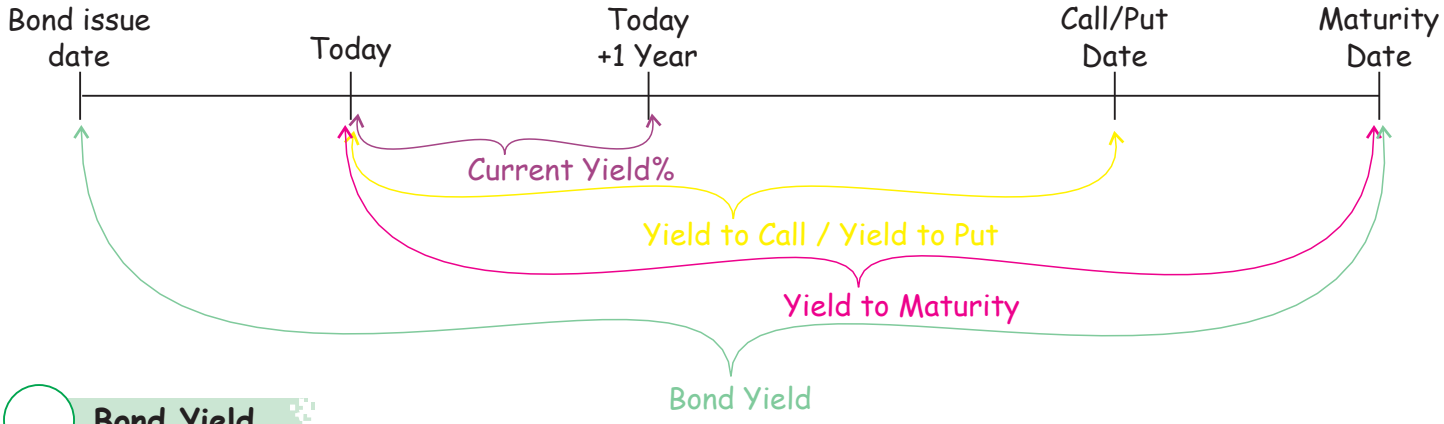
(b) 12% pa comp qtrly

Solve :

(a) PV = 10000 x $PVF_{@12\%,5th\ yr}$ = ₹ 5674.27

(b) PV = 10000 x $PVF_{@3\%,20thQtr}$ = ₹ 5536.75

Various Types of Yield



Bond Yield

Bond yield is the return an investor will earn if he purchases the bond on its issue date & holds the bond until its maturity

Alt1: Accurate Approach

Use IRR

Alt2: Shortcut or Approximate Approach

$$= \frac{I + \frac{RP - IP}{n}}{\frac{RP + IP}{2}}$$

n ← Life of the bond

here, RP means Redemption price

IP means Issue price

If bond is both issued & redeemed at par then Bond yield% = Coupon rate%

Exam Tip

Although very rare, but if Q asks to calculate Post-tax Yield or Post-tax Returns then -

In IRR method, we should write Post-tax Cashflows.

In Shortcut method also appropriate adjustment to calculate Post-tax Yield should be made [generally it would be I(1-t) and/or Capital Gains Tax is also deducted from RP. This note is equally applicable for below varieties of Yield's as well.

Yield to maturity (YTM) / Redemption Yield %

Alt1: Accurate Approach

Use IRR

If a Bond is selling at its par value then its YTM is same as its coupon rate

Alt2: Shortcut - Accurate Approach

$$= \frac{I + \frac{RP - PP}{n}}{\frac{RP + PP}{2}}$$

n ← Remaining life of the bond

Yield to call (YTC)

Alt1: Accurate Approach

Use IRR

Alt2: Shortcut- Approximate Approach

$$= \frac{I + \frac{CP - PP}{n}}{\frac{CP + PP}{2}}$$

n ← No. of yrs till call date

Yield to put (YTP)

Alt1: Accurate Approach

Use IRR

Alt2: Shortcut- Approximate Approach

$$= \frac{I + \frac{\text{Put Price} - \text{Purchase Price}}{n}}{\frac{\text{Put Price} + \text{Purchase Price}}{2}}$$

n ← No. of yrs till put date

Current Yield% [aka Income Yield or Running Yield]

It is the return% in the form of interest over the next 1 year.

$$CY\% = \frac{\text{Annual Interest}}{\text{Market Price}}$$

Caution Note: Don't make the mistake of using Fair Price in the denominator. The correct denominator is Market Price.

Total Yield%

Current yield is an incomplete form of return. It ignores price appreciation%.
To find complete return% over 1 year period, we use Total Yield%

Total yield % = Current yield % + Price Appreciation %

RYTM i.e. Realized Yield to Maturity

i.e. IRR

i.e. MIRR

IRR inherently assumes that intermediate cash flows are reinvested at the same rate as IRR itself.

Proof that IRR assumes Reinvestment @ IRR%

0	1	2	3	4
(1000)	300	400	500	600

This rate is IRR%

500 x 1.2489 → 624

400 x 1.2489^2 → 624

300 x 1.2489^3 → 584

2432

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

$2432 = 1000(1 + r)^4$

$\sqrt[4]{2432} = 1 + r$

$\therefore r = 24.88\% \sim 24.89\%$

However, it may not always be possible to reinvest CF's at the same rate as IRR. Hence, if reinvestment rate is different from IRR we use the concept of MIRR.

Calc MIRR if reinvestment rate is 15% insted of 24.89% ?

Steps to calculate MIRR or RYTM

1. Calculate 'Future Value on Maturity date' of Intermediate Cf's @ Reinvestment Rate%
2. Now Use $FV = PV(1+r)^n$ to find 'r'. The 'r' so calculated is MIRR or RYTM.

Solve: Caln of FV if reinv. rate is 15%

Year	CF's	FV at Yr 4 end @15%
1	300	456
2	400	529
3	500	575
4	600	600
FV at the end of 4th year		2160

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

$2160 = 1000(1 + r)^4$

$\sqrt[4]{2.16} = 1 + r$

$\therefore r = 21.23\%$

i.e. MIRR or RYTM = 21.23%

There is no requirement to calc IRR before calculating MIRR.
MIRR can be calc with the help of reinv. rate only (even if we don't know IRR)

Discount Yield %

$$DY\% = \frac{FV - PP}{FV} \times 100 \times \frac{360}{n}$$

here,

FV means Face Value

PP means Purchase price

Disc yield is a term normally used for short-term govt securities. It calculates Disc% on the base of Face value & annualizes it assuming 360 days in a year.

vs.

Bond Equivalent Yield %

If life < 6 months

$$BEY\% = \frac{FV - PP}{PP} \times 100 \times \frac{365}{n}$$

If life > 6 months

To find BEY% we have to calculate YTM% (IRR%) per annum compounded semi-annually

Money Market Yield %

Money Market is market for Short-term securities buying & selling

MMY% is applicable on securities with life upto one year.

$$\text{Money Market yield \%} = \frac{\text{Face value - Purchase Price}}{\text{Purchase Price}} \times 100 \times \frac{360}{n}$$

However if Q mentions "1 year = 365 days" then use 365 days

Holding period yield%

$$HPY = \frac{I + P_1 - P_0}{P_0} \times 100$$

Effective annual yield % (EAY) = $(1 + HPY)^{365/HP} - 1$ this is same as $ER = \left(1 + \left[\frac{NR}{m}\right]^{m}\right)^{365/HP} - 1$

NR/m is 'HPY'

Example: A money market instrument with face value of ₹ 100 and discount yield of 6% will mature in 45 days. You are required to calculate:

(i) Current Price of the Instrument

(ii) Bond Equivalent Yield

(iii) Effective Annual Return

[Assume 1 Year = 360 days]

Answer:

(i) $\text{Discount Yield \%} = \frac{\text{Face Value - Current Price}}{\text{Face Value}} \times 100 \times \frac{360}{n}$

$$6 = \frac{100 - CP}{100} \times 100 \times \frac{360}{45}$$

$\therefore$ CP = ₹ 99.25

(ii) Bond equivalent yield

$$BEY\% = \frac{FV - CP}{CP} \times 100 \times \frac{360}{n}$$

$$= \frac{100 - 99.25}{99.25} \times 100 \times \frac{360}{45} = 6.045\% \text{ pa}$$

(iii) Effective Annual Return

$$\left(1 + \frac{0.06045}{8}\right)^{8} - 1 = 6.207\% \text{ pa}$$

Convertible Bonds

same concept applies to Convertible Preference Shares

Eg. Indigo Airlines Bond
Remaining Life = 4 Years
Face value = ₹ 1000
Coupon Rate = 12%
Market Price = ₹ 1240

Bond is Convertible into 15 equity share of Indigo Airlines currently trading @ ₹ 75.
It is expected that share price will grow by 5 % p.a.
Investor's reqd. rate of return is 11%
Dividend per share = ₹ 5.50

Calc the following :-

- Conversion Ratio
- Conversion Value
- Conversion Premium
- Floor Value. (aka straight Value of Bond)
- Premium over Straight value
- % downside risk
- Conversion Parity Price
- Favourable Income differential
- Premium payback period
- Fair Value of the Bond
- Market Conversion Price

Conversion Ratio

means how many equity shares will be issued against 1 convertible bond
In our case, 15 : 1 or 15 is the Conversion Ratio

Conversion Value or Stock Value of the Bond

means value of equity shares as on today resulting upon conversion of each Bond
Conversion Value = Conversion Ratio x MP of Eq. Shares
= 15 x ₹ 75
= 1125

Conversion Premium

means 'Premium' over Conversion value' that people are ready to pay for purchasing a Convertible bond.

Convertible bond commands premium because of two features :-
(i) Limited downside risk as compared to Eq. shares
(ii) Coupon Rate% > Dividend Yield % (usually)

Conversion Premium (in ₹) = MP of the Convertible Bond - Conversion Value
= 1240 - 1125
= ₹ 115

or

$$\text{Conversion Premium \%} = \frac{\text{MP of the Convertible Bond - Conversion Value}}{\text{Conversion Value}} = \frac{1240 - 1125}{1125} = 10.22\%$$

Tutorial note: ICAI sometimes also uses an alternative formula

$$= \frac{\text{MP - Conversion Value}}{\text{MP}} = \frac{1240 - 1125}{1240} = 9.27\%$$

We recommend using first formula with 10.22% answer in Exams.

$$\text{Conversion Premium per share} = \frac{\text{MP of the Convertible Bond - Conversion Value}}{\text{Conversion Ratio}} = \frac{₹\ 115}{15} = ₹\ 7.67$$

Floor Value / Straight Value

is the Value of Bond without any conversion feature.

Floor Value or Straight Value = Interest x PVAF + Redemption Price x PVF

= ₹ 120 x $PVAF_{(@11\%4Yrs)}$ + ₹ 1000 x $PVF_{(@11\%4thYr)}$

= ₹ 1031

Premium Over Straight Value

= MP of the Bond *less* Floor Value

= 1240 - 1031

= ₹ 209

or in % terms = $\frac{\text{MP of the Bond - Floor Value}}{\text{Floor Value}} \times 100$

= $\frac{209}{1031} \times 100 = 20.27\%$

% Downside Risk

= $\frac{\text{MP of the bond - Floor Value}}{\text{MP of the bond}}$ = $\frac{1240 - 1031}{1240}$ = 16.85%

Current MP of bond = ₹ 1240

Floor value = ₹ 1031

Tutorial Note: Using Floor value in the denominator is second preference if situation in the question so demands

Conversion Parity Price

To bring parity either Bond Price has to come down to match Stock Value or Share price has to go up to match Bond Price

Bond	Equity
₹ 1240	₹ 82.67 [₹ 1240/15 eq sh]
₹ 1125	₹ 75 x 15 Eq sh = ₹ 1125

Conversion parity price of the bond = Conversion Value = MP of Eq Sh x Conversion Ratio = ₹ 1125

Conversion parity price of Eq. sh. = $\frac{\text{MP of the Bond}}{\text{Conversion Ratio}}$ = $\frac{₹\ 1240}{15\ \text{Eq. sh.}}$ = ₹ 82.67

or Current MP of the Share + Conversion Premium per share

or ₹ 75 + ₹ 7.67 = ₹ 82.67

Favourable Income Differential

One who holds Bond

Interest Income = 12% x ₹ 1000

= ₹ 120

vs.

One who holds Eq. Sh

Dividend Income= 15 Eq. sh x ₹ 5.5

= ₹ 82.5

Favourable income differential per bond = 120 - 82.5 = ₹ 37.5

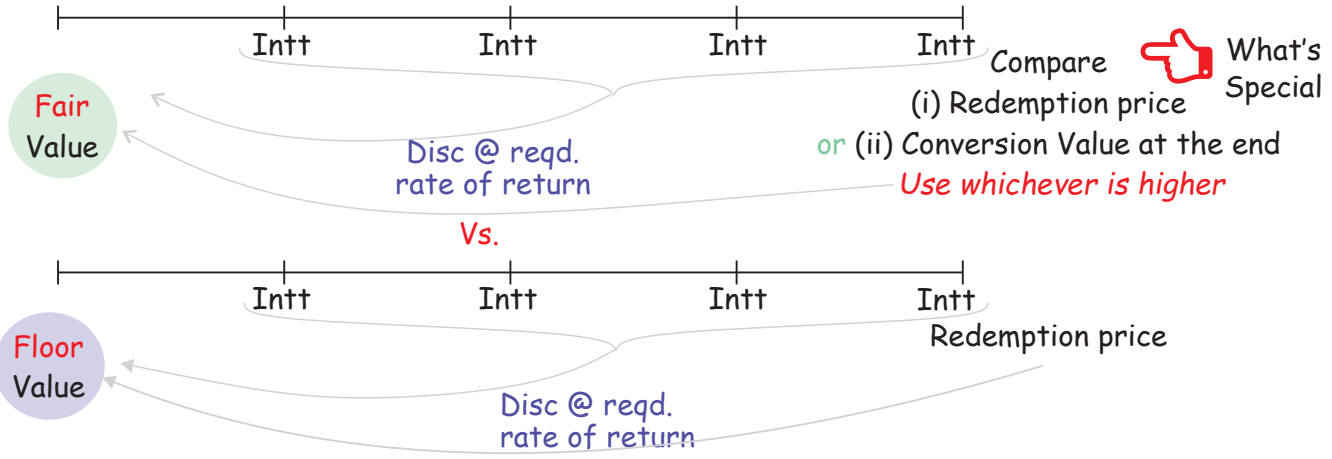
Favourable income differential per share = 37.5 / 15 Eq. sh = ₹ 2.5

Premium Pay-back Period aka Payback Period or Breakeven Period

One who buys convertible bond actually pays premium for it (₹ 115) but in return he earns favourable income differential as well. How much time it will take to recover the Premium paid?

= $\frac{\text{Conversion Premium per Bond}}{\text{Favourable Income diff per Bond}}$ = $\frac{₹\ 115}{₹\ 37.5}$ = 3.067 Years

Fair Value Convertible of Bond vs. Floor Value of Convertible Bond



Forecasted Share price at the end of 4th yr = ₹ 75 x 1.05^4 = ₹ 91.16

Conversion Value at the end of 4th yr = ₹ 91.16 x 15 Eq sh = ₹ 1367.44

Since Conv Value > Redemption Value, ∴ we'll use Conv. Value to calc fair Price,

Fair Value = Interest x PVAF + Conversion Value or Redemption Value (Whichever is higher) x PVF

= 120 x $PVAF_{@11\%4Yrs}$ + 1367.44 x $PVF_{@11\%4Yrs}$

= ₹ 1273.06

Market Conversion Price

is same as Conversion parity price of Eq Sh. i.e. ₹ 82.67 in our case

Valuation of Warrants

[Warrants Vs Convertible Bonds]

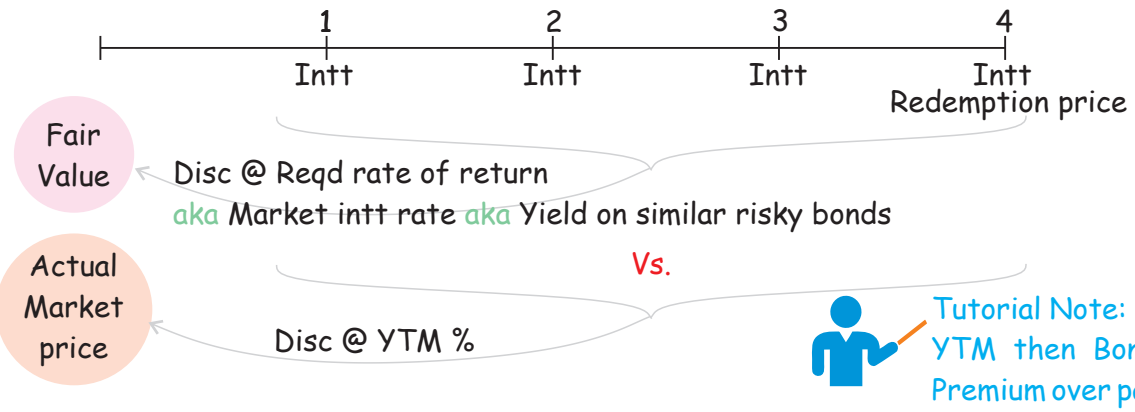
A warrant is a right that entitles a holder to subscribe some No. of Equity shares at a stated price

Warrants	Convertible Bonds
✓ Option of conversion is detachable	✓ Not detachable
✓ Exercisable for cash payment	✓ Doesn't involve cash payment

Theoretical Value of Warrant = (MP-E) x n

here, MP = Current Market Price of Share
E = Exercise Price of Warrant
n = No. of Equity shares convertible with one warrant

Discounting @ Reqd. Rate of Return vs. YTM % or [Fair Price vs Market Price of Bond]



Tutorial Note: If Coupon Rate > YTM then Bond will trade @ Premium over par & vice-verse.

Clean Price Vs. Dirty Price

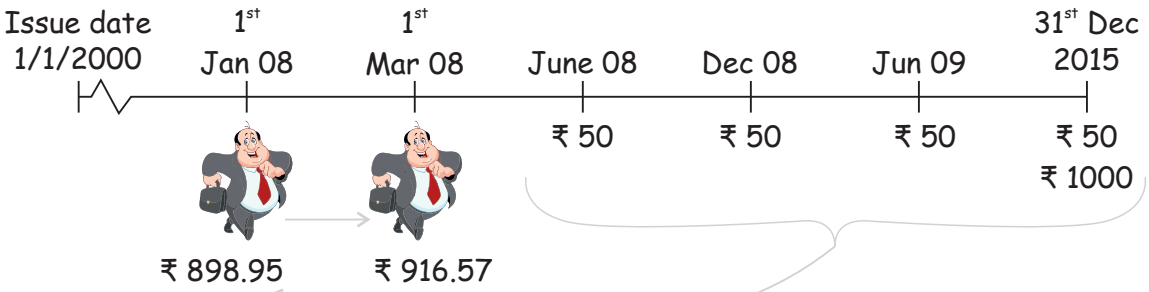
Clean Price (aka flat price)	Vs.	Dirty Price (aka Full Price)
is the price of the bond excluding accrued interest		is the price of the bond including accrued interest since the issue of most recent interest payment

Example: MP Ltd. issued a new series of bonds on January 1, 2000. The bonds were sold at par (₹ 1000), having a coupon rate 10% p.a. and mature on 31st December 2015. Coupon payments are made semiannually on June 30th & December 31st each year. Assume that you purchased an outstanding MP Ltd. Bond on 1st March, 2008 when the going interest rate was 12%.

Required:

(i) What was the YTM of MP Ltd. Bonds as on January 1, 2000?

(ii) What amount you should pay to complete the transaction? Of that amount how much should be accrued interest and how much would represent bonds basic value [Exam Nov 2007]



Alternative1

Step 1 : Calc PV of Bond on 1st Jan 08

PV of the Bond as on 1st Jan 2008

= Intt x $PVAF_{(@r\%,n)periods}$
+ Redemption Price x $PVF_{(@\ r\%,\ n)}$
= ₹ 50 x $PVAF_{(@6\%,16periods)}$
+ ₹ 1000 x $PVF_{(@\ 6\%,\ 16th\ periods)}$
= ₹ 898.95

Step 2: Calc FV as on 1st March 08

Value of Bond as on 1st March 2008

= PV x $(1+r)^n$
= ₹ 898.95 x $(1.06)^{1/3}$
= ₹ 898.95 x 1.0196
= ₹ 916.57 i.e. Dirty Price

Out of the above amount

Accrued intt for 2 months = ₹ 50 x $\frac{2}{6}$ = ₹ 16.67

∴ Bonds Basic Value (i.e. Clean Price) = ₹ 916.57 - 16.67 = ₹ 899.90

Alternative 2

Step 1: Calc PV of Bond on 30th June 08

= Intt x $PVAF_{(@r\%,n)periods}$
+ RP x $PVF_{(@\ r\%,\ n)}$
= ₹ 50 x $PVAF_{(@6\%,15periods)}$
+ ₹ 1000 x $PVF_{(@\ 6\%,\ 15th\ periods)}$
= ₹ 902.88

Step 2: Add Coupon Intt Amount of 30th june 08 date

= 902.88 + 50 = 952.88

Step 3: Calc PV as on 1st March 08

= FV / $(1+r)^n$
= ₹ 952.88 / $(1.06)^{2/3}$
= ₹ 952.88 / 1.0396
= ₹ 916.57 is Dirty Price

Exam Tip: If Q is silent about whether given Actual Price is Dirty price OR Clean Price then assume such actual price to be a clean price (in USA bonds are quoted at clean price)
{above text is applicable only when Q explicitly mention about clean & Dirty price terms in Q else above text is not applicable}

Bond Refunding Decisions

means replacement of old bond with new bonds because coupon rate on new issue will be lower than old bond

Tip : Use Incremental Approach for All the Cash Flows

Format for Solution

Incremental initial investment

1.	Redemption value of old bonds (including premium)	Outflow
2.	Tax Benefit On Premium paid on redemption of Old Bonds	Inflow
3.	Tax benefit on Write- off of issue exps/ Discount on Old Bonds	Inflow
4.	Net Issue Proceeds of New Bond (after deducting issue exps)	Inflow
	Net Initial Outflow	xxxx

If Overlapping period Interest amount needs to be paid then simply show the After-tax Interest for the overlapping period on Old Bonds (at undiscounted amount) under 'Incremental Initial Investment'.

Alternatively, we can separately calc "Annual cost of old bonds" & "Annual cost of new bonds & then calc their difference. Annual cost of old/ new bond = Interest exps (-) tax benefit on intt, discount & floatation cost.

Annual Cash Flows (Incremental)

1.	After - tax savings of Interest Ex ps.	Inflow
2.	Tax benefit on amortization of Incremental issue exps.	Inflow / Outflow
3.	Opportunity loss of tax benefit on amortization of discount on old bond	Outflow
	Net Annual Cash Inflow	xxx

When issue cost pa of New > Old ← | → When issue cost pa of New < Old

NPV of the decision = Annual Cash Inflow x PVAF $_{(@\text{After tax Kd\%, Remaining life of old bond})}$ - Net Initial Outflow

Decision Criteria: If NPV is +ve then Redeem Old Bonds & Replace with New Bonds
If NPV is -ve then Continue with the Old Bonds

Exam Tip: Discounting rate for 'Bond refunding decisions' will be After-tax Kd given in the Question. If Q doesn't provide Kd then use After-tax Interest Rate on New Bond as discounting rate.

Types of Risks

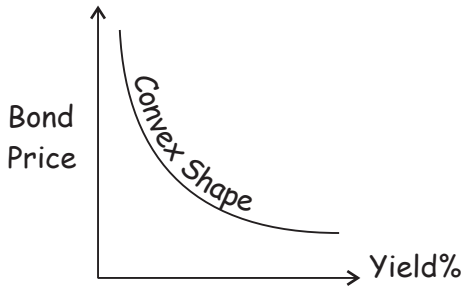
1. **Inflation Risk** – refers to the rise in the price of products and the consequent fall in the value of money.
2. **Interest Rate Risk (aka Price Risk)** – refers to the impact that rising interest rates have on bond values. When interest rates go up, the value of an existing bond comes down & vice-versa.
3. **Reinvestment Risk** – Risk that intermediate CF's cannot be reinvested @ IRR of the Original Bond.

(2 & 3: either of the Risk at a time)

4. **Liquidity Risk** – Loss of Value at the time of en-cashing the Bond before its maturity
5. **Credit Risk / Default Risk** – Possibility that issuer goes bankrupt

Measurement of Risk

Bond Price-yield relationship



Bond Price-Yield relationship is a convex shape relationship. By convex shape we mean that

- ✓ when YTM decreases, bond price increases but at a higher pace.
- ✓ on the contrary when YTM increases then bond price decreases but at a slower pace.

Proof of convex relationship

Eg 1. A Zero coupon bond having maturity after 5 years.
F.V. = ₹ 1000 is trading at ₹ 620. Calc YTM ?

Solve: $F.V. = PV(1+r)^n$

$1000 = 620(1+r)^5$

$r = 10.03\%$ i.e YTM = 10.03%.

Q Calc New Price of the bond

(i) If YTM ↑ 60 bps

(ii) If YTM ↓ 60 bps {Remember 1% = 100bps}

(i) If YTM ↑ 60 bps i.e. 0.60%

New YTM = 10.03% + 0.60%
= 10.63%

$$\text{New MP} = \frac{₹\ 1000}{(1.1063)^5}$$

= ₹ 603.44

(ii) If YTM ↓ 60 bps i.e. 0.60%

New YTM = 10.030% - 0.60%
=9.43%

$$\text{New MP} = \frac{₹\ 1000}{(1.0943)^5}$$

= ₹ 637.26

Conclusion: If YTM ↓ 60 bps then Price rose by ₹ 17.26 or 2.78%

637.26 ↑

620

603.44 ↓

If YTM ↑ 60 bps then Price fell by ₹ 16.56 or 2.67%

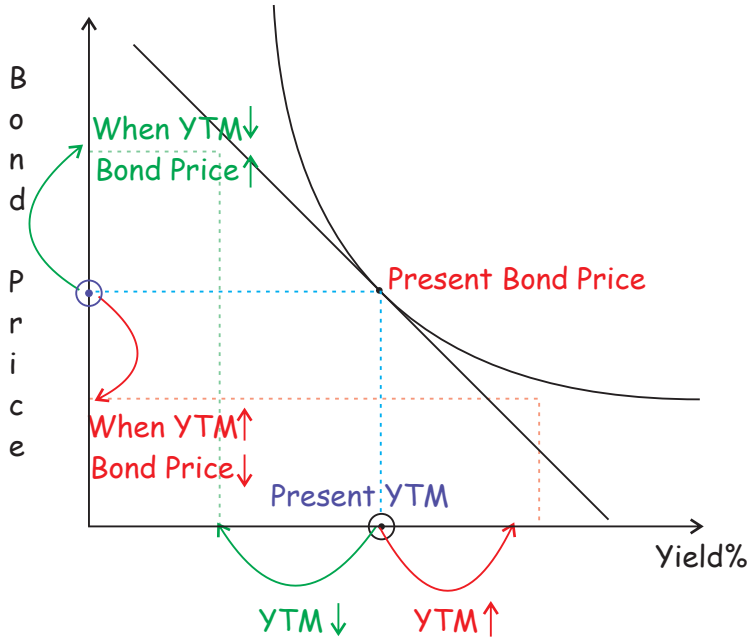
Observe that the change in price is different in both the directions.

Now let's measure risk i.e. by how much price changes due to change in interest rates by calculating volatility.

Volatility

Measurement of risk is done by calculating volatility.

Volatility means by how much the bond price will change for every 1% change in YTM [i.e. every 1% change in prevailing interest rates in the economy]



Ideally, we should measure slope of curve to get the accurate answers, however it is difficult to measure slope of curve. ∴ we use a work around by dropping a tangent line at present YTM level. Now we measure slope of the tangent line ignoring convexity feature. The slope of this tangent line is called as volatility.

$$= \frac{2.78\% + 2.67\%}{2} = 2.725\%$$

∴ Bond prices will change by 2.725% for every 0.60% Δ (change) in interest rate.
However, volatility is measured w.r.t. 1% change in interest rates (NOT 0.60%)

Δin YTM%	Δin Bond Price
∵ 0.60 %	2.275%
∴ 1%	? = 2.725% × 1% / 0.60% = 4.54%

Interpretation of Volatility

Bond prices will change by 4.54% for every 1% change in YTM [i.e. change in market interest rates / prevailing interest rate in the economy] in the opposite direction.

Alternatively above calculation of volatility can also be done by using effective duration formula:

$$\text{Effective Duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta y}$$

This formula has been derived using logic already taught above

here, V_0 means bond current prices; V_- & V_+ means New Bond price when YTM is decreased & increased respectively.

Δy means change in YTM

$$= \frac{637.26 - 603.44}{2 \times 620 \times 0.60} = 4.54\%$$

Two approaches to calculate Volatility

Method 1: Effective Duration

Step 1 Find out Present bond price & Present YTM

Step 2 Give interest rate shock [usually less than 1%] and find out % Δ in price in both the direction

Step 3 Calculate average % change in price. But remember this percentage is with respect to shock %. Re-express above change to 1% Δ in interest rates using unitary method [cross- multiplication]

or Use Effective Duration formula

Method 2: Modified Duration {Prefer in Exams}

Step 1 Calculate Macaulay duration

Step 2 Calculate Modified duration

Eg. 2. FV = ₹ 1000, Coupon rate = 12%, life = 5 yrs, current YTM = 10%. Calculate volatility using both the methods ?

Method 1: Effective duration Suppose, shock = 0.40%

Year	Cash flows	PV @ 10%	PV @ 9.6%	PV @ 10.40%
1-5	120	454.82		
5	1000	620.92		
		1075.81	1091.92	1060.04

1.5% 1.47%

$\therefore$ Average change $= \frac{1.5\% + 1.47\%}{2}$

$= 1.485\%$ for 40 bps Δ in Intt Rates

$\therefore$ Volatility $= 1.485\% \times \frac{1}{0.40}$ or $\frac{100 \text{ bps}}{40 \text{ bps}} = 3.71\%$

Alternatively,

Effective duration $= \frac{V_- - V_+}{2 \times V_0 \times \Delta y}$

$= \frac{1091.92 - 1060.04}{2 \times 1075.81 \times 0.40} = 3.71\%$

Method 2: Modified duration

Step - 1: Macaulay duration

For a 1% Δ in YTM, Bond price will change by 3.71%

For a 2% Δ in YTM, Bond price will change by 3.71% x 2 = 7.42%

Macaulay Duration (or simply say 'duration') of the bond is the Weighted average maturity of its cash flow structure, where present value of CFs discounted at current YTM are assigned as weights.

Step to calculate Duration of bond

Step 1: Find expected cash flow from Bond in each year

Step 2: Calculate present value of each year cash flow using YTM.

Σ PV of CF's = Market price of bond

Step 3: Calculate Weight of present value of cash flow of each year

$\frac{\text{PV of cash flow of each year}}{\Sigma \text{ PV of cash flows}}$

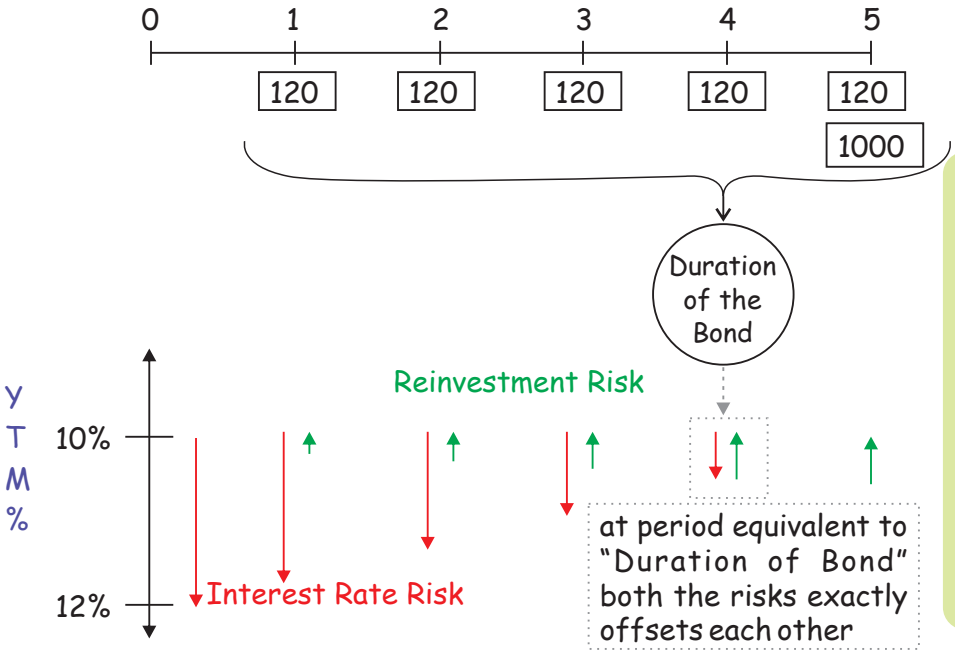
Step 4: Year x Weight of PV of cash flow of each year

'Σ Year x Weight' becomes Duration of bond

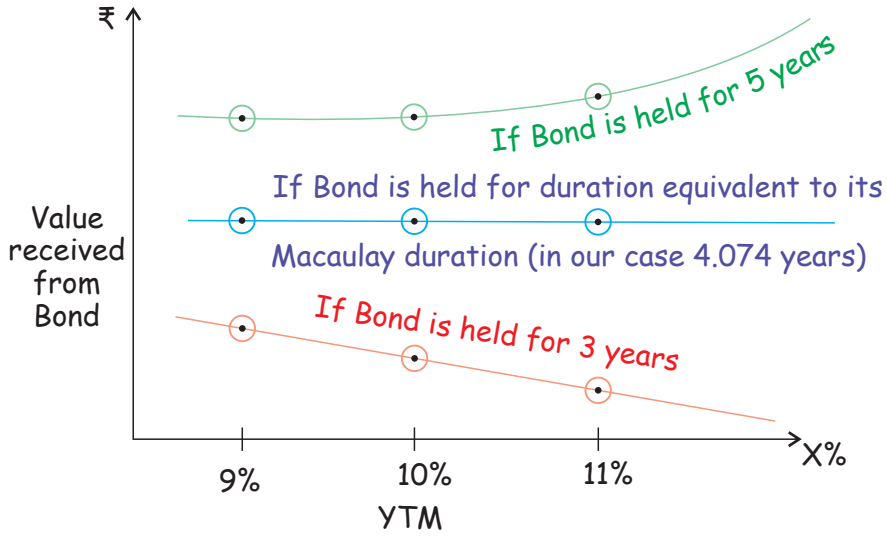
Format for calculation of duration of bond:

Year	Cash flow	PVF @YTM%	P.V.	Weight of P.V.	Weight of P.V. x Year
(1)	(2)	(3)	(4) = (2) x (3)	(5)	(6) = (1) x (5)

Significance of Macaulay duration



In the initial years, Interest rate risk has a greater impact on the value of bond but as the time passes and nears the maturity, interest rate risk effect lessens. On the contrary, reinvestment rate risk has negligible role to play in the initial years but as the time passes, its dominance increases. At Duration, both the risks tends to offset each other.



Conclusion: Duration of the bond is that point of time for which if the bond is held, then an investor is insulated (protected) from both types of risk [interest rate risk as well as reinvestment rate risk]. The concept of duration is also used for 'Bond Immunization'.

Year	CF	PV @ YTM 10%	Weights	Weights x Year
1	120	109.09	109.09 / 1075.82	0.1014
2	120	99.17	99.17 / 1075.82	0.1843
3	120	90.16	90.16 / 1075.82	0.2514
4	120	81.96	81.96 / 1075.82	0.3047
5	1120	695.43	695.43 / 1075.82	3.231
		1075.82	1	**4.074**

Macaulay Duration = 4.074 years

Alternatively we may use production method to calculate weighted average.

Year [D]	CF	PV @ 10% [W]	W x D
1	120	109.09	109.09
2	120	99.17	198.34
3	120	90.16	270.48
4	120	81.96	327.84
5	1120	695.43	3477.15
		ΣW = 1075.82	ΣWD = 4382.90

$$\text{Duration} = \frac{\Sigma WD}{\Sigma W} = \frac{4382.90}{1075.82} = 4.074 \text{ years}$$

Step 2: Modified Duration (aka Volatility)

$$\text{Modified Duration or Volatility} = \frac{\text{Duration}}{1 + \text{Periodic YTM}} \text{ or } \frac{\text{Duration}}{1 + \text{YTM} / m}$$

$$= \frac{4.074}{1 + 0.10} = \frac{4.074}{1.10} = 3.70\%$$

Tutorial Note

If YTM is 10%p.a. &

(i) Bond Cf's are semi-annual then Periodic YTM (or YTM/m) = 5%

(ii) Bond Cf's are quarterly then Periodic YTM (or YTM/m) = 2.5%

Bond selection decision

Decision Making using the concept of duration

If Interest rates are expected to ↑ then Bond price ↓ prefer low volatility ↓ prefer low duration ↓

If Interest rates are expected to ↓ then Bond price ↑ prefer high volatility ↑ prefer high duration ↑

Duration of Bond Portfolio

is weighted average duration of individual bonds where market values are the assigned weights.

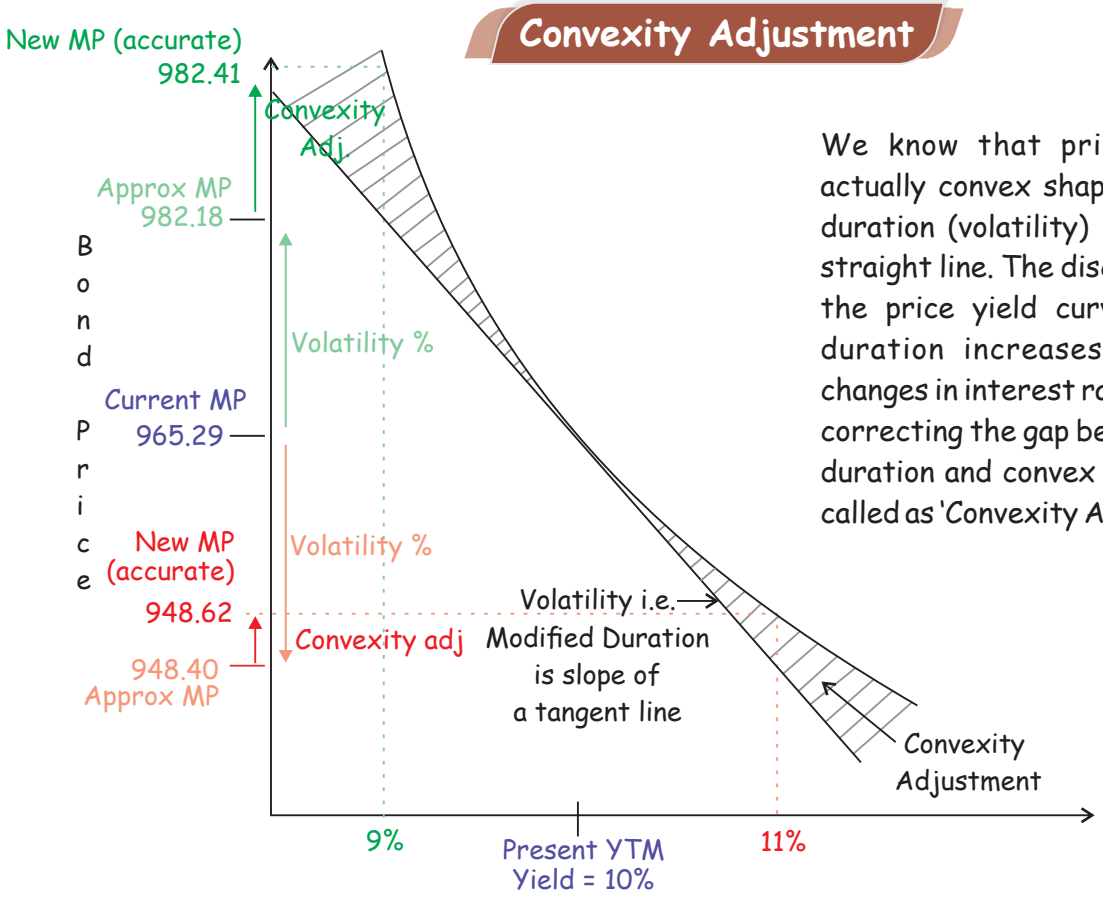
Duration of bonds portfolio = $\Sigma \text{Duration}_i \times W_i$ Weights are Market Value weights

Caution Note Don't make the mistake of using Face Value, Market Price per Bond or No. of Bonds as Weights. The correct Weight is Market Value of Bonds in the portfolio

If Question provides you Bonds Portfolio Duration and asks for churning advice given the expected change in Interest Rates then simply follow the above taught concept of Bonds selection. It means

- ✓ If Interest Rates are expected to rise, then advise Selling some Long Duration Bonds and Invest the proceeds in Short Duration Bonds so as to reduce Overall Duration of Bonds Portfolio.
- ✓ If Interest Rates are expected to lower, then advise Buying Long Duration Bonds by Selling some Short Duration Bonds so as to increase Overall Duration of Bonds Portfolio.

Convexity Adjustment



We know that price yield curve is actually convex shape but the modified duration (volatility) is the slope of the straight line. The discrepancies between the price yield curve & the modified duration increases with the bigger changes in interest rates. The process of correcting the gap between the modified duration and convex price yield curve is called as 'Convexity Adjustment'.

Steps to calculate accurate price when YTM changes

Step 1: Calc Modified Duration i.e. Volatility

Step 2: Calculate Convexity

$$\text{Convexity} = \frac{V_- + V_+ - 2V_0}{2 \times V_0 \times (\Delta Y)^2}$$

Squared since it is 2nd derivative of modified duration

Since Numerator gives double sided difference

Since the difference in the numerator is right now in ₹ terms but we want to convert it into % term

here, V_+ means Price of the Bond if yield increases by ΔY
V_- means Price of the Bond if yield decreases by ΔY
ΔY means change in YTM used (i.e. shock given) to calc above V_+ & V_-

Step 3: Calculate convexity adjustment

$$\text{Convexity adj.} = \text{Convexity} \times 100 \times \Delta Y^2$$

Step 4: % change in bond price = Volatility ± Convexity adjustment

% Change in Market Price of Bond

If YTM decreases

% Change in Market Price of Bond using Volatility
+
Convexity of Bond

'Plus' because Bond Price increases at a faster pace. Prices जोर से बढ़ती है

If YTM increases

% Change in Market Price of Bond using Volatility
-
Convexity of Bond

'Minus' because Bond Prices falls at a slower pace due to convex shape. Prices धीरे धीरे गिरती है

Step 5: New bond price

= Old MP ± % change in bond price [as calc above in step 4]

Eg. 2yrs, 8% coupon bond having F.V. $ 1000 is trading at YTM = 10%, calculate convexity & find out new price of the bond for 1% change in YTM in either direction.

Step 1: Calculate Macaulay Duration

Year [D]	CF's	PV @10% [W]	W x D
1	80	72.73	72.73
2	1080	892.56	1785.12
		∑W = 965.29	∑WD = 1857.85

Duration $= \frac{\sum WD}{\sum W} = \frac{1857.85}{965.29} = 1.9247$ Years

Modified duration i.e. volatility $= \frac{\text{Duration}}{1 + YTM} = \frac{1.9247}{1 + 0.10} = 1.75$ Years or 1.75%

Step2: Calculate Convexity

Calc of V+ & V- (Assuming interest rate shock of 1% is given)

Year	CF's	PV @ 9%	PV @ 11%
1	80	73.39	72.07
2	1080	909.014	876.55
		982.408 or 982.41	948.62

$$\text{Convexity} = \frac{V_- + V_+ - 2V_0}{2 \times V_0 \times (\Delta Y)^2}$$

$$= \frac{982.41 + 948.62 - 2 \times 965.29}{2 \times 965.29 \times (1\%)^2} = 2.33$$

Take it in decimal form, 1% = 0.01
hence $(1\%)^2$ means $(0.01)^2 = 0.0001$

Step 3: Convexity Adjustment

= Convexity x 100 x ΔY^2

= 2.33 x 100 x $(1\%)^2$

=0.0233%

On Calculator write 1% as 0.01

Since we have already multiplied by 100 above hence answer will be in % terms

Step 4 & 5: % Change in Bond Price & New MP of the Bond

Change in YTM	New MP of the Bond		
	Direct calculation of New MP [by discounting]	Using volatility [approximation Approach]	Using Volatility + Convexity Adj. [Accurate Approach]
When YTM ↓ by 1% (i.e.10% to 9%)	982.41	982.18 [965.29 + 1.75%]	982.41 [965.29 + (1.75% + 0.0233%)]
When YTM ↑ by 1% (i.e.10% to11%)	948.62	948.40 [(965.29 + 1.75%)]	948.62 [965.29 - (1.75% - 0.0233%)]

tallies

Conclusion : Applying only 'Volatility %' gives us Approx New MP of Bond
Applying 'Volatility % ± Convexity Adjustment %' gives us Accurate New MP of Bond

When does Convexity Adjustment should be added to Volatility% & when deducted ?
Since Price-Yield Curve is a convex shape, bond price rises at a higher pace when YTM decreases, accordingly CA% should be added to Volatility % when yield decreases.

On the contrary, the bond price falls at a lower pace when YTM increases, accordingly CA% should be deducted from Volatility% when yield increases.

Caution Note Delta ΔY comes at 2 places, once in convexity formula & next time in convexity adj. formula. Remember that both ΔY are different.
ΔY in Convexity formula here ΔY means 'Quantam of interest rate shock given' to find out V+ & V-. It is at our discretion how much shock we want to give (usually less than 1%)
ΔY in Convexity Adjustment formula this is actual / expected change in YTM (Usually given in the question) corresponding to which New market price is to be found.

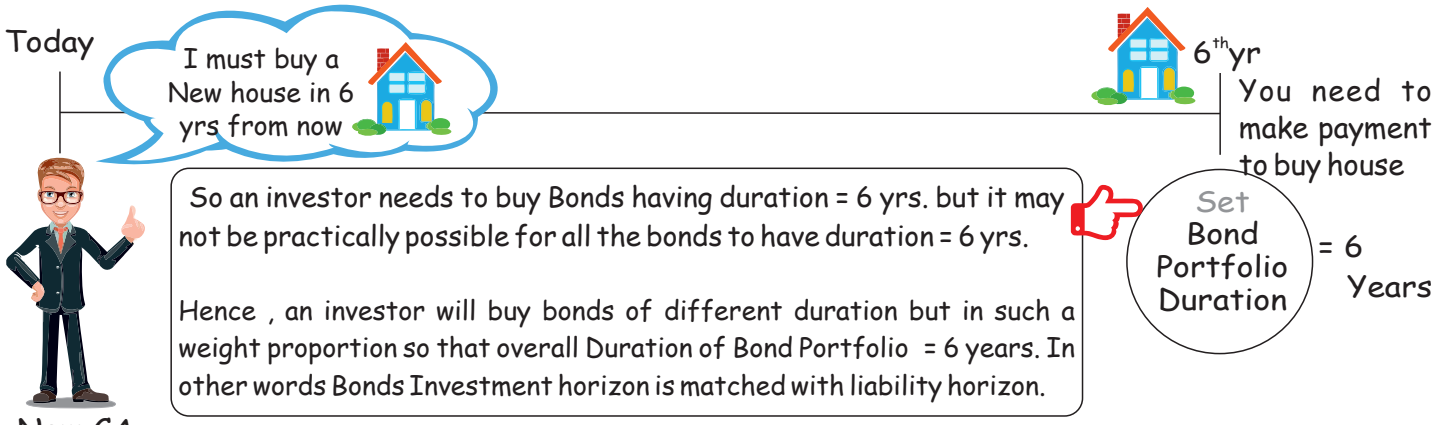
Exam Tip: We can use same Δy at both the places. In other words we will give discretionary shock same as change in YTM given in the question.

Bond Immunization

Bond Immunization is an Investment strategy used to minimize Interest Rate Risk & Reinvestment Rate Risk. It is done by adjusting Bond's Portfolio Duration so as to match with Investor's Liabilities due dates.

Immunization locks-in a fixed rate of return or yield %

$$D_A = D_L$$



Duration of Bond Portfolio i.e. D_A = Duration of Liability i.e. D_L

D_A: $Duration_A \times Weight_A + Dur_B \times W_B + Dur_C \times W_C$

D_L: It will be given in question

* here, $Weight_A + Weight_B + Weight_C = 1$

1. How to calc "Amount to be invested initially in each Bond" on the basis of weights calculated above
   Step 1: Calculate PV of liability to be settled using Bond's YTM
   Step 2: Amount to be invested in each Bond = PV of Liab x Weight of Bond as calc above.

2. If on some future date, Duration of Bond changes (for whatever reason) then we need to calculate Revised Weights for each of the Bond so as to match D_L.

3. If Q gives info about Liabilities spreaded over multiple period then first calc W.A. D_L i.e. weighted Avg. Duration of liabilities in the same way as we calc Duration of an individual Bond. Hence calc PV of such Liabilities & use them as weights to multiply by 'Year in which liability is due'. If Q gives only a single liability which is due in say, 6 years, then there is no need to apply the concept of PV. 6 yrs itself will be the D_L.

Money Market Instruments

Money market is a market for trading in short term securities viz Treasury Bills, Commercial Bills, Commercial Papers & Certificate of deposit. These instruments are front- ended negotiable instrument, issued at a discount and redeemed at face value.

Eg. Face value = ₹ 100 ; t = 6 months ; Rate of discount = 20 % pa

Solve: Discount = ₹ 100 x 20% x $\frac{6}{12}$ = ₹ 10

Issue Price or sales value = ₹ 100 - ₹ 10 = ₹ 90

Effective yield % = $\frac{FV - SV}{SV} \times \frac{365 \text{ or } 12}{n} \times 100$ = $\frac{100 - 90}{90} \times \frac{12}{6} \times 100$ = 22.22%

Cost of funds [raised through Commercial Paper (CP)]

$$= \frac{[\text{Interest Expense + Issue Expense}](1 - t)}{\text{Net Amount received by the company}} \times \frac{12 \text{ or } 365}{n} \times 100$$

here, Interest Expense = Face value - Issue price

t = Tax rate

Net amount received by the company = Issue Price - Issue Expenses - Minimum balance to be maintained in Bank

How Repo transactions are conducted ?

Step 1: First Leg

SBI sells GOI Bond to RBI

i.e. Dirty Price (Clean price + Accrued Intt)

SBI

Initial Proceeds collected = Full Price less Initial margin %

Step 2: Second Leg

SBI Buys back Bond @ Initial Proceeds + Intt @ Repo rate

$$\text{Intt @ Repo rate} = \text{Initial proceeds} \times \text{Repo Rate\%} \times \left[\frac{\text{No. of days of repo transaction}}{365 \text{ or } 360}\right]$$

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Question 1 2Q Merged | MTP April 2021, (5 Marks) Exam Nov 2013

ABC Ltd. issued 9%, 5 year bonds of ₹ 1,000/- each having a remaining maturity of 3 years. The present rate of interest is 12% for one year tenure. It is expected that Forward rate of interest for one year tenure is going to fall by 75 basis points and further by 50 basis points for every next year in further for the same tenure. This bond has a beta value of 1.02 and is more popular in the market due to less credit risk.

Calculate

(i) Intrinsic value of bond

(ii) Expected price of bond in the market

(iii) Interpret the nature of the above yield curve and reasons for the same.

Solution: (i) Intrinsic value of Bond

PV of Interest + PV of Maturity Value of Bond

Forward rate of interests

1st Year	12%
2nd Year	11.25%
3rd Year	10.75%

PV of interest

$$= \frac{90}{(1+0.12)} + \frac{90}{(1+0.12)(1+0.1125)} + \frac{90}{(1+0.12)(1+0.1125)(1+0.1075)} = 217.81$$

$$\text{PV of Maturity Value of Bond} = \frac{100}{(1+0.12)(1+0.1125)(1+0.1075)} = 724.67$$

Intrinsic value of Bond = ₹ 217.81 + ₹ 724.67 = ₹ 942.48

(ii) Expected Price = Intrinsic Value x Beta Value = ₹ 948.48 x 1.02 = ₹ 961.33

(iii) The given yield curve is inverted yield curve.

The main reason for this shape of curve is expectation for forthcoming recession when investors are more interested in short term rates over the long term.

Question 2 (5 Marks) Exam Nov 2012

Calculate the Current price and the Bond equivalent yield (using simple compounding) of a money market instrument with face value of ₹ 100 and discount yield of 8% in 90 days. Take 1 year = 360 days.

Solution:

Cal^{-n} of Current Price

$$\text{Discount Yield \%} = \frac{\text{Face Value - Current Price}}{\text{Face Value}} \times 100 \times \frac{360}{n}$$

$$8 = \frac{100 - CP}{100} \times 100 \times \frac{360}{90}$$

Current Price = ₹ 98

Cal^{-n} of B E Y

$$\text{BEY \%} = \frac{\text{Face Value - Current Price}}{\text{Current Price}} \times 100 \times \frac{360}{n}$$

$$= \frac{100 - 98}{98} \times 100 \times \frac{360}{90}$$

= 8.16%

Question 3

MTP Series 2 Nov 2023, MTP May 2025

Following information is related to the Convertible Bond of A Ltd. which is currently priced at ₹ 1060 per Bond:

(1) Conversion Parity Price - ₹ 53

(2) Conversion Premium – 10.41667%

(3) Percentage of Downside Risk with respect to Straight Value of Bond – 12.766%

Calculate:

(i) No. of shares on Conversion.

(ii) Current Market Price Per Share of A Ltd.

(iii) Straight Value of Bond

Solution: (i) The No. of share on Conversion shall be computed as follows:

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

$$₹\ 53 = \frac{1060}{\text{No. of shares on Conversion}}$$

Accordingly, No. of shares on Conversion = 20

(ii) To determine current Market Price Per Share of A Ltd. we shall use Conversion Premium as follows:

$$\text{Conversion Premium} = \frac{\text{Market Price of Bond - Conversion Value of Bond}}{\text{Conversion Value of Bond}}$$

$$0.1041667 = \frac{1060 - \text{Conversion Value of Bond}}{\text{Conversion Value of Bond}}$$

Conversion Value of Bond = ₹ 960

Since the No. of share on Conversion = 20

The current market price of share of A Ltd. shall be = ₹ 960/ 20 = ₹ 48 per share

(iii) To determine the Straight Value of Bond we shall use Percentage of Downside Risk as follows:

$$\text{Percentage of Downside Risk} = \frac{\text{Market Price of Bond - Straight Value of Bond}}{\text{Straight Value of Bond}}$$

$$0.12766 = \frac{1060 - \text{Straight Value of Bond}}{\text{Straight Value of Bond}}$$

Straight Value of Bond = ₹ 940 per Bond

Question 4

2Q Merged | Study Material

Calculate Market Price of:

(i) 10% Government of India security currently quoted at ₹110, but interest rate is expected to go up by 1%.

(ii) A bond with 7.5% coupon interest, Face Value ₹10,000 & term to maturity of 2 years, presently yielding 6%. Interest payable half yearly.

(iii) If the yield of 7.5% coupon bonds fall to 4%, whether the price of bond will increase or decrease? What percentage of this increase/decrease comes from a change in the present value of bond's principal amount and what percentage of this increase/decrease comes from a change in the present value of bond's interest payments?

Solution: (i) YTM = (Coupon Interest / Market Price) x 100
(10/110) x 100 = 9.09%

Tutorial Note: In Study material edition 2026, ICAI has added one more info in point (i) viz "Face value ₹ 100"

If current YTM goes up by 1% i.e. 10.09% the market price would be

10.09 = 10 / Market Price x 100

Market Price = ₹ 99.11

An incorrect way to calculate PV of Principal is = ₹ 10000 x $PVF_{(@6\%, 2nd Year)}$ Why ? Since we have assumed 6% pa as compounded half-yearly. Hence, now we have to always first divide 6% by 2 i.e. make it as 3% for 6 months & then use it for discounting purposes.

(ii) Market Price of Bond = P.V. of Interest + P.V. of Principal

= ₹ 375 x $PVAF_{(@3\%, 4 periods)}$ + ₹ 10000 x $_{(PVF@3\%, 4th period)}$

= ₹ 1394 + ₹ 8885

= ₹ 10,279

(iii) If the yield of the bond falls the price will always increase. This can be shown by following calculation.

IF YIELD FALLS TO 4%

Price of 2yr. bond

₹ 375 (PVIFA 2%, 4 periods) + ₹ 10,000 (PVIF 2%, 4 periods)

₹ 375 (3.808) + ₹ 10,000 (0.9238)

1428 + 9238 = 10,666

Increase in 2 year's bond price = ₹ 387

PRICE INCREASE DUE TO CHANGE IN PV OF PRINCIPAL

₹ 10,000 (PVIF 2%, 4) - ₹ 10,000 (PVIF 3%, 4)

₹ 9238 - ₹ 8885 = ₹ 353

& change in price due to change in PV of Principal

(₹ 353/₹ 387) x 100 = 91.21%

PRICE CHANGE DUE TO CHANGE IN PV OF INTEREST

₹ 375 (PVAF 2%, 4) - ₹ 375 (PVAF 3%, 4)

₹ 1428 - ₹ 1394 = ₹ 34

% change in price $\frac{₹\ 34}{₹\ 387}$ x 100 = 8.79%

Question 5

RTP Nov 2018, Practice Manual

Pet feed plc has outstanding, a high yield Bond with following features:

Face Value	£ 10,000
Coupon	10%
Maturity Period	6 Years
Special Feature	Company can extend the life of Bond to 12 years.

Presently the interest rate on equivalent Bond is 8%.

(a) If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now.

(b) Now suppose, on the basis of that expectation, he invests in the Bond, but interest rate turns out to be 12%, six years from now, then what will be his potential loss/ gain.

Solution:

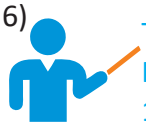
(a) If the current interest rate is 8%, the company will not extend the duration of Bond and the maximum amount the investor would ready to pay will be:

= £ 1,000 x PVIAF (8%,6) + £ 10,000 x PVIF (8%, 6)
= £ 1,000 x 4.623 + £ 10,000 x 0.630
= £ 10,923

(b) If the current interest rate is 12%, the company will extend the duration of bond. After six years the value of Bond will be

= £ 1,000 x PVIAF (12%,6) + £ 10,000 x PVIF (12%, 6)
= £ 1,000 x 4.111 + £ 10,000 x 0.507
= £ 9,181

Thus, potential loss will be 9,181 – 10,923 = £ 1,742



Tutorial Note:
Ideally 9181 should be compared with 10000 because if Company didn't extend the Bond then it would be redeemed @ 10000.

Question 6 (8 Marks) Exam Nov 2005, Nov 2018 (Similar)

M/s Transindia Ltd. is contemplating calling ₹ 3 crores of 30 year's, ₹ 1,000 bond issued 5 years ago with a coupon interest rate of 14 per cent. The bonds have a call price of ₹ 1,140 and had initially collected proceeds of ₹ 2.91 crores due to a discount of ₹ 30 per bond. The initial floating cost was ₹ 3,60,000. The Company intends to sell ₹ 3 crores of 12 per cent coupon rate, 25 years bonds to raise funds for retiring the old bonds. It proposes to sell the new bonds at their par value of ₹ 1,000. The estimated floatation cost is ₹ 4,00,000. The company is paying 40% tax and its after cost of debt is 8 per cent. As the new bonds must first be sold and their proceeds, then used to retire old bonds, the company expects a two months period of overlapping interest during which interest must be paid on both the old and new bonds. What is the feasibility of refunding bonds?

Solution:

NPV for bond refunding	**₹**
PV of annual cash flow savings (W.N. 2) (3,49,600 × PVIFA 8%,25 i.e. 10.675)	37,31,980
Less: Initial investment (W.N. 1)	29,20,000
NPV	8,11,980

Recommendation: Refunding of bonds is recommended as NPV is positive.

Working Notes:

(1)	Initial investment:			
	(a)	Call premium Before tax (1,140 – 1,000) × 30,000 Less tax @ 40%	42,00,000 16,80,000	
		After tax cost of call premium		25,20,000
	(b)	Floatation cost		4,00,000
	(c)	Overlapping interest Before tax (0.14 × 2/12 × 3 crores) Less tax @ 40%	7,00,000 2,80,000	4,20,000
	(d)	Tax saving on unamortised discount on old bond 25/30 × 9,00,000 × 0.4		(3,00,000)
	(e)	Tax savings from unamortised floatation Cost of old bond 25/30 × 3,60,000 × 0.4		(1,20,000)
				29,20,000

(2) Annual cash flow savings:

(a)	Old bond		
	(i) Interest cost (0.14 × 3 crores)		
	Less: Tax @ 40%		25,20,000
	(ii) Tax savings from amortisation of discount 9,00,000/30 × 0.4		(12,000)
	(iii) Tax savings from amortisation of floatation cost 3,60,000/30 × 0.4		(4,800)
	Annual after tax cost payment under old Bond (A)		25,03,200
(b)	New bond		
	(i) Interest cost before tax (0.12 × 3 crores)	36,00,000	
	Less tax @ 40%	14,40,000	
	After tax interest		21,60,000
	(ii) Tax savings from amortisation of floatation cost (0.4 × 4,00,000/25)		(6,400)
	Annual after tax payment under new Bond (B)		21,53,600
	Annual Cash Flow Saving (A) – (B)		3,49,600

Question 7 2 Questions Merged | RTP May 2018, RTP Nov 19

XL Ispat Ltd. has made an issue of 14 per cent non-convertible debentures on January 1, 2007. These debentures have a face value of ₹ 100 and is currently traded in the market at a price of ₹ 90.

Interest on these NCDs will be paid through post-dated cheques dated June 30 and December31. Interest payments for the first 3 years will be paid in advance through post-dated cheques while for the last 2 years post-dated cheques will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required:

(i) Estimate the current yield & the YTM of the bond.

(ii) If BEY on equivalent comparable bond is 11.80% then calculate the spread of yield of the above Bond from this comparable bond.

(iii) Calculate the duration of the NCD.

(iv) Assuming that intermediate coupon payments are, not available for reinvestment calculate the realised yield on the NCD.

Solution:

(i) Current Yield = $\frac{₹ 7}{₹ 90} \times \frac{12}{6}$ = 0.1555 or 15.55%

YTM can be determined from the following equation

7 x PVIFA (YTM, 10) + 100 x PVIF (YTM, 10) = 90

Let us discount the cash flow using two discount rates 7.50% and 9% semi-annually as follows:

Period	Cash Flows	PVF@7.50%	PV@7.50%	PVF@9%	PV@9%
0	-90	1	-90	1	-90
1	7	0.930	6.51	0.917	6.419
2	7	0.865	6.055	0.842	5.894
3	7	0.805	5.635	0.772	5.404
4	7	0.749	5.243	0.708	4.956

5	7	0.697	4.879	0.650	4.550
6	7	0.648	4.536	0.596	4.172
7	7	0.603	4.221	0.547	3.829
8	7	0.561	3.927	0.502	3.514
9	7	0.522	3.654	0.460	3.220
10	107	0.485	51.90	0.422	45.154
			6.560		-2.888

Now we use interpolation formula

$$7.50\% + \frac{6.560}{6.560 - (-2.888)} \times 1.50\% \qquad = 7.50\% + 1.041\%$$

YTM = 8.541% say 8.54% semi annually OR 17.08% pa compounded semi - annually.
Note: Students can also compute the YTM using rates other than 15% and 18%.

(ii) Spread from comparable Bond = 17.08% - 11.80% = 5.28%

(iii) The duration can be calculated as follows:

Period	Cash Flow	PVF@ 8.54%	PV@ 8.54%	Proportion of NCD value	Proportion of NCD value x time
1	7	0.921	6.447	0.0717	0.0717
2	7	0.849	5.943	0.0661	0.1322
3	7	0.782	5.474	0.0608	0.1824
4	7	0.721	5.047	0.0561	0.2244
5	7	0.664	4.648	0.0517	0.2585
6	7	0.612	4.284	0.0476	0.2856
7	7	0.563	3.941	0.0438	0.3066
8	7	0.519	3.633	0.0404	0.3232
9	7	0.478	3.346	0.0372	0.3348
10	107	0.441	47.187	0.5246	5.2460
			89.95		7.3654

Duration = 7.3654 half years i.e. 3.683 years.

(iv) Realized Yield can be calculated as follows:

$$\Rightarrow \frac{(7 \times 10) + 100}{(1 + R)^{10}} = 90 \qquad \Rightarrow (1 + R)^{10} = \frac{170}{90} \qquad \Rightarrow R = \left(\frac{170}{90}\right)^{1/10} - 1$$

$\therefore$ R = 0.0656 or 6.56% for half yearly and 13.13% p.a. comp semi-annually.

Question 8

Exam May 2007

Find the current market price of a bond having face value ₹ 1,00,000 redeemable after 6 year maturity with YTM at 16% payable annually and duration 4.3202 years. Given $1.16^6 = 2.4364$.

Solution: Let the interest Amount be x Caln of Duration

Year (D)	CF's	PV of CF's @ YTM = 16% (W)	W x D
1	x	0.8620 x	0.8620 x
2	x	0.7432 x	1.4864 x
3	x	0.6406 x	1.9218 x
4	x	0.5523 x	2.2092 x
5	x	0.4761x	2.3805 x
6	100000 + x	41044 + 0.41044 x	246264 + 2.46264 x
		∑W = 41044 + 3.6847 x	∑W D = 246264 + 11.3225 x

$$\text{Duration} = \frac{\sum WD}{\sum W} \quad \Rightarrow 4.3202 = \frac{246264 + 11.3225\,x}{41044 + 3.6847\,x}$$

$\therefore$ x = 15049 ~ 15000 [$\because$ Coupon Rate = 15%]

MP = Interest x $PVPIF_{(@\ YTM\%,\ n\ Yrs)}$ + Redemption Price x $PVF_{(@YTM\%,\ nth\ Year)}$

= ₹ 15000 x $PVAF_{(@\ 16\%,\ 6\ Years)}$ + ₹ 100000 x $PVF_{(@16\%,\ 6th\ Year)}$

= ₹ 96315

Alternative Solution

$$\text{Duration} = \frac{1+Y}{Y} - \frac{(1+Y) + T(C-Y)}{C[(1+Y)^T - 1] + Y}$$

here, Y means YTM
T means Maturity Period
C means Coupon Rate

$$4.3202 = \frac{1.16}{0.16} - \frac{1.16 + 6(C - 0.16)}{C[(1.16)^6 - 1] + 0.16}$$

$$4.3202 = 7.25 - \frac{1.16 + 6C - 0.96}{1.4364C + 0.16}$$

$$\frac{0.20 + 6C}{1.4364C + 0.16} = 2.9298$$

$\Rightarrow$ 4.2083C + 0.4687 = 0.20 + 6C

$\Rightarrow$ 0.2687 = 1.7917C

$\therefore$ C = 0.14996 ~ 0.15 or 15%

Question 9 RTP May 2017

Based on the following data, estimate the Net Asset Value (NAV) 1st July 2016 on per unit basis of a Debt Fund:

Name of Security	Face Value ₹	Purchase Price ₹	Maturity Date	No. of Securities	Coupon Date(s)	Duration of Bonds
10.71% Gol 2028	100	104.78	31st March 2028	100000	31st March	7.3494
10% Gol 2023	100	100.00	31st March 2023	50000	31st March & 30th September	5.086
9.5% Gol 2021	100	97.93	31st December 2021	40000	30th June & 31st December	4.3949
8.5% SGL 2025	100	91.36	30th June 2025	20000	30th June	6.5205

Number of Units (₹ 10 face value each): 100000

All securities were purchased at a time when applicable Yield to Maturity (YTM) was 10%. On NAV date, the required yield increased by 75 basis point and Cash in hand and accrued expenses were ₹ 6,72,800 and ₹ 2,37,400 respectively.

Solution: Working Notes:

(i) Calculation of Interest Accrued

Name of Security	Maturity Date	Amount (₹)
10.71% GOI 2028	$100 \times 100000 \times 10.71\% \times \frac{3}{12}$	2,67,750
10% GOI 2023	$100 \times 500000 \times 10.00\% \times \frac{3}{12}$	1,25,000
Total		3,92,750

Note: Interests on two remaining securities shall not be considered as last interest was paid on 30.06.2016.

(ii) Valuation of Securities

Name of Security	Purchase Amount ₹	Duration of Bonds	Volatility (%)	(+)/(-)	Total Amount ₹
10.71% GOI 2028	1,04,78,000	7.3494	$\frac{7.3494}{1.10}$ x 0.75 = 5.0110	- 5,25,053	99,52,947
10% GOI 2023	50,00,000	5.086	$\frac{5.086}{1.05}$ x 0.75 = 3.6329	- 1,81,645	48,18,355
9.5% GOI 2021	39,17,200	4.3949	$\frac{4.3949}{1.05}$ x 0.75 = 3.1392	- 1,22,969	37,94,231
8.5% SGL 2025	18,27,200	6.5205	$\frac{6.5205}{1.10}$ x 0.75 = 4.4456	- 81,230	17,45,970
					2,03,11,503

Calculation of NAV

Particulars	₹ crores
Value of Securities as computed above	2,03,11,503
Cash in hand	6,72,800
Interest accrued	3,92,750
Sub total assets (A)	**2,13,77,053**
Less: Liabilities Expenditure accrued	2,37,400
Sub total liabilities (B)	**2,37,400**
Net Assets Value (A) - (B)	**2,11,39,653**
No. of units	1,00,000
Net Assets Value per unit (₹ 2,11,39,653/ 1,00,000)	₹ 211.40

Question 10 Q Trimmed to save time | 2 Q Merged | Exam May 2015 (Similar)

On 31st March, 2013, the following information about Bonds is available:

Name of Security	Face Value ₹	Maturity Date	Coupon Rate	Coupon Date(s)
T – Bill	1,00,000	20th June, 2013	N.A.	N.A.
10% GOI 2018	100	31st March, 2018	10.00	31st March & 30th September

Calculate:

(i) What will be the annualized yield if the T-Bill is traded @ 98500?

(ii) If 10% GOI 2018 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?

(iii) Find the number of days required to break even transaction cost if the 10% GOI bonds are available at par and 2% is the transaction cost.

Solution:

(i) The day count basis is actual number days/365. Accordingly annualized yield shall be:

$$\text{Yield} = \frac{\text{FV - Price}}{\text{Price}} \times \frac{365}{\text{No. of days}} = \frac{100000 - 98500}{98500} \times \frac{365}{81} = 6.86\%$$

Note: Alternatively, it can also computed on 360 days a year.

(ii) Price GOI 2018 bond would fetch:

= ₹ 5 x PVAF (4%, 10) + ₹ 100 x PVF (4%, 10)

= ₹ 5 x 8.11 + ₹ 100 x 0.6756

= 40.55 + 67.56 = 108.11

(iii) No. of days required to break even

$$= \frac{2\% \times 100}{100 \times \frac{10\%}{365}} = 73 \text{ days}$$

Question 12

3 Questions Merged | Study Material, (6 Marks) Exam N15, N18, RTP N21, M25, MTP M21

Mr. A will need ₹ 1,00,000 after two years for which he wants to make one time necessary investment now. He has a choice of two types of bonds. Their details are as below:

	Bond X	Bond Y
Face Value	₹ 1,000	₹1,000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current Price	₹ 972.73	₹ 936.52
Current Yield	10%	10%

(i) Advice Mr. A whether he should invest all his money in one type of bond or he should buy both the bonds and, if so, in which quantity?

Assume that there will not be any call risk or default risk.

(ii) State the condition to be fulfilled for perfect immunization.

(iii) After the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of these bonds are : Bond X = 1 Year and Bond Y = 3.546 years. Is the portfolio still immunized ? Why or why not ?

(iv) Determine the new percentage of X and Y bonds that are needed to immunize the portfolio.

Solution: **(i) Duration of Bond X**

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	1070	.909	972.63	1.000	1.000

Duration of the Bond is 1 year

Duration of Bond Y

Year	Cash flow	P.V. @ 10%		Proportion of bond value	Proportion of bond value x time (years)
1	80	.909	72.72	0.077	0.077
2	80	.826	66.08	0.071	0.142
3	80	.751	60.08	0.064	0.192
4	1080	.638	737.64	0.788	3.152
			936.52	1.000	3.563

Duration of the Bond Y is 3.563 years

Let X be the investment in Bond X and therefore investment in Bond Y shall be (1 - X). Since the required duration is 2 year the proportion of investment in each of these two securities shall be computed as follows:

$2 = X \times 1 + (1 - X) \times 3.563$

$X = 0.61$

Accordingly, the proportion of investment shall be 61% in Bond X and 39% in Bond Y respectively.

Amount of investment

Bond X	Bond Y
PV of ₹ 1,00,000 for 2 years @ 10% x 61%	PV of ₹ 1,00,000 for 2 years @ 10% x 39%
= ₹ 1,00,000 (0.826) x 61% = ₹ 50,386	= ₹ 1,00,000 (0.826) x 39% = ₹ 32,214
No. of Bonds to be purchased	No. of Bonds to be purchased
= ₹ 50,386/₹ 972.73 = 51.79 i.e. approx. 52 bonds	= ₹ 32,214/₹ 936.52 = 34.40 i.e. approx. 34 bonds

Note: The investor has to keep the money invested for two years. Therefore, the investor can invest in both the bonds with the assumption that Bond X will be reinvested for another one year on same returns.

(ii) Assumption for perfect immunization :

(a) Yield curve is flat

(b) Duration of Asset & liability remains unchanged

(c) Interest Rate changes are Parallel shifts up or down in the yield curve.

(iii) With revised yield the Revised Duration of Bond Portfolio stands at

0.61 x 1 year + 0.39 x 3.546 year = 1.9929 years

No, Portfolio is not immunized as the duration of the portfolio has been decreased from 2 years to 1.9929 years.

(iv) New percentage of X and Y bonds that are needed to immunize the portfolio

Let proportion of investment in Bond X and Y is x and 1-x respectively, then

$1x + 3.546(1-x) = 2$

$x = 0.6072$

Accordingly, the % of investment of X and Y is 60.72% and 39.28 % respectively

Question 13 2 Q Merged | Study Material (4 Marks) Exam May 17, MTP Oct 22, Nov 23, Apr 24

Bank A enter into a Repo for 14 days with Bank B in 10% Government of India Bonds 2028 @ 5.65% for ₹ 8 crore. Assuming that clean price be ₹ 99.42 and initial Margin be 2% and days of accrued interest be 262 days.

You are required to determine

(i) Dirty Price

(ii) Repayment at maturity. (consider 360 days in a year).

(iii) Suppose repo rate & clean price are not given in the Q how could you find using rest of the info & addl. info obtained in points answered above

Solution:

(i) Dirty Price = Clean Price + Interest Accrued

$$= 99.42 + 100 \times \frac{10}{100} \times \frac{262}{360} \qquad = 106.70$$

(ii) First Leg (Start Proceed)

$$= \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100}$$

$$= ₹\ 8,00,00,000 \times \frac{106.72}{100} \times \frac{100 - 2}{100}$$

$$= ₹\ 8,36,52,800$$

Second Leg (Repayment at Maturity)

$$= \text{Start Proceed} \times \left(1 + \text{Repo rate} \times \frac{\text{No. of days}}{360}\right)$$

$$= ₹\ 8,36,52,800 \times \left(1 + 0.0565 \times \frac{14}{360}\right)$$

$$= ₹\ 8,38,36,604$$

Repo means Repurchase transaction. In a repo, one party sells an Asset (usually fixed income securities) to another party at one price & commits to repurchase the same from second party at a different price at a future date. The assets, therefore, acts as a collateral & mitigates credit risk.

(iii) Calculation of Repo Rate

$$\text{Second Leg} = \text{Start Proceed} \times \left(1 + \text{Repo Rate} \times \frac{\text{No. of days}}{360}\right)$$

$$₹\ 8,38,36,604 = ₹\ 8,36,52,800 \times \left(1 + \text{Repo Rate} \times \frac{14}{360}\right)$$

$$1.002197 = \left(1 + \text{Repo Rate} \times \frac{14}{360}\right)$$

Repo Rate = 0.0565 = 5.65%

Calculation of Dirty Price

$$\text{First Leg (Start Proceed)} = \text{Nominal Value} \times \frac{\text{Dirty Price}}{100} \times \frac{100 - \text{Initial Margin}}{100}$$

$$₹\ 8,36,52,800 = ₹\ 8,00,00,000 \times \frac{\text{Dirty Price}}{100} \times \frac{100 - 2}{100}$$

$$1.04566 = \frac{\text{Dirty Price}}{100} \times \frac{100 - 2}{100} \qquad \therefore \text{Dirty Price} = ₹\ 106.70$$

Derivatives Analysis & Valuation

Derivatives are financial instruments that derive their value from the value of an underlying asset. Underlying assets could be stocks, currency, gold, bonds, commodities etc.

- Forward
- Futures
- Options
- Swaps {Covered as a separate chapter}

A forward contract is a customized contract under which one party agrees to buy and the other party agrees to sell a specified asset on a specified future date at a price agreed upon today.

A futures contract is a standardized contract under which one party agrees to buy and the other party agrees to sell a specified asset on a specified future date at a price agreed upon today. In other words, futures are exchange-traded forward contracts.

An option is a contract between two parties under which the buyer of an option buys the right, and not the obligation, to buy or sell a specified quantity of certain underlying asset at or before pre-determined date at a price agreed upon today.

Forward vs Futures

Forward	Futures
Customized - Individually tailored	Standardized - In terms of Qty & Delivery dates
Two parties involved	Three Parties, 3rd party being stock exchange
Credit Risk - Any party can default	Guarantee of performance
No margin requirements & not subject to MTM Margin	Margin is required & are subject to MTM Margin

Bid Rate & Ask Rate

	Bid Rate		Ask Rate
1 unit of Gold	₹ 65000	-	₹ 66000
Gold Businessman	Buys @ ₹ 65000		Sells @ ₹ 66000
Customer	Sells @ ₹ 65000		Buys @ ₹ 66000

Customer बेचारा always looses in Bid Ask spread

Time Value of Money

Discrete Compounding

If Comp freq. is given

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

If Comp freq. is not given

$FV = PV\left(1 + r \times \frac{n}{12}\right)$

Continuous Compounding

$FV = PV \times e^{rt}$

here, e means exponential value [e = 2.71828]

r means rate of interest compounded continuously
Always use per annum rate in place of 'r'

t means time period (in n/12 or n/365 format)

Example: IF PV = ₹ 100, n = 3 months, r = 12% Calculate FV under below situations:

(i) If comp freq is given
  (a) r =12 % pa comp annually
  (b) r =12 % pa comp quarterly

(ii) If r =12 % pa (Comp freq not given)

(iii) If r =12 % pa compounded continuously.

Solve: (i) (a) $FV = PV(1+r)^n$
$= 100(1+0.12)^{3/12 \text{ years}}$
$= 102.87$

(b) $FV = 100(1+0.03)^{1 \text{ Qtr}}$
$= 103$

(ii) $FV = 100(1 + 0.12 \times 3/12)$
$= 103$

(iii) $FV = 100 \times e^{0.12 \times 3/12}$
$= 100 \times e^{0.03}$
$= 100 \times 1.03045$
$= 103.045$

Types of Margin

1. Initial Margin is required to be deposited at the time of initiation of the contract.

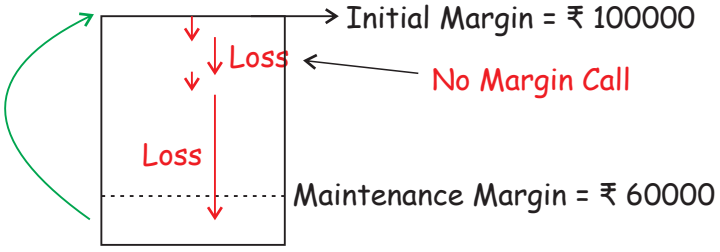
Initial Margin = $\mu + 3\sigma$ or Contract value x Initial margin%

here, μ means Average daily absolute change
σ means Standard Deviation of daily price Changes

Example: The average daily absolute change of Reliance Industries shares is ₹ 60 and standard deviation of these changes is ₹ 25. Then Initial Margin = ₹ 135 per share [₹ 60 + 3 x ₹ 25]. If 1 Lot has 300 shares of Reliance, then Initial Margin per lot = ₹ 135 x 300 = ₹ 40500

2. Mark - to market margin [MTM] takes care of daily gain / losses. The party who incurs loss makes the Payment which is then passed on to the other party who made gains.
Daily MTM = (Δin closing futures price of today vs. previous day) x Lot size x No. of lots

3. Maintenance Margin
As soon as you breach the maintenance level, you have to re-fill it back upto the initial margin level



4. Additional Margin When Exchange predicts higher volatility ahead then it calls for Addl. margin which is in addition to the Initial margin so as to cover the additional risk posed by major events such as Election results etc.

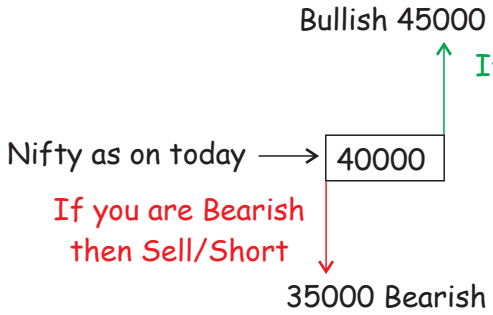
Uses of Derivatives

HEDGING
means to protect ourself from any kind of price fluctuations

SPECULATION
is one-sided tr^{n} entered into in the hope of making gains. If our view holds good then we make gains else we incur loss

ARBITRAGE
Arbitrage is a two-sided tr^{n} entered into at the same time to earn risk-free arbitrage gains due to mispricing in market

Speculation



Tutorial Note
Speculation in Forward/ Futures may result into either gain/ loss depending upon the movement of share prices.

Arbitrage

is the process of buying a security in one market and simultaneously selling an equal product in another market to profit from pricing differences. Hence, a two-step process is followed:

Step 1 Calculate Fair Futures Prices

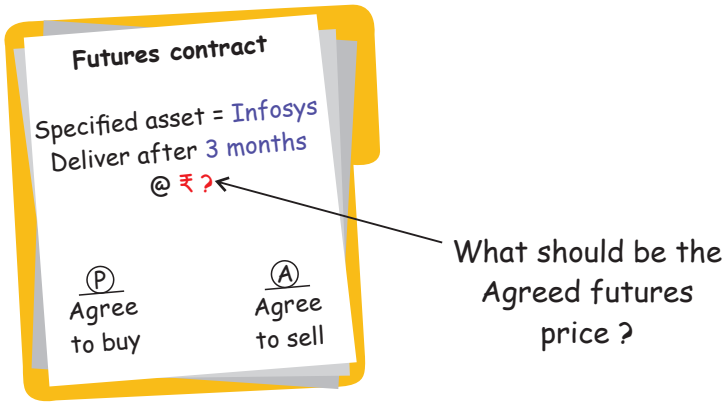
Step 2 If Fair Futures Price ≠ Actual Futures Price then arbitrage opportunity exists. To earn profits simply enter into following actions:

(a) Buy Undervalued Instrument,

(b) Sell the Other instrument &

(c) Borrow/ Invest the appropriate amount.

Determination of Fair Futures Price - Using Cost of Carry Model



Let's say, we wish to calc 6-m Futures Price on Gold which is currently trading in spot @ ₹ 60000.

Fair Futures Price	= Spot price	+ Cost of carry: Interest (say @ 10% pa for 6m)	+ Cost of carry: Storage cost (say ₹ 100 per month)	- Income (say ₹ 50 p.m.)
	= ₹ 60000	+ 3000	+ 600	- 300
	= ₹ 63300			

Net cost of carry

Determination of fair futures price - various situations

- Stock
  - Non-dividend paying stock [case I]
  - Dividend paying stock
    - Dividend info is given in absolute ₹ terms [case II]
    - Dividend info is given as div. yield % [case III]
- Commodities
  - Investment commodity [case IV]
  - Consumption commodity [case V]

Case I: Underlying Stock Providing No Income

Basic Equation Futures price = Spot price + Interest + Storage cost - Income

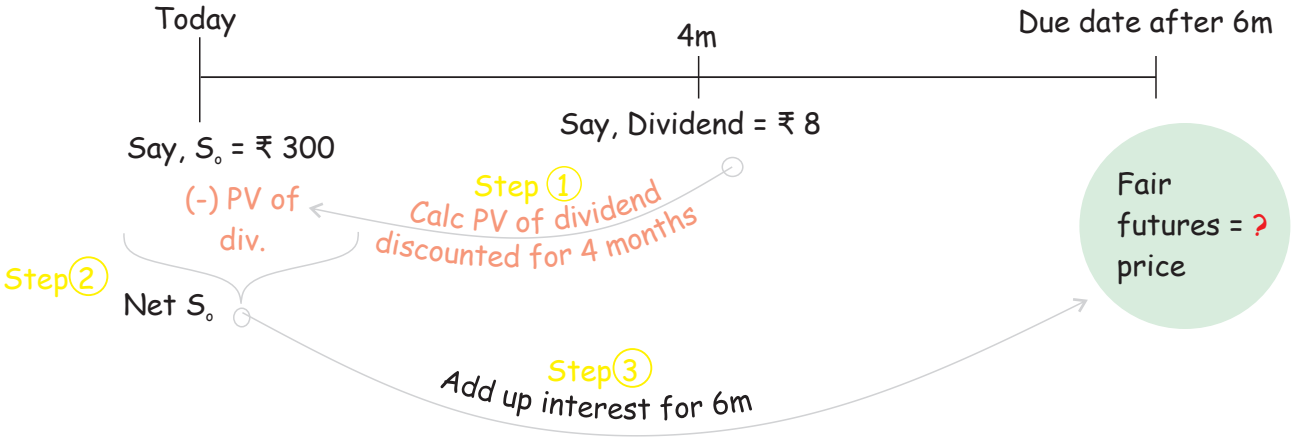
There is no storage cost in case of shares

Since Underlying asset provides NO Income

If discrete Compounding	If Continuous Compounding
If Comp freq given $F = S_0 \times (1 + r)^n$	$F = S_0 \times e^{rt}$
If Comp freq NOT given $F = S_0\left(1 + r \times \frac{n}{12}\right)$	here, F means Futures price, S_0 means Spot price today

Case II: Underlying asset providing income-Dividend income given in absolute terms (₹)

Basic Equation Fair futures price = Spot price + Interest + Storage Cost - Income

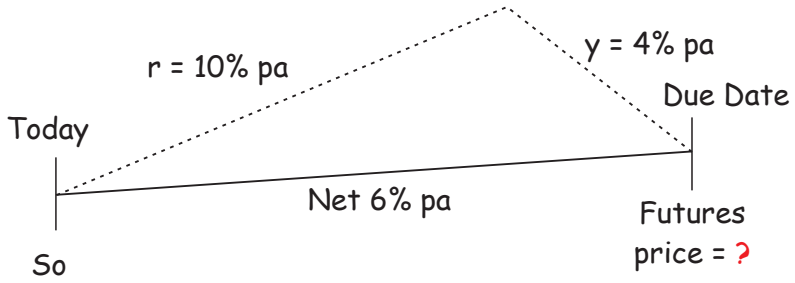


Obviously, Only those dividends that fall due before futures contract expiry dates are considered here.

If discrete Compounding	If Continuous Compounding
If Comp freq given $F = (S_0 - I) \times (1 + r)^n$	$F = (S_0 - I) \times e^{rt}$
If Comp freq NOT given $F = (S_0 - I) \times \left(1 + r \times \frac{n}{12}\right)$	here, I means PV of dividend income PV of dividend = $\frac{\text{Dividend}}{(1+r)^n}$ or $\frac{\text{Dividend}}{1 + r \times \frac{n}{12}}$ or $\frac{\text{Dividend}}{e^{rt}}$

Tutorial Note :
Instead of calculating PV of Dividends, an alternative way is to
(i) Calculate FV of Dividend Income, then
(ii) Calculate FV of S_0 and then
(iii) Deduct 'FV of Div' from 'FV of S_0'
You'll get same Answer of Fair Futures Price

Case III : Underlying asset providing income in yield% terms



If discrete Compounding	If Continuous Compounding
If Comp freq given $F = S_0 \times (1 + (r - y))^n$	$F = S_0 \times e^{(r-y)t}$
If Comp freq NOT given $F = So \times \left(1 + (r - y)\frac{n}{12}\right)$	here, y means Dividend Yield%

Caution Note
1 These formulas are applicable only when compounding freq. of r & y is same else use case (ii) formula.
2 These formulas are applicable only when 'Dividend Yield%'word is given. However, if only 'Dividend%' is given then simply apply Div% on Face Value and use case (ii) formula.

General Points to Remember

1. Contango & Backwardation Market situations:

Basis = Spot Price - Future Price

If Basis is Positive → Backwardation Market

If Basis is Negative → Contango Market

2. If Actual Futures Price > Theoretical Future Price then Future is Overpriced.
Action: Short Future, Long Spot & Borrow {it is called as Cash & Carry Arbitrage}

If Actual Future Price < Theoretical Future Price then Future is Underpriced.
Action: Long Future, Short Spot & Invest {it is called as Reverse Cash & Carry Arbitrage}

3. Settlement of futures contract

Two modes

By Price Difference
i.e. pay/ receive the Difference b/w Futures price agreed originally vs. spot price prevailing on the due date

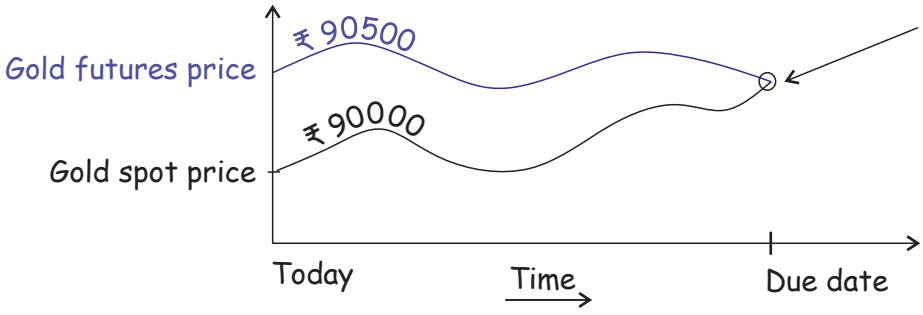
By Actual delivery
i.e. actually Buy / Sell share @ originally agreed futures price

Index Future are always settled by price difference since an Index cannot be delivered in spot

If Q is silent about mode of settlement & Future price on expiry date is not given in the Q, then settle Stock future contract through delivery.

Tutorial Note : Irrespective of the mode of settlement, final arbitrage gain amount remains the same, usually !

4. Convergence of Futures price & Spot price on expiry date.



Ideally futures price on the last date should exactly equal spot price on last date.
However, practically there could be some minor differences. Hence, if in exam actual futures price on the due date is given then use it to square off the transaction else use spot price on the due date.

5. How to find equivalent rates continuous ⇌ Normal

Continuous to Normal

$r_1 = m \times (e^{\frac{r_2}{m}} - 1)$

here, r_1 means Normal rate
r_2 means Continuous rate
m means No. of compoundings in a year

Normal to Continuous

$r_2 = m \times Ln\left(1 + \frac{r_1}{m}\right)$

Eg. 12% pa continuously compounded.
Calc equivalent rate if compounded semi- annually

Solve: $r_1 = m \times (e^{r2/m} - 1)$
$= 2 \times (e^{0.12/2} - 1)$
$= 2 \times (e^{0.06} - 1)$
$= 2 \times (1.06184 - 1)$
$= 12.368\%$ pa comp semi-annually

Eg. If 12.368% pa compounded semi- annually is the rate then calc equivalent continuously comp rate.

Solve: $r_2 = 2 \times Ln\left(1 + \frac{0.12368}{2}\right)$
$= 2 \times Ln(1.06184)$
$= 2 \times 0.06$
$= 0.12$ i.e. 12% pa cc

Example [Source: ICAI Study Material, RTP May 2024]

The price of ACC stock on 31 December 2024 was ₹ 220 and the futures price on the same stock on the same date, i.e., 31 December 2024 for March 2025 was ₹ 230. Other information:

Time to expiration	-	3 months (0.25 year)
Borrowing rate	-	15% p.a.
Annual Dividend on the stock	-	25% payable before 31.03.2025
Face Value of the Stock	-	₹ 10

Evaluate arbitrage opportunity if any ?

Solve: Step 1 Calculate fair future price

Fair future price = 220 + (220 x 0.15 x 0.25) — (0.25 x ₹ 10) = 225.75

Step 2 Compare future prices (Fair v/s actual) & evaluate arbitrage opportunity.

Since Fair futures price (₹ 225.75) < Actual future price (₹ 230), future contract are overvalued. This would give rise to arbitrage opportunities.

An arbitrageur should:

(i) Buy the ACC stock at ₹ 220

(ii) Borrow the amount of ₹ 220 @ 15 % for a period of 3 months and

(iii) Sell the March 2025 futures on ACC stock.

By 31st March 2025, he will receive the dividend of ₹ 2.50 per share.

On the expiry date of 31st March, he will deliver the ACC stock against the March futures contract sales.

The arbitrager's inflows/outflows are as follows:

Particulars	Amount
Sale proceeds of March 2025 futures on due date	₹ 230.00
Dividend	₹ 2.50
Total (A)	₹ 232.50
Pays back the Bank	₹ 220.00
+ Cost of borrowing i.e. Interest	₹ 8.25
Total (B)	₹ 228.25
Net Arbitrage Gain (A) - (B)	₹ 4.25

Thus, the arbitrager earns ₹ 4.25 per share without involving any risk.

Q. What if in above case ACC futures were trading @ ₹ 222 instead of ₹ 230.

Step 1 Same as above

Step 2 Since Fair futures price (₹ 225.75) < Actual future price (₹ 222), future contract are undervalued. This would give rise to arbitrage opportunities.

An arbitrageur should:

(i) Sell the ACC stock at ₹ 220 (by borrowing stock under SLBS scheme)

(ii) Invest the amount of ₹ 220 @ 15 % for a period of 3 months and

(iii) Buy the March 2025 futures on ACC stock.

By 31st March 2025, he will need to pay the dividend of ₹ 2.50 per share.

On the expiry date of 31st March, he will receive the ACC Stock under future contract and deliver the same under SLBS scheme.

The arbitrager's inflows/outflows are as follows:

Particulars	Amount
Outflow on buying stock under March 2025 futures on due date	₹ 222.00
Payment of Dividend	₹ 2.50
Total (A)	₹ 224.50
Redemption of investment	₹ 220.00
+ Interest income	₹ 8.25
Total (B)	₹ 228.25
Net Arbitrage Gain (A) - (B)	₹ 3.75

Thus, the arbitrager earns ₹ 3.75 per share without involving any risk.

Commodities

Case (iv)
Investment Commodity / Carry - type Commodity
Eg . Gold

Case (v)
Consumption Commodity / Non - Carry type Commodity
Eg . Wheat

If discrete Compounding	If Continuous Compounding
If Comp freq given $F = (S_0 + S - I) \times (1 + (r-c))^n$	$F = (S_0 + S - I) \times e^{(r-c)t}$
If comp freq NOT given $F = (S_0 + S - I) \times \left(1 + (r-c)\ \frac{n}{12}\right)$	here, C means Convenience yield S means PV of Storage cost I means PV of Income

Meaning of Convenience Yield

One who buys commodity in spot also enjoys the convenience of consuming/ using such commodity in times of need. But this convenience is not enjoyed by Futures Contract buyer, hence he'll deduct amt for Conv Yield.

Exam Tip: If Convenience Yield is given in ₹ terms instead of % terms, then formula changes to:

$F = (So + S - I - C) \times e^{rt}$

here, C means PV of Convenience Yield amount

Mathematics of e^x

How to find value of fractional x in e^x formula

Example: ITC CMP = ₹ 300

Rf = 8% p.a. continuously compounded. Calculate 5-month futures price.

Solve: $F = S_0 \times e^{rt}$ | or $FV = PV \times e^{rt}$

$= ₹ 300 \times e^{0.08 \times 5/12}$

$= ₹ 300 \times e^{0.0333}$

$= ₹ 300 \times 1.0338688 = ₹ 310.16$

Caln of $e^{0.0333}$ value

Alt 1 : Interpolation method

e power		Corresponding value {Refer table on the last page}
$e^{0.03}$		1.03045
When power increases by 0.01	0.0033 ↑	? → ?? = 1.0338688 → value increases by 0.01036
$e^{0.04}$		1.04081

When Power ↑ by	Value ↑ by
∵ 0.01	0.01036
∴ 0.0333	? = $\frac{0.01036 \times 0.0033}{0.01}$ = 0.0034188

There fore , $e^{0.0333}$ = 1.03045 + 0.0034188 = 1.0338688

Alt 2 : % age of the difference method

$e^{0.0333}$ ← take %age equivalent to 3th & 4th decimal place i.e. 33% in our case .

Ignore 0.03 for rightnow

Now calc 33% of the difference in value of $e^{0.04}$ & $e^{0.03}$ & then add this calculated amount to the value of $e^{0.03}$

= (1.04081 - 1.03045) x 33% = 0.0034188

$e^{0.0333}$ = 1.03045 + 0.0034188 = 1.0338688

Please also note that $e^{-x} = \frac{1}{e^x}$ $e^{x-y} = \frac{e^x}{e^y}$

Mathematics of Ln(x)

Just like Antilog is opposite of Log, similarly Ln is opposite of e^x.
It means if you take some number say 'x', then calc e^x, then calc Ln (e^x), you'll get 'x' again.

Eg. 2 ITC CMP = ₹ 300
5-m futures contract on ITC is trading @ ₹ 310.16 Calc continuous rate of interest ?

Solve : $F = S_o \times e^{rt}$

$310.16 = 300 \times e^{r \times 5/12}$

$1.03386 = e^{0.4167r}$

Since, Ln (x) & e^x are opposite of each other, applying this learning to our example
Taking Ln on both the sides

Ln (1.03386) = Ln ($e^{0.4167r}$)

Ln 1.03386 = 0.4167r ..... eq^n 1

Ln		value (from table)
Ln 1.03		0.02956
When Ln increases by 0.01	0.00386	? = 0.003728
Ln 1.03386		?? = 0.033288 → Value increases by 0.00966
Ln 1.04		0.03922

When Ln ↑ by	Value ↑ by
0.01	0.00966
∴ 0.00386	? = $\frac{0.00386 \times 0.00966}{0.01}$ = 0.003728

hence, Ln 1.03386 = 0.02956 + 0.003728

Replacing Ln (1.03386) by 0.033288 in eqⁿ 1

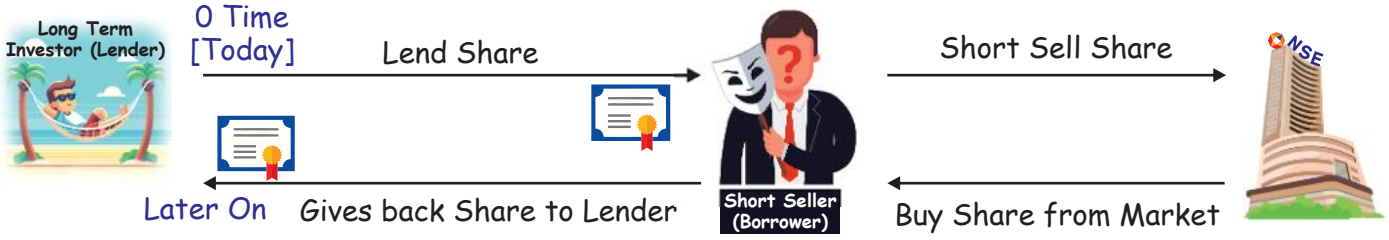
Ln 1.03386 = 0.4167r

0.033288 = 0.4167r

∴ r = 0.0799 ... ~ 0.08 or 8% pa cc

Stock Lending & Borrowing Scheme [SLBS]

Process of Stock Lending & Borrowing



Computation of Total Earnings of Lender in this process

Lending Charges/ Fees per share	xx ← Calculate only this if ICAI asks 'Earnings through SLB scheme'
x No. of shares	
Total lending charges	
(+) Dividend Received per share	xx
Total Earnings per Share	xx
x No. of Shares	xxx
Total Earnings	xxxx ← Calculate this if ICAI asks 'Total earnings of lendes'

Computation of Total Profit / (Loss) of Borrower in this process

Lending Fees Paid per share	(xx)
Bank Guarantee Charges [Price of share at 0 time x Bank Guarantee Cost% x No. of days or months of Borrowing / 365 or 12]	xx
Gain / (Loss) on short sale of share [Price of share at 0 time - Price of share at the End]	xxx/(xxx)
Total Profit / (Loss) per Share	xxx/(xxx)
x No. of Shares	xxx
Total Profit/ (Loss)	xxx/(xxx)

ICAI doesn't give the effect of dividend reimbursed by borrower to lender

Hedging Master Chart

Hedging a Single Stock

Concept 1 — If Stock Futures Contract on such stock exists

Simply enter into "Opposite Action"

In other words

- ✓ If Long in Stock then go Short in Futures
- ✓ If Short in Stock then go Long in Futures

Concept 2 — If futures contract on such stock doesn't exist

"Use Index Futures"

*Amt of Index Futures to be traded

= β x Rupee value of spot position requiring hedging

$$\text{*No. of Index Futures to be traded} = \frac{\beta \times \text{Rupee value of spot position requiring hedging}}{\text{Value of One Index Futures contract}}$$

Note:

If β is +ve then take opposite action, If β is -ve then take same action as in Spot.

Hedging an entire portfolio

Concept 3 — by buying / selling shares in spot

*Amount of stock to be traded

$$= \frac{\beta_2 - \beta_1}{\beta_1} \times \text{Current Value of portfolio}$$

here, β_1 means existing β_P

β_2 means desired β_P

Note:

If the result of above formula is positive then long shares by borrowing money.

If the result is negative then should sell shares & invest the proceeds in risk free / keep in cash.

Concept 4 — by Trading in Index Futures

*No. of Index Futures to be traded

$$= \frac{(\beta_2 - \beta_1) \times \text{Current Value of portfolio}}{\text{Value of One Index Futures contract}}$$

Note:

If the result is positive then long index futures [Required when we desire to increase β].

If the result is negative then short index futures [required when β is desired to be decreased]

Tutorial Notes:

Note 1 - If above formulas result into fractional no. of lots then simply round it off to the nearest whole number.

Note 2 - If question gives both index spot price as well as index futures price then we have to use "Index futures price x Lot size" to calculate Value of One Index Futures contract

Note 3 - If desired beta after hedging (β_2) is not given in the Q, then assume it as 0 (zero)

Note 4 - Exception to above formulas: If question uses word "Bring in"/ Brought in" then above formulas do not hold good. In such a situation either risk free investment is brought in from somewhere outside or cash is taken out of the portfolio. Solve this situation by assuming weight of Rf Inv as "x" [Refer LDR Q]

Note 5 - If Q asks to calc β after hedging then the easiest way (& also preferred by ICAI) is to use below formula

$$\beta_P = \frac{\%\ \Delta \text{ in portfolio value [i.e. G/(L) in spot } \pm \Delta \text{ in cash due to MTM paid/ recd on index futures)}}{\%\ \Delta \text{ in Index/ Market}}$$

Concept 1: Hedging a stock - Using stock futures

Suppose you hold 9600 shares of ITC @ ₹ 450. Now you expect a sudden fall in share price. How can you protect your long position?

Simply enter into Opposite Action in Future Contract
i.e. If Long in Spot then go Short in Future contract or If Short in spot then go Long in future contract for the same no. of shares.

Proof: If shares of ITC falls by 10%, show how are you protected?

Spot Position	Futures Position
Long in Spot on ITC shares @ 450	Short ITC Futures @ ₹ 450
↓ 10%	↓ 10%
₹ 405	₹ 405
Loss in spot = ₹ 45 per share x 9600 shares = (₹ 432000)	Gain on futures = ₹ 45 per share x 9600 = + ₹ 432000

On overall basis we were protected

Concept 2: Hedging a Stock - Using Index Futures

Suppose you hold 10,000 shares of Shalby hospitals which is currently trading @ ₹ 285. You expect an adverse macro economic event to occur because of which share prices will fall, how can you protect yourself.

If stock futures on such stock are not traded then we use Index futures for heding, this is so because there exists some connection between every stock & the index which is explained by β

Interpretation of βeta (β)

β tells us how the stock will move with respect to movements in the market. For example if β is 2 times, then it means that for every 1% movement in index the share will move by 2% in the same direction.

Question: Let us assume β of Shalby hospitals 1.5 times. Let us say Index is trading at 22000 with a lot size of 50, how many Index Futures will you trade to hedge the position in spot?

Stock in Spot
Long = ₹ 285 x 10,000 shares
= ₹ 28,50,000
↓ Stock falls by @15%
Loss in Spot = ₹ 4,27,500

β = 1.5 times

Since β Shalby hospitals is 1.5 times

Incorrect Approach
Index Futures
Short in futures
= ₹ 28,50,000
↓ say, Index falls by @10%
Gain on Futures = ₹ 2,85,000

Oh No! It did not result in complete hedging

Wow! Now we have achieved complete hedging, since Loss in Spot is Exactly Offset by Gain on Futures.

Correct Approach
Index Futures Short in futures
= 1.5 times x 28,50,000
= ₹ 42,75,000
say ↓ @10%
Gain on futures = ₹ 4,27,500

Amount of index futures to be traded = β x Rupee Value of spot position requiring hedging

No. of Index futures to be traded = $\frac{\beta \times \text{Rupee value of spot requiring hedging}}{\text{Value of One Index Futures contract}}$

$$= \frac{1.5 \text{ times} \times 2850000}{22000 \times 50} = 3.88 \text{ lots}$$

Ans: Since futures contract cannot be traded in fractions, therefore, we will round it off ⟶ approx 4 lots Index Futures short

Tutorial Note: If ß is +ve then we take Opposite Action in Index Futures
If ß is -ve then we take Same Action in Index Futures

Concept 3: Hedging an entire Portfolio - by buying / selling share in spot

Example

Company	MP	n	β
Reliance	₹ 1400	1000	1.6 times
ONGC	₹ 200	10,000	0.7
Vedanta Ltd.	₹ 150	8,000	2.2

Q. Calculate β of portfolio

Company	MP	n	β_i	MV	W_i	$\beta_i \times W_i$
Reliance	₹ 1400	1000	1.6	14,00,000	14/46	0.466
Ongc	₹ 200	10000	0.7	20,00,000	20/46	0.3043
Vedanta	₹ 150	8000	2.2	12,00,000	12/46	0.5739
				46,00,000		β_P = 1.365

Interpretation - β_P of 1.365 times indicates that for every 1% fall in stock market our portfolio will fall by 1.365%.

How can we reduce β_P to 0.80?

Do not make the mistake of selectively selling one or two shares & selectively investing the proceeds in specific shares since it will distort the composition of your portfolio.

Trick: We will sell all three stock in the same proportion as these are currently present in the portfolio, consequently β of these three stocks combined together will remain same at 1.365.
But since the sale proceeds will be kept in cash / invested in Risk free having β = 0, overall β_P will decrease.

Alt - 1 - Assuming X

Let the weight of combined stocks be X, hence weight of cash will be 1-X

$$\beta_P = \left(\begin{matrix}\beta \text{ of combined} \\ \text{stocks}\end{matrix} \times \begin{matrix}\text{Weight of} \\ \text{combined stocks}\end{matrix}\right) + \left(\begin{matrix}\beta \text{ of cash} \\ \text{or Rf}\end{matrix} \times \begin{matrix}\text{Weight of} \\ \text{cash or Rf}\end{matrix}\right)$$

$0.80 = 1.365 \times X + 0 \times (1 - X)$

$0.80 = 1.365\ X$

$X = 0.5861$

$\therefore$ Amount to be kept in combined stocks = ₹ 46 lakhs x 0.5861 = ₹ 26,96,060

Amount to be kept in cash / risk free i.e. amount of stocks to be sold = ₹ 46,00,000 - 26,96,060
= ₹ 19,03,940

Action Portfolio manager should sell stocks worth ₹ 19,03,940 in the same proportion as these are present in the Portfolio [14:20:12] and invest the proceeds in risk free security/ keep in cash, in order to reduce β_P to 0.80

Alt - 2 Cross Multiplication

β_P	Inv. in stock
∵ 1.365	₹ 46 lakh
∴ 0.80	?

$$= \frac{0.80 \times ₹\ 46 \text{ lakhs}}{1.365} = ₹\ 26.95971 \text{ lakhs}$$

Amount of stock to be sold & kept in cash / RF
= ₹ 46 - 26.95971
= 19.04 lakhs

Alt - 3 Formula (Prefer in Exams)

$$\text{Amount of stock to be traded} = \frac{\beta_2 - \beta_1}{\beta_1} \times \text{Current value of portfolio}$$

here, β_1 means - existing β of portfolio
β_2 means - desired β of portfolio

$$= \frac{0.80 - 1.365}{1.365} \times 46 \text{ lakhs}$$

= - ₹ 19.04029 lakhs

"-" means we will sell stocks worth this much

Q How can you increase β_P to 1.8 times ?

Alt 1 - Assuming X Let the weight of amount to be borrowed be denoted by "-X" and total investment in 3 combined stock be denoted by "1 + X"

$\beta_P = \beta_{\text{Combined stock}} \times W_{\text{Combined stock}} + \beta_{\text{Borrowing}} \times W_{\text{Borrowings}}$

$1.8 = 1.365 \times (1 + X) + 0 \times (-X)$

$1.8 = 1.365 + 1.365\ X + 0$

$0.435 = 1.365\ X$

$X = 0.31868$

$\therefore$ Amount to be borrowed = ₹ 46 lakhs x 0.31868 = ₹ 14,65,928

Action Portfolio manager should borrow ₹ 14,65,928 and invest the proceeds in these three stocks in the same proportion as these are present in the portfolio [14:20:12] in order to increase β_P to 1.8 times

Alt -2 Cross multiplication

β_P	Inv. in stock
∵ 1.365	₹ 46 lakhs
∴ 1.8	?

$$\frac{1.8 \times ₹\ 46 \text{ lakhs}}{1.365} = ₹\ 60.6593 \text{ lakhs}$$

Therefore, amount of stock to be bought
= ₹ 60.6593 lakhs - ₹ 46 lakhs
= ₹ 14.6593 lakhs

Alt -3 Formula (Prefer in Exams)

$$\text{Amount of stock to be traded} = \frac{\beta_2 - \beta_1}{\beta_1} \times \text{Current value of portfolio}$$

$$= \frac{1.80 - 1.365}{1.365} \times 46 \text{ lakhs}$$

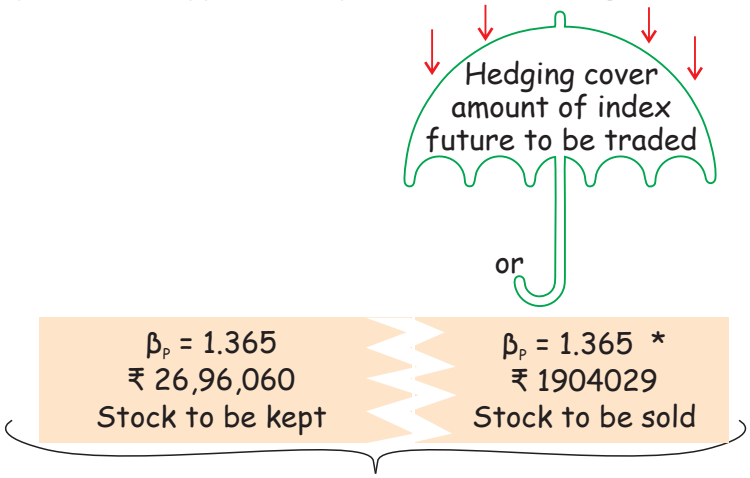
= + ₹ 14.6593 lakhs

"+" indicates we have to buy the shares

Concept 4: Hedging an entire portfolio - Using Index Futures

Q. How can you achieve the same position as in Concept 3 - Case 1 above i.e. reduce β_P from 1.365 to 0.80 by trading in Nifty futures. Suppose, Nifty Futures are trading at 12,500 with lot size of 20.

Alternative 1:



Amount of index futures to be traded
= 1.365 times x ₹ 1904029
= ₹ 25,99,000

or $\left[\frac{₹\ 25,99,000}{12500 \times 20}\right]$

10.40 ~ 10 lots Short

Total investment = ₹ 46 lakhs : β_P = 1.365 times

* The logic is simple, instead of selling the stocks worth ₹ 1904029 we can simply take complete hedge on these stocks by entering into Short Index Futures Contract.

Alternative 2: Formula (Prefer in exam)

$$\text{No. of index futures to be traded} = \frac{(\beta_2 - \beta_1) \times \text{current value of portfolio}}{\text{Value of One Index Futures contract}}$$

$$= \frac{[0.80 - 1.365] \times 46 \text{ lakhs}}{12500 \times 20}$$

= -10.396 lots ~ 10 lots short

Q. How can you increase β_P to 1.80 using index futures

$$\text{No. of index futures to be traded} = \frac{[1.80 - 1.365] \times 46 \text{ lakhs}}{12500 \times 20} = 8.004 \text{ lots} \sim 8 \text{ lots Long}$$

Q. In the above case how will you prove that β_P = 1.8 times

To prove that β_P = 1.8 times, let us assume that market goes up by 10% hence our overall position should provide gain of 18%

Gain in spot [46,00,000 x 13.65%]	=	627900
Gain on index futures [8.004 or 8 x 20 x 12500 x 10%]	=	200000
Total Gain	=	827900

$$\text{Total Gain\%} = \frac{827900}{4600000} = 0.18 \text{ or } 18\%$$

Hedging commodities using Commodity Futures

Steps to be followed to solve the question:

Step 1: Which position should be created in commodity futures

If we already have a long position on commodity [i.e. Bought commodity]	If we already have a Short position on commodity [i.e. Sold commodity]
↓	↓
Create short position on commodity Futures [i.e. Sell Commodity Futures]	Create Long position on commodity Futures [i.e. Buy Commodity Futures]

Step 2: Calc No. of commodity futures contract to be bought or sold

$$= \frac{\text{Total Physical Quantity in spot x Hedge Ratio}}{\text{Future Contract Physical quantity Size}}$$

$$\text{Hedge Ratio} = Corr_{SF} \times \frac{\sigma_s}{\sigma_F}$$

[Imagine $\beta_i = Corr_{im} \times \frac{\sigma_i}{\sigma_m}$]

here,

σ_s = Standard deviation of change in spot price of commodity

σ_F = Standard deviation of change in Future price of commodity

$Corr_{SF}$ = Correlation between change in spot & Future price.

Tutorial Note:

(i) If Hedge ratio is not given in Q, then assume it as 1.

(ii) Exposure in Commodity futures:

Amount of Commodity futures contract to be bought or sold = No. of Commodity futures contracts (as calc above) × Commodity contract physical Size × Actual/ Quoted/ Trading Price of commodity futures

Step 3: Calculate Net Cash received on maturity after Hedging

Amount received from actual sale of Commodity on maturity [Total physical Quantity in spot x Actual spot price]	xxx
± Gain/ Loss on Commodity futures contracts [No. of Future contracts × Future Contract Size × Difference between price of future on maturity (Settlement price) & Initially contracted price]	xxx/(xxx)
Net Cash Received on maturity after Hedging	xxx

Step 4: Calculate Effective price realised from sale of commodity on maturity due to hedging

$$= \frac{\text{Net Cash Received on maturity after Hedging}}{\text{Total Quantity of Commodity in spot}}$$

Options Contract

Basics

Two Types of Options

CALL OPTION
Underlying asset: Reliance
Lot size: 250 shares
Agreed price or Strike price or Exercise price: ₹3000
Premium
(P) Buyer of CO — (A) Seller of CO

PUT OPTION
Underlying asset: Reliance
Lot size: 250 shares
Agreed price or Strike price or Exercise price: ₹2800
Premium
(P) Buyer of PO — (A) Seller of PO

read as "has acquired right to buy"

read as "has given right to buy to someone else" hence CO seller has an 'obligation to sell' if CO buyer chooses to buy the asset

read as "has acquired right to sell" the underlying asset

read as "has given 'right to sell' to someone else" & hence you have an obligation to buy the underlying asset when PO buyer decides to sell the asset

Tutorial Note: Buyer of an option aka 'Option holder'
Seller of an option aka 'Option writer'

Options Terminologies

In the money , At the money, Out of the money, Intrinsic value & Extrinsic value

Underlying asset Reliance industries | CMP ₹ 1000

Type of option Call Option						Type of option Put Option					
Exercise price	CMP ₹	Intrinsic value	Extrinsic value*	Total premium	Option status	Exercise price	CMP ₹	Intrinsic value	Extrinsic value*	Total premium	Option status
960	1000	40	25	65	ITM	960	1000	0	12	12	OTM
980	1000	20	15	35	ITM	980	1000	0	18	18	OTM
1000	1000	0	10	10	ATM	1000	1000	0	25	25	ATM
1020	1000	0	7	7	OTM	1020	1000	20	23	43	ITM
1040	1000	0	3	3	OTM	1040	1000	40	21	61	ITM

*Extrinsic value represents Time value of money component

Note: 'Option status' simply compares Exercise price vs. CMP. Ignore premium amount paid / received while determining option status

Style of Option - Based on their Exercisability

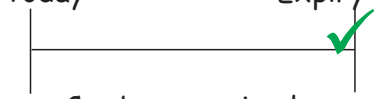
American style option

Today — Expiry date

Can be exercised at Anytime

European style option

Today — Expiry date



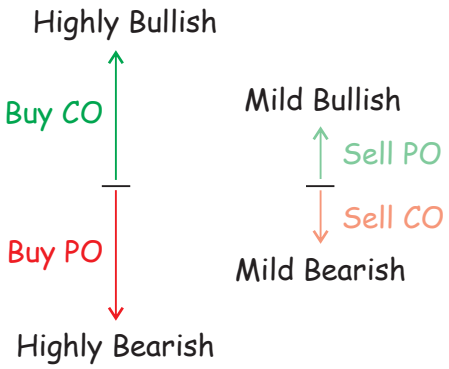
Can be exercised only on Expiry date

Bermudan style option

Today — Expiry date

Can be exercised in - between some specific dates i.e. can be exercised on Broken dates

Speculation



Arbitrage

A two-step process is followed:
Step 1: Calculate Fair Option Prices
Step 2: If Fair Option Price ≠ Actual Option Price then arbitrage opportunity exists.

Fair Value of an Option / Fair Option Price / Fair Option Premium

Value of an option Before expiry

Option premium amount comprises of
- ✓ Intrinsic value
- ✓ Extrinsic value

↓

Use Option pricing models:
- ✓ Put-Call parity theorem
- ✓ The Binomial model
  - Risk Neutral Method
  - Establishing a perfectly hedged position
- ✓ The Black-Scholes model

Value of an option On expiry date

Option premium amount comprises of only
- ✓ Intrinsic value

↓

Tutorial Note:
No rocket science model is required. Simply, find intrinsic value & it becomes option premium

$V_c = Max [S_1 - E, 0]$

$V_p = Max [E - S_1, 0]$

here, S_1 means spot price on maturity date
E means exercise price

Arbitrage Propects - On Maturity date

Option Type	Status	Action on Option	Action on Stock
Call	Undervalued	Buy	Sell
Call	Overvalued	Sell	Buy
Put	Undervalued	Buy	Buy
Put	Overvalued	Sell	Sell

Tutorial Note: Remember, if CO then opposite action. If PO then same action.

Cal^{n} of fair value of an Option on expiry date & evaluating Arbitrage Opportunity, if any

Example : PO Ex. P. = ₹ 55

S_1 i.e. spot price on maturity date = ₹ 50 suppose today is the expiry date. Calc fair Vp ?

Solve : V_p = Max [E - S_1 ,0]

= Max [55 - 50, 0]

= ₹ 5

Suppose actual V_p is ₹ 7 , evaluate Arbitrage Opportunity ?

Solve: Since actual V_p (₹ 7) > fair V_p (₹ 5) therefore , PO is Overvalued. Hence an arbitrageur should

(i) Sell PO

(ii) Sell in spot

to earn risk- free arbitrage gain of ₹ 2. (the extent of mis pricing)

Proof of Arbitrage Table	Amount	Share
Sell PO - premium recd.	+7	
PO exercised on us - Pay Exercise Price & Receive share	- 55	+ 1
Sell in spot	+ 50	- 1
Net arbitrage gain =	+ 2	

Pay-off Graphs on Maturity Date

Gross Pay-off means Price difference exchanged between option buyer & seller on due date.

Net payoff means Gross pay off adjusted by premium amount

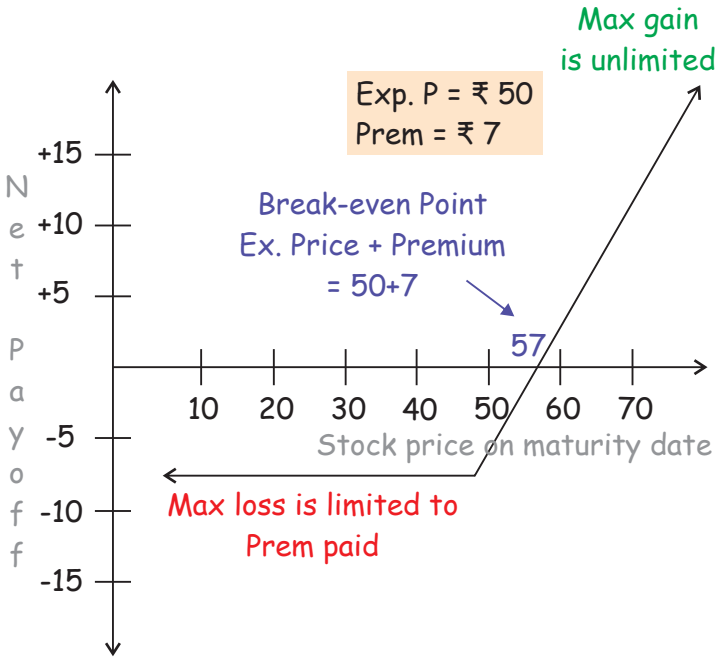
Net payoff of an option buyer = Gross pay off - Premium paid

Net pay off of an option seller = Premium received - Gross payoff

	Call Option		Put Option	
	Buyer	Seller	Buyer	Seller
Max Loss	Limited upto premium paid	Unlimited	Limited upto premium paid	Limited to "Ex Price (-) Prem received"
Max Gain	Unlimited	Limited upto the amt of Prem received	Limited upto "Ex Price (-) Premium paid"	Limited upto the amt of Prem received

1. Call Option Buyer

Pay off graph for call option buyer



Pay off table for call option buyer

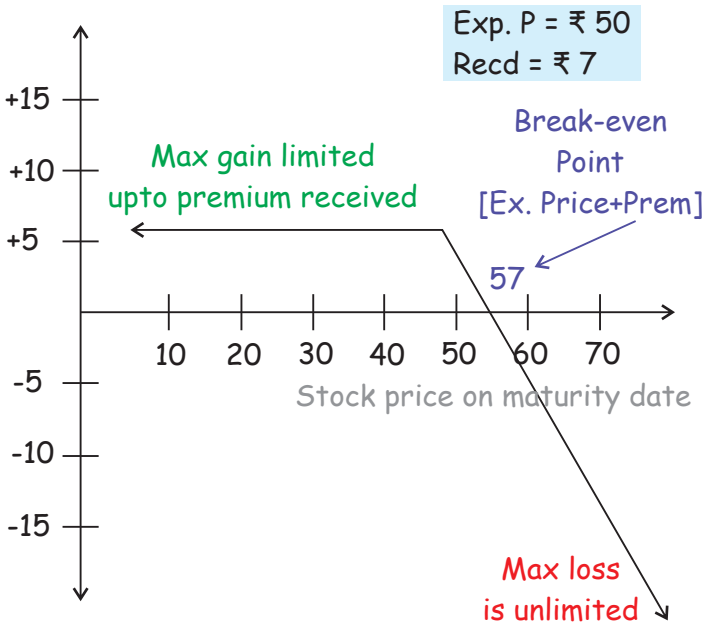
Stock Prices on mat. date	Exercise Price	Gross Payoff	Less Premium Paid	Net Payoff
0	50	0	-7	-7
10	50	0	-7	-7
20	50	0	-7	-7
30	50	0	-7	-7
40	50	0	-7	-7
50	50	0	-7	-7
60	50	10	-7	3
70	50	20	-7	13

2. Call Option Seller

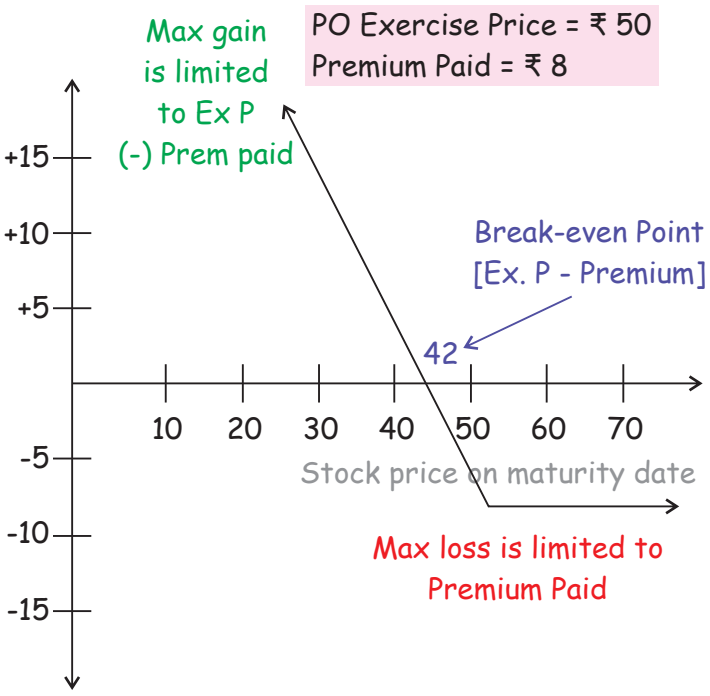
Pay off table for call option seller

Stock Prices on mat. date	Exercise Price	Premium Received	Less Gross Pay off	Net Payoff
0	50	7	0	7
10	50	7	0	7
20	50	7	0	7
30	50	7	0	7
40	50	7	0	7
50	50	7	0	7
60	50	7	- 10	- 3
70	50	7	- 20	- 13

Pay off graph for call option seller



3. Put option Buyer



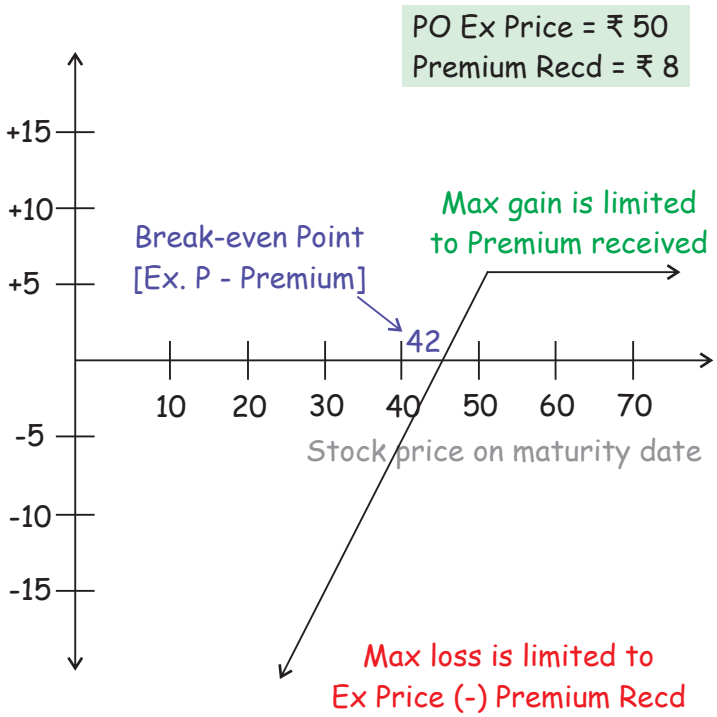
Pay-off table

Spot Price on mat date	Exercise Price	Gross Pay off	Less : Premium Paid	Net Payoff
0	50	50	-8	42
10	50	40	-8	32
20	50	30	-8	22
30	50	20	-8	12
40	50	10	-8	2
50	50	0	-8	- 8
60	50	0	-8	- 8
70	50	0	-8	- 8
80	50	0	-8	- 8

4. Put option Seller

Pay-off table

Stock Prices on mat. date	Exercise Price	Premium Received	Less Gross Pay off	Net Payoff
0	50	8	50	-42
10	50	8	40	-32
20	50	8	30	-22
30	50	8	20	-12
40	50	8	10	-2
50	50	8	0	8
60	50	8	0	8
70	50	8	0	8



Arbitrage Prospects - Before Maturity Date

Put - Call Parity Theorem

$V_S + V_P = V_C + PV \text{ of Ex. Price}$

here, V_s means value of stock i.e. S_0
V_c & V_p Value of Call/Put i.e. Call/Put Premium Today

Eg. ITC CMP = ₹ 285
3m Call option Ex. Price = ₹ 300 trading at a premium of ₹ 8
R_f = 7% p.a. Calc Price of 3m PO Ex P = ₹ 300 ?

Solve : $V_S + V_P = V_C + PV \text{ of Ex. P}$

$$285 + V_p = 8 + \frac{300}{(1 + 0.07 \times 3/12)}$$

$\therefore V_p$ = ₹ 17.84
hence, fair Vp = ₹ 17.84

Derivation of Put - Call Parity Theorem

"If Two alternatives have same maturity value & same risk then their initial investment must also be the same"

Particulars	Today		On Due date					
	Action	Amount	Action	Amount				
				If S_1 = ₹60	If S_1 = ₹ 80	If S_1 = ₹100	If S_1 ₹120	If S_1 ₹140
Investment Avenue 1								
Stock in spot	Buy	Outflow	Sell	+60	+80	+100	+120	+140
Put option Ex. P = ₹ 100	Buy	Outflow	Exercise /Lapse	+40	+20	0	0	0
			Total Cashflow	**100**	**100**	**100**	**120**	**140**
Investment Avenue 2								
Call Option Ex. P = ₹ 100	Buy	Outflow	Lapse/ Exercise	0	0	0	20	40
Inv in Rf Equivalent to PV of Ex Price	Buy	Outflow	Liquidate	100	100	100	100	100
			Total Cashflow	**100**	**100**	**100**	**120**	**140**

It is evident from the above Table that Maturity CF's & risks of the two investment avenue are same. Hence, their initial inv must also be the same.

Buying a Stock & Buying a PO = Buying a CO & Inv in R_f equivalent to PV of Ex. P

$-V_S$ $-V_P$ = $-V_C$ $-PV \text{ of Ex. Price}$

Hence, $V_S + V_P = V_C + PV \text{ of Ex. P.}$

Two Assumptions before applying Put-Call party :-

- ✓ Both CO & PO must have Same Exercise Price
- ✓ Both CO & PO must have Same Maturity date

Q What if Actual V_p = ₹ 15

Solve: Wow ! Arbitrage opportunity

Trick : Buy one of the investment avenue (that entails lower outflow today) & sell other Investment Avenue (that results in higher inflow today)

Since Actual V_p (15) < fair V_p (17.84), therefore, PO is Undervalued, Hence, an arbitrageur should:

(i) Buy PO Ex P = ₹ 300
(ii) Buy in Spot
(iii) Sell CO Ex. P = ₹ 300
(iv) Borrow an amount equivalent to PV of Ex. P.
to earn risk free arbitrage gain of ₹ 2.84 today.

Sell R_f Inv.

Q What if Actual V_p = ₹ 25

Solve: Since Actual V_p (25) > fair V_p (17.84), therefore, PO is Overvalued, Hence, an arbitrageur should:

(i) Sell PO Ex P = ₹ 300
(ii) Sell in Spot
(iii) Buy CO Ex. P = ₹ 300
(iv) Invest an amount equivalent to PV of Ex. P.
to earn risk free arbitrage gain of ₹ 7.16 today.

The Binomial Model - Risk Neutral Method

One Period Binomial Model

R_f = 16% pa

ITC CO Ex. P = ₹ 320

ITC
S_0 = ₹ 300

Step ① P = 0.60 + 20% return → 6-m Expected Spot Price i.e. S_1 = ₹ 360

Step ① 1 - P = 0.40 - 10% return → ₹ 270

	V_c	Prob	V_c x P
	40	0.60	24
	0	0.40	0
Step ② Expected V_c = ₹ 24 on maturity dt			

PV of CO Ex. P ₹ 320
i.e. fair V_c Today = ₹ 22.22

Step ③ $\left[\frac{₹\ 24}{1 + 0.16 \times 6/12}\right]$

Exam Presentation

Step 1: Calculate Probabilities

$e^{rt} - 1$ or Rf = % Upside on Stock x Probability of rise + % downside on stock x (1 - Prob of rise)

8% = 20% x P + (-10%) (1 - P)

0.08 = 0.20P - 0.10 + 0.10 P

0.18 = 0.30 P

P = 0.60 i.e. Prob of Rise

Remember to adjust R_f on LHS so as to match with life of an option. Don't make the mistake of putting 16% pa directly

Alternative way to calc Prob. of rise is

$$\text{Prob. of rise} = \frac{i - d}{u - d}$$

here, u means ${}_uS_1/S_0$ — here S_1 is higher S_1

d means ${}_dS_1/S_0$ — here S_1 is lower S_1

i means $1 + R_f$ p.a. x t or e^{rt} → hence "i" finally corresponds to the option life

Caution Note:
i is not just 'Intt Rate'. It is '1 + periodic Intt Rate'

$$\text{Prob. of rise} = \frac{1.08 - 0.90}{1.20 - 0.90}$$

$$= 0.60$$

Proof / Derivation that Prob of rise = $\frac{i - d}{u - d}$

R_F = % upside on stock x P + % downside on stock x (1 - P)

$$R_f = \frac{{}_uS_1 - S_0}{S_0} \times P + \frac{{}_dS_1 - S_0}{S_0} \times (1 - P)$$

$$R_f = \left(\frac{{}_uS_1}{S_0} - \frac{1}{S_0/S_0}\right) P + \left(\frac{{}_uS_1}{S_0} - \frac{1}{S_0/S_0}\right) (1 - P)$$

$R_f = (u - 1) P + (d - 1) (1 - P)$

$R_f = uP - P + d - dP - 1 + P$

$1 + R_f = uP + d - dp$

$i - d = uP - dP$

$i - d = P (u - d)$

$\therefore P = i - d / u - d$

Step 2: Calc Expected Vc on maturity date

$= {}_uV_c \times P + {}_dV_c \times (1 - P)$

$= ₹ 40 \times 0.60 + ₹ 0 \times (1 - 0.6)$

$= ₹ 24$

Don't make the mistake of comparing S_0 & S_1. i.e. don't compare ₹300 & ₹ 360 and write ₹60 here. Dude, here we have to write V_c hence compare Ex. P vs S_1

Step 3: PV of Call option

$$= \frac{\text{Expected } V_c \text{ on maturity date}}{e^{rt} \text{ or } 1 + R_f \text{ p.a. x t}}$$

$$= \frac{₹ 24}{1.16} \quad \frac{₹ 24}{1 + 0.16 \times 6/12}$$

$= ₹ 22.22$

Remember to adjust R_f in denominator so as to match with life of an option. Don't make the mistake of dividing by 1.16 directly

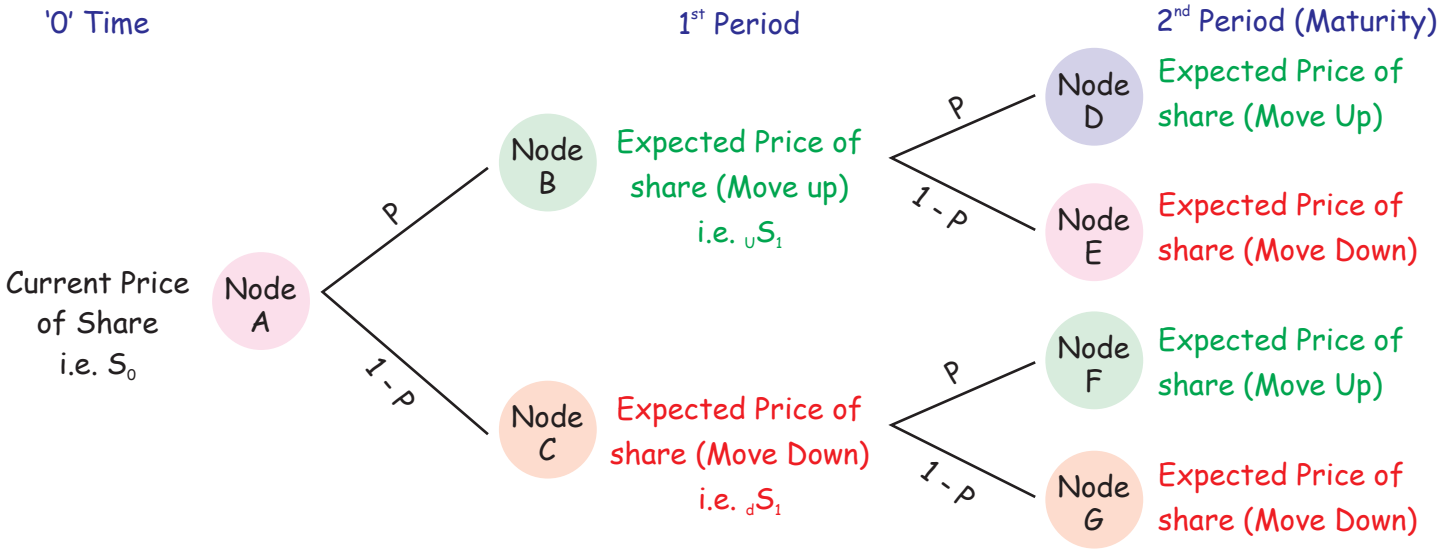
Two Assumptions of risk neutral model

- ✓ An Investor is neutral between R_f Investment & Investment in stock market as far as Risk is concerned.
- ✓ A Stock might assume only 2 possible prices on maturity date.

Two Period Binomial Model/ Multiple Period Binomial Model

applied when Price of Underlying Share changes more than once before maturity

Step 1: Draw a Binomial Tree



Step 2: Calculate Probabilities (Consider 1st Period only, and the same Probabilities will be applicable for 2nd Period & onwards)

Probability of Price Moving up i.e. $P = \frac{i - d}{u - d}$ (in 4 Decimals)

here,

$$u = \frac{\text{Expected Price of underlying Share at 1st Period (Move up)}}{\text{Current Price of underlying share at '0' Time}} \text{ or } \frac{_uS_1}{S_0}$$

$$d = \frac{\text{Expected Price of underlying Share at 1st Period (Move Down)}}{\text{Current Price of underlying share at '0' Time}} \text{ or } \frac{_dS_1}{S_0}$$

$i = 1 + Rf\ p.a. \times t$ or e^{rt}

t corresponds to the time interval of 1st period only. Hence $t = \frac{\text{No. of Months till 1st Period End}}{12}$

Probability of Price Moving Down (in 4 Decimals) = 1 - P

Step 3: Calculate Pay off at each Node of 2nd Period (Maturity)

Node D, E, F, G in our example, by comparing Spot Price at maturity vs. Exercise Price

Step 4: Calculate Value of Option at each Node of 1st Period

$$\text{Value of Option at Node B} = \frac{\text{Expected Value of Option at 2nd Period (Maturity) considering Node D \& E}}{i}$$

$$\text{Value of Option at Node C} = \frac{\text{Expected Value of Option at 2nd Period (Maturity) considering Node F \& G}}{i}$$

Caution Note:
i is not just 'Intt Rate'. It is '1 + periodic Intt Rate'

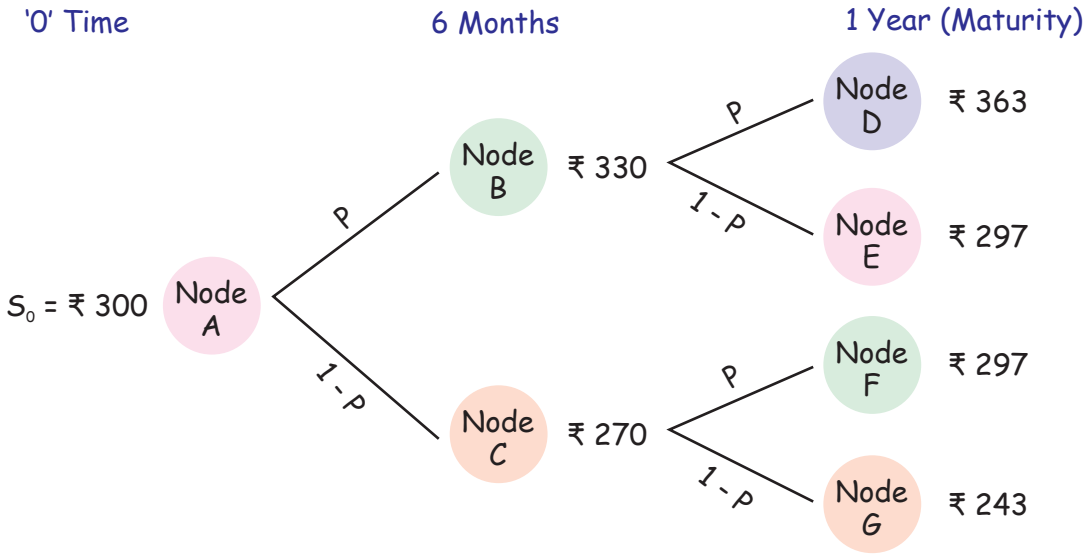
Step 5:

$$\text{Value of Option at Beginning} = \frac{\text{Value of Option at Node B} \times P + \text{Value of Option at Node C} \times (1 - P)}{i}$$

Example:
Current Price of Share of ITC Ltd. is ₹ 300.
Consider 2 time periods of 6 Months each & in each period price of share can move up or down by 10 %.
Calculate Value of a 1 Year Call Option if Strike Price is ₹ 290 & Interest Rate is 16 % p.a.

Solve:

Step 1: Binomial Tree



Step 2: Calculation of Probabilities

$$u = \frac{330}{300} = 1.1 \quad , \quad d = \frac{270}{300} = 0.90$$

$$P = \frac{\left(1 + 0.16 \times \frac{6}{12}\right) - 0.90}{1.1 - 0.90} = \frac{1.08 - 0.90}{1.1 - 0.90} = 0.90$$

$$1 - P = 1 - 0.90 = 0.10$$

Step 3: Calculation of Pay off at each Node of 1st Year (Maturity)

Node D = 363 - 290 = 73
Node E = 297 - 290 = 7
Node F = 297 - 290 = 7
Node G = 0 [Lapse]

Step 4: Calculation of Value of Option at each Node of 6 Months (1st Period)

$$\text{Node B} = \frac{73 \times 0.90 + 7 \times 0.10}{1.08} = 61.48$$

$$\text{Node C} = \frac{7 \times 0.90 + 0 \times 0.10}{1.08} = 5.83$$

Step 5: Value of Option at Beginning = $\frac{61.48 \times 0.90 + 5.83 \times 0.10}{1.08}$ = ₹ 51.77

Exam Tip: In step 1 of risk neutral method (both single & Multiple period) we calc fair prob, hence in exams:

Situation 1

Rf → given in Q
Prob → Not given
Use either step 1 of risk neutral model or

$$P = \frac{i - d}{u - d}$$

to find out prob.

Situation 2

Rf → Not given
Prob → Given in Q
Use step 1 of risk neutral model or

$$P = \frac{i - d}{u - d}$$

to find out Rf

Situation 3

Rf → Given in Q
Prob → Given in Q

Caution Note Do not use Prob. given in Q bcoz these are actual prob. & we need fair prob. Hence, consider Rf given in Q & calc fair prob. using step 1 or $P = \frac{i - d}{u - d}$

How to establish a Perfectly Hedged Position/ Delta Hedging

R_f = 16% pa
or
8% for 6 months period

Step ② Buy 0.4444* ITC Share
CMP = ₹ 300
Sell 1 6mCO Ex. P = ₹ 320

Cash Flow

	6M	V_c	Share	CO	Net Amt
	360	40	+160	-40	+120
Spread	₹ 90	₹ 40	[0.4444 sh x ₹360]	[CO Exercised on us]	
or					
	270	0	+120	0	+120
			[0.4444 sh x ₹ 270]	[Lapse]	
			Guaranteed Inflow = in either case		₹ 120 Inflow

Step ① Spread

Step ③

Hence, Overall Outflow to create above position today must be equal to PV of Guaranteed Outcome

i.e. $\frac{₹\ 120}{1.08}$ = ₹ 111.11 Step ④

Cal^{n} Fair V_c today
Solve:

Buying 0.4444 ITC share Today & Selling 1 Co Ex. P 320 Today = PV of Perfectly hedged position outcome

read "=" sign as 'must require same Outflow as'

- 0.4444 share x ₹ 300 + V_c = - 111.11

V_c = ₹ 22.22

Exam Presentation

Step 1 : Calculate Delta ie Hedge Ratio

$$\Delta = \frac{\text{Spread in option price}}{\text{Spread in share price}} = \frac{{}_uV_c - {}_dV_c}{{}_uS_1 - {}_dS_1}$$

$$= \frac{40 - 0}{360 - 270} = \frac{40}{90} = 0.4444 \text{ Shares}$$

Step 2: Create a Perfectly hedged position

A perfectly hedged position can be created in either of the following two ways : -

1. Buy 0.4444 shares & Sell 1 CO today or
2. Sell 0.4444 shares & Buy 1 CO today

Let's assume that we Buy 0.4444 Shares & Sell 1 CO today

Step 3: Calculate Maturity proceeds of guaranteed outcome

Stock price on mat date	Cashflow		
	Stock Position	Call Option	Net Amount [M]
360	+ 160 [Sell 0.4444 share x ₹ 360]	- 40 [CO exercised on us]	+ 120 or
270	+ 120 [Sell 0.4444 share x ₹ 270]	0 [lapse]	+ 120

It may be observed that guaranteed outcome [M] is same @₹ 120 irrespective of stock price on maturity date.

Step 4: PV of maturity proceeds and fair V_c Today

PV of Maturity Proceeds $= \frac{-M}{1 + r \times n / 12} = \frac{-120}{1 + 0.16 \times 6/12} = -111.11$

Why Minus Sign ?

Since we are receiving Inflow on Maturity date, hence, we would need to incur Outflow today so as to receive Inflow on Maturity date.

$-\Delta \text{ share} \times S_0 + V_c$ = PV of maturity proceeds

$-0.4444 \text{ share} \times ₹ 300 + V_c = -111.111$

$\therefore V_c$ i.e. Fair V_c = ₹ 22.22

Q What if in above case Actual CO Premium is ruling @ ₹ 25

Solve:

There is NO need to apply 4 action arbitrage (taught earlier at the time of PC Parity Theorem.) Instead we will use 3 action arbitrage [because there are only 2 possible prices on maturity date.

Conclusion: When only 2 possible prices on mat date (i.e. Risk neutral, The Binomial Model, Perfectly hedged positions) - Use 3 action arbitrage

When more than 2 possible prices on mat date (eg., The black scholes model) - Use 4 action arbitrage

Since Actual V_c (₹ 25) > Fair V_c (22.22), CO is Overvalued. Hence we will:

(i) Sell 1 CO

(ii) Buy 0.4444 Share

(iii) Borrow an amount equivalent to PV of Maturity proceeds to earn risk free arbitrage gain of ₹ 2.78 today

Since action (i) & (ii) will result in Net Outflow hence we will Borrow the Amount.

Note: If Action (i) & (ii) will result in Net Inflow then we will Invest the Amount.

Proof of Arbitrage Table

Particulars	Today		On Due Date			
	Action	Amount	If S_1 = 360		If S_1 = 270	
			Action	Amount	Action	Action
Stock in Spot	Buy 0.4444 shares	-133.33	Sell 0.4444 shares	+ 160	Sell 0.4444 shares	+ 120
Call option Ex. P ₹ 320	Sell 1 CO	+ 25	Exercised on us	- 40	Lapse	0
Loan	Borrow	+ 111.11	Repay	- 120	Repay	- 120
Net Arbitrage gain =		+2.78		0		0

Q What is the expected rate of return on the above option if chances of above variations are 70% and 30% respectively and CO can be bought today at ₹ 22.22?

Solve:

$$\text{Expected Rate of Return on the Option} = \frac{\text{Expected Value of Option at maturity considering the actual probabilities given in Q} - \text{Option Premium [value of Option at Beginning]}}{\text{Option Premium [value of Option at Beginning]}} \times 100$$

Expected Option Value at maturity = (₹ 360 - ₹ 320) x 0.70 + ₹ 0 x 0.30 = ₹ 28

$$\text{Expected Rate of Return on the Option} = \frac{28 - 22.22}{22.22} \times 100 = 26.02\%$$

The Black-Scholes Model

Step ③ $V_c = S_0 \times N[d_1] - \frac{E \times N[d_2]}{e^{rt}}$ (Delta of Call Option)

Step ① $d_1 = \frac{Ln [S_0 / E] + [r + 0.5 \sigma^2] t}{\sigma\sqrt{t}}$

Step ① $d_2 = \frac{Ln [S_0 / E] + [r - 0.5 \sigma^2] t}{\sigma\sqrt{t}}$ or $d_2 = d_1 - \sigma\sqrt{t}$

here,

S_0 means Spot price today
E means Exercise price
r means risk-free rate p.a.
t means time remaining till maturity [n/12 or n/365]
Ln means Log natural
d_1 & d_2 means No. of deviations i.e. Z

Step ② $N[d_1]$ & $N[d_2]$ means Cumulative Area (under Normal Distribution Curve) upto d_1 & upto d_2

Alternatively

$V_c = S_0 \times N[d_1] - \frac{X \times N[d_2]}{e^{rt}}$

$d_1 = \frac{Ln [S_0 / X] + \left[r + \frac{\text{Variance}}{2}\right] t}{\sigma\sqrt{t}}$

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

here,

X means Exercise price

Note 1. In case of a dividend paying stock:

- If div amt is given in absolute terms → calc PV of Dividend & then deduct it from S_0, it will now become "Net S_0" Use this Net S_0 everywhere in the formulas in place of S_0
- If div is given in yield% terms →
  - ✓ Replace r by (r-y) in d_1 (& d_2) formula
  - ✓ Replaced S_0 by $\frac{S_0}{e^{yt}}$ i.e. PV of spot price discounted at div yield% in V_c formulas only. Don't make this change in d_1 d_2 formula.

Note 2. To calc V_p

i) First calc V_c using above formula
ii) Second apply Put-Call Parity theorem to find V_p

Hedging

If Long in Spot → then Buy Put option to hedge long exposure
If Short in Spot → then Buy Call option to hedge short exposure

Question 1 (8 Marks) Exam Dec 2021, May 2025

On 31/08/2021 Mr. R has taken a Long position of Two lots of Nifty Futures at 17300.

One lot of Nifty future is 50 units.

Initial Margin required is 10% of Contract Value.

Maintenance Margin required is 80% of Initial Margin.

The closing price of 5 days are given below-

Date	Closing Price of Nifty Future
01/09/2021	17340
02/09/2021	17180
03/09/2021	16990
06/09/2021	16900
07/09/2021	17120

You are required to-

(i) Prepare a statement showing the daily balances in the margin account & payment on margin calls, if any.

(ii) Compute the Gain or Loss of Mr. R, if contract squared off on 07/09/2021.

(iii) What would be the Gain or Loss if Mr. R, had taken the short position?

Solution:

(i) Contract Size (₹ 17,300 x 50 x 2) = ₹ 17,30,000

Initial Margin (10% of 17,30,000) = ₹ 1,73,000

Maintenance Margin (80% of 1,73,000) = ₹ 1,38,400

Statement showing the daily balances in Margin A/c and margin call if any,

Day	Changes in future Values (₹)	Margin A/c (₹)	Call Money (₹)
31/08/21	- - - -	1,73,000	-
01/09/21	(₹ 17,340 - ₹ 17,300) x 50 x 2 = 4,000	1,77,000	-
02/09/21	(₹ 17,180 - ₹ 17,340) x 50 x 2 = -16,000	1,61,000	-
03/09/21	(₹ 16,990 - ₹ 17,180) x 50 x 2 = - 19,000	1,42,000	-
06/09/21	(₹ 16,900 - ₹ 16,990) x 50 x 2 = - 9,000	1,73,000	40,000
07/09/21	(₹ 17,120 - ₹ 16,900) x 50 x 2 = 22,000	1,95,000	--

(ii) Gain or Loss of Mr. R squared off position on 07/09/21

Ending margin	₹ 1,95,000
Less: Initial Margin	1,73,000
Profit	22,000
Less: Margin Call	40,000
Net Loss	(18,000)

(iii) Gain/ Loss if Mr. R has taken Short Position

Day	Changes in future Values (₹)	Margin A/c (₹)	Call Money (₹)
31/08/21	- - - -	1,73,000	-
01/09/21	(₹ 17,300 - ₹ 17,340) x 50 x 2 = - 4,000	1,69,000	-
02/09/21	(₹ 17,340 - ₹ 17,180) x 50 x 2 = 16,000	1,85,000	-
03/09/21	(₹ 17,180 - ₹ 16,990) x 50 x 2 = 19,000	2,04,000	-
06/09/21	(₹ 16,990 - ₹ 16,900) x 50 x 2 = 9,000	2,13,000	-
07/09/21	(₹ 16,900 - ₹ 17,120) x 50 x 2 = - 22,000	1,91,000	--

Profit or Loss on Short Position

Ending margin	₹ 1,91,000
Less: Initial Margin	₹ 1,73,000
Profit	₹ 18,000

Question 2 Study Material, (5 Marks) Exam May 2012

On 31-8-2011, the value of stock index was ₹ 2200. The risk free rate of return has been 8% per annum. The dividend yield on this Stock Index is as under:

Month	Dividend Paid
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%
July	3%
August	4%
September	3%
October	3%
November	4%
December	3%

Assuming that interest is continuously compounded, find out the future price of contract deliverable on 31-12-2011. Given $e^{0.01583} = 1.01593$

Solution: The price of futures, when dividend yield is given, is written as:

$F = Se^{(r-d)\times t}$

here F = ?; S = 2200; r = 8% or 0.08;

d = Average dividend yield of four months viz. September to December

= (3 + 3 + 4 + 3)/4 = 3.25% or 0.0325

t = Time to expiry = 4 months or 4/12 or 0.333

$F = 2200 \times e^{(0.08-0.0325)\times 0.333} = 2200 \times e^{0.01583}$

$= 2200 \times 1.01593 = 2235.046$

Question 3 Study Material, RTP May 2022, (8 Marks) Exam July 2021, MTP Sep 2022

BSE Index	5000
Value of portfolio	₹ 10,10,000
Risk free rate of interest	9% p.a.
Dividend yield on index	6% p.a.
Beta of portfolio	1.5

We assume that a futures contract on the BSE index with four months maturity is used to hedge the value of portfolio over next three months. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

(i) Price of future contract

(ii) The gain on short futures position if index turns out to be 4500 in three months.

Solution:

(i) Current future price of the index = $5000 + 5000\ (0.09 - 0.06)\ \frac{4}{12}$ = 5000 + 50 = 5,050

∴ Price of the future contract = 50 x ₹ 5,050 = ₹ 2,52,500

(ii) Hedge ratio = $\frac{10,00,000}{2,52,500}$ x 1.5 = 6 contracts

Index after 3 months turns out to be 4500

Future price will be = $4500 + 4500\ (0.09 - 0.06) \times \frac{1}{12}$ = 4511.25

Therefore, Gain from the short futures position is = 6 x (5050 - 4511.25) x 50

= ₹ 1,61,625

ICAI Note: Alternatively we can also use daily compounding (exponential) formula.

Question 4 Study Material, (5 | 8 Marks) Exam Nov 13, July 21, RTP Nov 16, MTP March 24

A trader is having in its portfolio shares worth ₹ 85 lakhs at current price and cash ₹ 15 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

(i) Current portfolio beta

(ii) Portfolio beta after 3 months if the trader on current date goes for long position on ₹ 100 lakhs Nifty futures.

Solution: Current portfolio

Current Beta for share =1.6

Beta for cash =0

Current portfolio beta = 0.85 x 1.6 + 0 x 0.15 = 1.36

Portfolio beta after 3 months:

$$\text{Beta for portfolio of shares} = \frac{\text{Change in value of portfolio of share}}{\text{Change in value of market portfolio (index)}}$$

$$1.6 = \frac{0.032}{\text{Change in value of market portfolio (index)}}$$

Change in value of market portfolio (Index)	= (0.032 /1.6) 100 = 2%
Position taken on 100 lakh Nifty futures:	Long
Value of index after 3 months	= ₹ 100 lakh (100 – 0.02)
	= ₹ 98 lakh
Mark-to-market paid	= ₹ 2 lakh
Cash balance after payment of mark-to-markets	= ₹ 13 lakh
Value of portfolio after 3 months	= ₹ 85 lakh (1 - 0.032) + ₹ 13 lakh
	= ₹ 95.28 lakh
Change in value of portfolio	$= \frac{₹\ 100\ lakh - ₹\ 95.28\ lakh}{₹\ 100\ lakh} = 4.72\%$
Portfolio beta	= 0.0472/0.02 = 2.36

Question 5 (5 Marks) Exam May 2012, RTP Nov 21, RTP Nov 2023, Sep 2025

A company is long on 10 MT of copper @ 534 per kg (spot) and intends to remain so for the ensuing quarter. The variance of change in its spot and future prices are 16% and 36% respectively, having correlation coefficient of 0.75. The contract size of one contract is 1,000 kgs.

Required:

(i) Calculate the Optimal Hedge Ratio for perfect hedging in Future Market.

(ii) Advice the position to be taken in Future Market for perfect hedging.

(iii) Determine the number and the amount of the copper futures to achieve a perfect hedge.

Solution:

(i) The optional hedge ratio to minimize the variance of Hedger's position is given by:

$$H = \rho \frac{\sigma_S}{\sigma_F}$$

σ_S = Standard deviation of ΔS (Change in Spot Prices)

σ_F = Standard deviation of ΔF (Change in Future Prices)

ρ = coefficient of correlation between ΔS and ΔF

H = Hedge Ratio

ΔS = change in Spot price.

ΔF = change in Future price.

Accordingly

Standard deviation of $\Delta S = \sqrt{16\%} = 4\%$ and

Standard deviation of $\Delta F = \sqrt{36\%} = 6\%$ and

$$H = 0.75 \times \frac{0.04}{0.06} = 0.5$$

(ii) Since the company is long position in Spot (Cash) Market it shall take Short Position in Future Market.

(iii) Since contact size of one contract is 1,000 Kg,

$$\text{No. of contract to be short} = \frac{10{,}000\ \text{Kgs}}{1{,}000\ \text{kgs}} \times 0.50 = 5\ \text{Contracts}$$

Amount = 5000 x ₹ 534 = ₹ 26,70,000

Question 6 RTP May 2015

Mr. Careless was employed with ABC Portfolio Consultants. The work profile of Mr. Careless involves advising the clients about taking position in Future Market to obtain hedge in the position they are holding. Mr. ZZZ, their regular client purchased 100,000 shares of X Inc. at a price of $22 and sold 50,000 shares of A Plc for $40 each having beta 2. Mr. Careless advised Mr. ZZZ to take short position in Index Future trading at $1,000 each contract.

Though Mr. Careless noted the name of A Plc along with its beta value during discussion with Mr. ZZZ but forgot to record the beta value of X Inc.

On next day Mr. ZZZ closed out his position when:

- Share price of X Inc. dropped by 2%
- Share price of A Plc appreciated by 3%
- Index Future dropped by 1.5%

Mr. ZZZ, informed Mr. Careless that he has made a loss of $114,500 due to the position taken. Since record of Mr. Careless was incomplete he approached you to help him to find the number of contract of Future contract he advised Mr. ZZZ to be short to obtain a complete hedge and beta value of X Inc.

You are required to find these values.

Solution:

Tutorial Note : Q says that Mr. zzz has gone Short on Nifty Futures but on solving it is found that position on Nifty Futures is Long.

Let the number of contract in Index future be y and Beta of X Inc. be x. Then,

$$\frac{100{,}000 \times 22 \times X - 50{,}000 \times 40 \times 2}{1{,}000} = -y$$

* Negative (-) sign indicates the sale (short) position

$2{,}200{,}000x - 4{,}000{,}000 = -1{,}000y$

Cash Outlay (Outflow)

Purchase of 100,000 shares of X Inc. at a price of $22 (100,000 x 22)	2,200,000
Sale of 50,000 shares of A plc for $40 (50,000 x 40)	-2,000,000
Short Position in Index Futures (1,000 x y)	–1,000y*
Net	200,000 – 1,000y

* Negative (-) sign indicates the inflow due to sale (short) position

Cash Inflow

Sale of 100,000 shares of X Inc. (100,000 x 22 x 0.98)	2,156,000
Purchase of 50,000 shares of A plc (50,000 x 40 x 1.03)	-2,060,000
Long Position in Index Futures (1,000 x y x 0.985)	-985y
Net	96,000 - 985y

* Negative (-) sign indicates the indicates outflow due to purchase (long) position

Position on Close Out
(200,000 -1,000 y) – (96,000 - 985y) = 114,500
y = -700

Thus number of future contract short is 700

Beta of X Inc. can be calculated as follows:
2,200,000x - 4,000,000 = -1000 x 700
2,200,000x = 3,300,000
x = 1.5

Thus Beta of X Inc. shall be 1.5

If ICAI's presentation looks a bit scary to you then we have explained the same solution in 4 easy steps & even without using X & Y.
Scan above QR code & follow steps 1 through 4

Question 7 (8 Marks) Exam Nov 2011, RTP May 2020, RTP Nov 2021

A Portfolio Manager has the following four stocks in his portfolio:

Security	No. of shares	Market Price per share	Beta
A	10000	50	0.9
B	5000	20	1.0
C	8000	25	1.5
D	2000	200	1.2

Required:
(i) Portfolio beta
(ii) If the PM seeks to reduce the beta to 0.8, how much risk free investment should he bring in?
(iii) If the PM seeks to increase the beta to 1.2, how much risk free investment should he bring in?

Solution:

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
A	10000	50	500000	0.4167	0.9	0.375
B	5000	20	100000	0.0833	1	0.083
C	8000	25	200000	0.1667	1.5	0.250
D	2000	200	400000	0.3333	1.2	0.400
			1200000	1	β_P =	1.108

(ii) Required Beta 0.8
It should become (0.8 / 1.108) 72.2 % of present portfolio
If ₹ 12,00,000 is 72.20%, the total portfolio should be ₹ 12,00,000 × 100/72.20 or ₹ 16,62,050
Additional investment in zero risk should be (₹ 16,62,050 – ₹ 12,00,000) = ₹ 4,62,050

Our Alternative Presentation (Not by ICAI)
Let the amt of Rf inv to be brought in be denoted by X. ∴ Total portfolio value = 12,00,000 + X

$$0.80 = 1.108 \times \frac{12,00,000}{12,00,000 + x} + 0 \times \frac{X}{12,00,000 + X}$$

∴ X = ₹ 4,62,000

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
A	10000	50	500000	0.3008	0.9	0.271
B	5000	20	100000	0.0602	1	0.060
C	8000	25	200000	0.1203	1.5	0.180
D	2000	200	400000	0.2407	1.2	0.289
Risk free asset	46205	10	462050	0.2780	0	0
			1662050	1		0.800

(iii) To increase Beta to 1.2

Required beta 1.2

It should become 1.2 / 1.108 108.30% of present beta

If 1200000 is 108.30%, the total portfolio should be 1200000 × 100/108.30 or 1108033 say 1108030

Additional investment should be (-) 91967

i.e. Divest ₹ 91970 of Risk Free Asset

Our Alternative Presentation (Not by ICAI)

Let the amt to be borrowed be denoted by X

$$1.20 = 1.108 \times \frac{12,00,000}{12,00,000 + X} + 0 \times \frac{X}{12,00,000 + X}$$

$\therefore$ X = ₹ 92,000

Amt to be borrowed = ₹ 92,000

Revised Portfolio will be

Security	No. of shares (1)	Market Price of Per Share (2)	(1) × (2)	% to total (w)	ß (x)	wx
A	10000	50	500000	0.4513	0.9	0.406
B	5000	20	100000	0.0903	1	0.090
C	8000	25	200000	0.1805	1.5	0.271
D	2000	200	400000	0.3610	1.2	0.433
Risk free asset	- 9197	10	- 91970	- 0.0830	0	0
			1108030	1	β_P =	1.20

Question 8 RTP Nov 20, 13, Nov 13, Sep 25, (8 Marks) Exam May 19, May 23

A Rice Trader has planned to sell 22000 kg of Rice after 3 months from now. The spot price of the Rice is ₹ 60 per kg and 3 months future on the same is trading at ₹ 59 per kg. Size of the contract is 1000 kg. The price is expected to fall as low as ₹ 56 per kg, 3 months hence. Required:

(i) to interpret the position of trader in the Cash Market.

(ii) to advise the trader what position the trader should take in Future Market to mitigate its risk of reduced profit.

(iii) to demonstrate effective realized price for its sale if he decides to make use of future market and after 3 months, spot price is ₹ 57 per kg and future contract price for closing the contract is ₹ 58 per kg.

Solution:

(i) Since trader has planned to sell after 3 months now it implies, he is in Long Position in Cash or Spot Market.

(ii) Since the trader is in Long Position in Cash Market, he can mitigate its risk of reduced profit by hedging his position by selling Rice Futures i.e. Short Position in Future Market.

(iii) The gain on futures contract

= (₹ 59 - ₹ 58) x 22,000 kg. = ₹ 22,000

Revenue from the sale of Rice

= 22,000 x ₹ 57 = ₹ 12,54,000

Total Cash Flow = ₹ 12,54,000 + ₹ 22,000 = ₹ 12,76,000

$$\text{Cash Flow per kg. of Rice} = \frac{₹\ 12,76,000}{22,000} = ₹\ 58$$

Question 9 RTP May 2022, RTP Nov 2024

Mr. A is holding 10000 shares of face value of ₹ 100 each of M/s. ABC Ltd. He wants to hold these shares for long term and have no intention to sell.

On 1st January 2020, M/s XYZ Ltd. has made short sales of M/s. ABC Ltd.'s shares and approached Mr. A to lend his shares under Stock Lending Scheme with following terms:

(i) Shares to be borrowed for 3 months from 01-01-2020 to 31-03-2020,

(ii) Lending Charges/Fees of 1% to be paid every month on the closing price of the stock quoted in Stock Exchange and

(iii) Bank Guarantee will be provided as collateral for the value as on 01-01-2020.

Other Information:

(a) Cost of Bank Guarantee is 8% per annum,

(b) On 29-02-2020 M/s. ABC Ltd., declared dividend of 25%.

Closing price of M/s. ABC Ltd. share quoted in Stock Exchange on various dates are as follows:

Date	Share Price in Scenario -1 Bullish	Share Price in Scenario -2 Bearish
01-01-2020	1000	1000
31-01-2020	1020	980
29-02-2020	1040	960
31-03-2020	1050	940

You are required to find out:

(i) Earning of Mr. A through Stock Lending Scheme in both the scenarios,

(ii) Total Earnings of Mr. A during 01-01-2020 to 31-03-2020 in both the scenarios,

(iii) What is the Profit or loss to M/s. XYZ by shorting the shares using through Stock Lending Scheme in both the scenarios?

Solution: Earnings of Mr. A through stock lending scheme

		Scenario 1	Scenario 2
(i)	Lending fee		
	31-01-20 1020 x 1% and 980 x 1%	10.20	9.80
	29-02-20 1040 x 1% and 960 x 1%	10.40	9.60
	31-03-20 1050 x 1% and 940 x 1%	10.50	9.40
	Earnings from lending per Share (A)	31.10	28.80
	Total No. of Shares	10000	10000
	Total Earning from Lending	3,11,000	2,88,000

(ii)	Dividend income per Share (B)	25.00	25.00
	Total earnings per share (A) + (B)	56.10	53.80
	Total No. of Shares	10000	10000
	Total Earning	5,61,000	5,38,000
(iii)	Gain on shorting the shares		
	(1,050 - 1,000) and (1,000 - 940)	(50.00)	60.00
	Lending fees paid	(31.10)	(28.80)
	Bank guarantee charges @ 8%	(20.00)	(20.00)
	Gain Per Share	(101.10)	11.20
	Total No. of Shares	10000	10000
	Total Gain on shorting the shares	(10,11,000)	1,12,000

Question 10 Study Material, (6 Marks) Exam Nov 2013, Sep 2025, RTP Nov 2022

Ram buys 10,000 shares of X Ltd. at a price of ₹ 22 per share whose beta value is 1.5 and sells 5,000 share of A Ltd. at a price of ₹ 40 per share having a beta value of 2. He obtains a complete hedge by Nifty futures at ₹ 1,000 each. He closes out his position at the closing price of the next day when the share of X Ltd. dropped by 2%, share of A Ltd. appreciated by 3% and Nifty futures dropped by 1.5%. What is the overall profit / loss to Ram?

Solution: No. of the Future Contract to be obtained to get a complete hedge

$$= \frac{1000 \times ₹\ 22 \times 1.5 - 5000 \times ₹\ 40 \times 2}{₹\ 1000} = \frac{₹\ 3,30,000 - ₹\ 4,00,000}{₹\ 1000} = 70 \text{ contracts}$$

Thus, by purchasing 70 nifty future contracts to be long to obtain a complete hedge.

Cash Outflow

$= 10000 \times ₹\ 22 - 5000 \times ₹\ 40 + 70 \times ₹\ 1,000$
$= ₹\ 2,20,000 - ₹\ 2,00,000 + ₹\ 70,000$
$= ₹\ 90,000$

Cash Inflow at Close Out

$= 10000 \times ₹\ 22 \times 0.98 - 5000 \times ₹\ 40 \times 1.03 + 70 \times ₹\ 1,000 \times 0.985$
$= ₹\ 2,15,600 - ₹\ 2,06,000 + ₹\ 68,950$
$= ₹\ 78,550$

Gain/Loss

$= ₹\ 78,550 - ₹\ 90,000 = -₹\ 11,450$ (Loss)

Question 11 Study Material, (5 Marks) Exam May 2011, MTP May 2025

A Mutual Fund is holding the following assets in ₹ Crores :

Investments in diversified equity shares	90.00
Cash and Bank Balances	10.00
	100.00

The Beta of the equity shares portfolio is 1.1. The index future is selling at 4300 level. The Fund Manager apprehends that the index will fall at the most by 10%. How many index futures he should short for perfect hedging? One index future consists of 50 units.

Substantiate your answer assuming the Fund Manager's apprehension will materialize.

Solution: Number of index future to be sold by the Fund Manager is:

$$\frac{1.1 \text{ X } 90,00,00,000}{4,300 \text{ x } 50} = 4,605$$

Justification of the answer:

Loss in the value of the portfolio if the index falls by 10% is ₹ $\frac{11}{100}$ x 90 crore = ₹ 9.90 Crore.

Gain by short covering of index future is: $\frac{0.1 \text{ x } 4,300 \text{ x } 50 \text{ x } 4,605}{1,00,00,000}$ = 9.90 Crore

This justifies the answer. Further, cash is not a part of the portfolio.

Question 12

MTP March 2018, MTP Sep 2025

On 1 April 2015, Sunidhi was holding a portfolio of 10 securities whose value was ₹ 9,94,450, the [weighted average] of beta of 9 securities was 1.10.

Since she was expecting a fall in the prices of the shares in near future to hedge her portfolio, she sold 5 contract of NIFTY Futures (Multiplier of 25) expiring in May 2015, which was trading at 8767.07 on 1 April.

a) Calculate the beta of the 10th security.

b) Reconcile the reasons in spite of 2% fall in the market as per Sunidhi's apprehension if she would have earned some profit on her cash position.

Solution: (a) To compute the beta of 10th security first we shall compute overall weighted beta as follows:

Let weighted Beta be w, then 5 = $\frac{994450}{8767.07 \text{ x } 25}$ x W or

W = 1.102 approximately

Let beta of 10th security is β then,

1.102 = 0.90 x 1.10 + 0.10 x β

β = 1.12

Tutorial Note

ICAI has assumed that weight of 9 securities was 90% & that of 10th Sec is 10% (i.e. all the securities had equal weight in the portfolio)

(b) The main reason for the profit in cash position might due to reason that contrary to her expectation fall in the value of cash position there may be increase in value of cash position or decrease in the stock price may be lesser than 2%.

Question 13

2 Q Merged | Study Material, (8 Marks) Exam N22, N23, N24, MTP O19, N23, M25, RTP M20, M21, N21

On January 1, 2023 an investor has a portfolio of 3 shares as given below

Shares	No. of shares (Lakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	750	1.20
C Ltd.	2.00	250	1.60

The cost of capital of the investor is 10.5% per annum.

The investor is of the opinion that the risk of portfolio is very high as compared to the market risk and wants to reduce the portfolio beta to 0.91. He is considering two below mentioned alternative strategies:

(i) Dispose off a part of his existing portfolio to acquire risk free securities. or

(ii) Take appropriate position on Nifty Futures for february 2023

You are required to determine:

(1) Interpret the opinion of Investor, whether it is correct or not.

(2) portfolio beta.

(3) the value of risk-free securities to be acquired.

(4) the number of shares of each company to be disposed off.

(5) the number of Nifty contracts to be bought/sold if the current value of NIFTY is 5900 and each nifty point is worth ₹ 200. Assume that nifty future are trading at their fair value.

(6) the value of portfolio beta for 2% rise in Nifty.

(7) The number of nifty contracts to sell to get a full hedge

(8) What will be new portfolio beta if 45 futures contracts are sold to the investors ?

No. of days in a year be treated as 365

Given Ln (1.105) = 0.0998

$e^{0.015858}$ = 1.01598

Solution:

(1) Yes, the apprehension of investor is correct as the current portfolio is more riskier than market as the beta (Systematic risk) is more than 1.

Shares	No. of shares (lakhs) (1)	Market Price Per Share (2)a	(1) x (2) (₹ lakhs)	% to total (w)	β (x)	wx
A Ltd.	3.00	500.00	1500.00	0.30	1.40	0.42
B Ltd.	4.00	750.00	3000.00	0.60	1.20	0.72
C Ltd.	2.00	250.00	500.00	0.10	1.60	0.16
			5000.00	**1.00**		**1.30**

(2) Portfolio beta 1.30

(3) Required Beta 0.91

Let the proportion of risk free securities for target beta 0.91 = p

0.91 = 0 x p + 1.30 (1 - p)

p = 0.30 i.e. 30%

Shares to be disposed off to reduce beta (5000 x 30%) ₹ 1,500 lakh and Risk Free securities to be acquired.

(4) Number of shares of each company to be disposed off

Shares	% to total (w)	Proportionate Amount (₹ lakhs)	Market Price Per Share	No. of Shares (Lakh)
A Ltd.	0.30	450.00	500.00	0.90
B Ltd.	0.60	900.00	750.00	1.20
C Ltd.	0.10	150.00	250.00	0.60

(5) Number of Nifty Contract to be sold

Calculation of Theoretical Value of Future Contract

Cost of Capital = 10.5% p.a.

Accordingly, the Continuously Compounded Rate of Interest Ln(1.105) =0.0998

For February 2023 contract, t = 58/365 = 0.1589

Further, $F = S_0 \times e^{rt}$

$F = ₹5,900 \times e^{(0.0998)(0.1589)}$

$F = ₹5,900 \times e^{(0.015858)}$

$F = ₹5,900 \times 1.01598 = ₹5,994.28$

Alternatively, it can also be taken as follows :

$= ₹5900 \times e^{0.105 \times 58/365}$

$= ₹5900 \times e^{0.01668}$

$= ₹5900 \times 1.01682$

$= ₹5999.24$

Number of Nifty Contract to be sold $= \frac{(1.30 - 0.91) \times 5000 \text{ lakh}}{5994.28 \times 200} = 162.65$ contracts say 163 contracts

(6) 2% rise in Nifty is accompanied by 2% x 1.30 i.e. 2.6% rise for portfolio of shares

	₹ Lakh
Current Value of Portfolio of Shares	5000
Value of Portfolio after rise	5130
Mark-to-Market Margin paid (5994.28 x 0.020 x ₹ 200 x 163)	39.08
Value of the portfolio after rise of Nifty	5090.92
% change in value of portfolio (5090.92 - 5000)/ 5000	1.82%
% rise in the value of Nifty	2%
Beta	0.91

(7) $\frac{1.30 \times 5000 \text{ lakh}}{5994.28 \times 200} = 542.18$ contracts say 542 or 543 contracts

(8) $\frac{(1.30 - x) \times 5000 \text{ lakh}}{5994.28 \times 200} = 45$ ∴ New Portfolio beta (i.e. x) = 1.1921

Question 14

3 Questions Merged, Study Material, (8 Marks) Exam N 10, N 12, M 22, MTP April 24

The equity shares of X Ltd. of ₹ 10, are presently quoted at ₹ 132. The expected share price of X Ltd. after 4 months and related probability is given below:

Expected Price (₹)	120	140	160	180	190
Probability	.05	.20	.50	.10	.15

A call option with a strike price of ₹ 150 can be written .

Compute the following:

(1) Expected Share price at the end of 4 months.

(2) Value of Call Option at the end of 4 months, if the exercise price prevails.

(3) In case the option is held to its maturity, what will be the expected value of the call option?

(4) Find out the price of the shares to be quoted at the stock exchange to get the value of the call option as computed in (3) above

Solution:

(1) Expected Share Price

$= ₹120 X 0.05 + ₹140 X 0.20 + ₹160 X 0.50 + ₹180 X 0.10 + ₹190 X 0.15$

$= ₹6 + ₹28 + ₹80 + ₹18 + ₹28.50 = ₹160.50$

(2) Value of Call Option

$= ₹150 - ₹150 = Nil$

(3) If the option is held till maturity the expected Value of Call Option

Expected price (x)	Value of call (C)	Probability (P)	Exercise/ Lapse	CP
₹ 120	0	0.05	Lapse	0
₹ 140	0	0.20	Lapse	0
₹ 160	₹ 10	0.50	Exercise	₹ 5
₹ 180	₹ 30	0.10	Exercise	₹ 3
₹ 190	₹ 40	0.15	Exercise	₹ 6
			Total	₹14

(4) Price to be quoted at the stock exchange to get the value of Call option

= ₹ 150 + ₹ 14 = ₹ 164

Question 15 — Study Material, (8 Marks) Exam May 2012

Sumana wanted to buy shares of EIL which has a range of ₹ 411 to ₹ 592 a month later. The present price per share is ₹ 421. Her broker informs her that the price of this share can sore up to ₹ 522 within a month or so, so that she should buy a one month CALL of EIL. In order to be prudent in buying the call, the share price should be more than or at least ₹ 522 the assurance of which could not be given by her broker.

Though she understands the uncertainty of the market, she wants to know the probability of attaining the share price ₹ 592 so that buying of a one month CALL of EIL at the execution price of ₹ 522 is justified. Advise her. Take the risk free interest to be 3.60% and $e^{0.036}$ = 1.037.

Solution:

$$P = \frac{e^{rt} - d}{u - d}$$

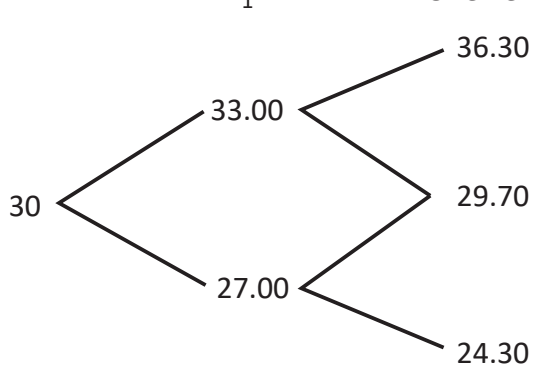
$e^{rt} = e^{0.036}$ $\quad d = 411 / 421 = 0.976$; $\quad u = 592 / 421 = 1.406$

$$P = \frac{e^{0.036} - 0.976}{1.406 - 0.976} = \frac{1.037 - 0.976}{0.43} = \frac{0.061}{0.43} = 0.1418.$$

Thus Probability of Rise in Price to 0.1418

Question 16 — 2 Questions Merged, Study Material, RTP Nov2010 (similar)

Following is a two sub-periods tree for a share of stock in CAB Ltd.:



Using the binomial model, calculate the current fair value of a regular call option on CAB Stock with the following characteristics: X = ₹ 28, Risk Free Rate = 5 percent p.a. You should also indicate the composition of the implied riskless hedge portfolio at the valuation date.

Also calculate option delta for the second 6 month, in case stock prices rises to ₹33 or falls to ₹ 27

Solution:

u = 33.00/30.00 = 36.30/33.00 = 1.10 d = 27.00/30.00 = 24.30/27.00 = 0.90

$r = (1 + .05)^{1/2} = 1.0247$

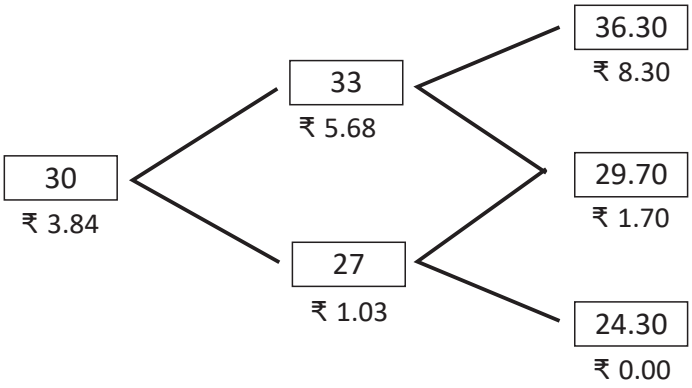
$$P = \frac{r - d}{u - d} = \frac{1.0247 - 0.90}{1.10 - 0.90}$$

= 0.1247/0.20 = 0.6235 (Prob. of increase in price of share)

C_{uu} = Max [0, 36.30 – 28] = 8.30

C_{ud} = Max [0, 29.70 – 28] = 1.70

C_{dd} = Max [0, 24.30 – 28] = 0



$$C_u = \frac{(0.6235)(8.30) + (0.3765)(1.70)}{1.025} = \frac{5.175 + 0.64}{1.025} = 5.815 / 1.025 = ₹ 5.673$$

$$C_d = \frac{(0.6235)(1.70) + (0.3765)(0.00)}{1.025} = \frac{1.05992}{1.025} = ₹ 1.0341$$

$$C_o = \frac{(0.6235)(5.673) + (0.3765)(1.0341)}{1.025} = \frac{3.537 + 0.3893}{1.025} = ₹ 3.83$$

Tutorial Note: Mistake by ICAI. While calc Prob, rate of 5% pa was assumed comp semi-annually.
While calc PV, rate of 5% pa is assumed as simple interest. But in exams, do as ICAI did.

The composition of the implied risk-less hedge portfolio at valuation date is called Delta (Δ) and it is calculated as follows:

$$\frac{C_u - C_d}{S_u - S_d}$$

Where,

C_u = Pay-off from Call Option if price of Stock goes up

C_d = Pay-off from Call Option if price of Stock goes down

S_u = Upward price of the Stock

S_d = Downward price of the Stock

Accordingly, the Risk-less Portfolio shall require Δ Share shall be required for writing off one Call Option. The Δ shall be computed as follows:

$$\Delta = \frac{5 - 0}{33 - 27} = \frac{5}{6}$$

Thus, $\frac{5}{6}$ shares shall be held or purchased for writing one Call Option.

Calc of Option delta after 6 months :-

(i) If price rises to ₹ 33

$$\Delta = \frac{8.30 - 1.70}{36.30 - 29.70} = 1.0$$

(ii) If price falls to ₹ 27

$$\Delta = \frac{1.70 - 0}{29.70 - 24.30} = 0.3148$$

Question 17 4 Questions Merged | Study Material, (8 Marks) Exam N06, RTP M20

From the following data for certain stock, find the value of a call option:

CMP = ₹ 85

Exercise Price = ₹ 75

Std. Deviation = 0.40

Maturity period = 6 months

Annualized treasury bill rate corresponding to this option life = 12%

The company is going to declare a dividend of ₹ 5.20 & it is expected to be paid in four months time.

Given

No. of S.D. from Mean (Z)	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

or Cumulative Area

No. of S.D. from Mean (Z)	Cumulative Area
0.25	0.5987
0.30	0.6179
0.55	0.7088
0.60	0.7257

or Two tail area

No. of S.D. from Mean (Z)	Area of the left & right (two tail)
0.25	0.8026
0.30	0.7642
0.55	0.5823
0.60	0.5485

$e^{0.12x0.50} = 1.062$ $e^{0.12x4/12} = 1.04081$

Ln 1.0667 = 0.0646

Also calculate value of 6 months Put Option Ex. Price = ₹ 75

Solution:

WN# 1 Calc pv of dividend $= \frac{₹\ 5.20}{e^{0.12 \times 4/12}} = \frac{₹\ 5.20}{1.04081} = ₹\ 5$ $\therefore$ Net S_o = ₹ 85 - ₹5 = ₹ 80

Applying the Black Scholes Formula,

Value of the Call option now:

$C = S \times N(d_1) - K \times e^{-rt} N(d_2)$

$d_1 = \frac{Ln\ (s / k) + (r + \sigma^2 / 2)t}{\sigma\sqrt{t}}$

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

$d_1 = \frac{Ln\ (1.0.0667) + (0.12 + (0.08))0.5}{0.40\sqrt{0.5}}$

$= \frac{0.0645 + (0.2)\ 0.5}{0.40 \times 0.7071} = 0.5820$

$d_2 = 0.5820 - 0.2828 = 0.2992$

$Nd_1 = N(0.5820) = 0.7197$ $Nd_2 = N(0.2992) = 0.6177$

$C = S_o \times N(d_1) - \frac{E \times N(d_2)}{e^{rt}} = 80 \times 07197 - \frac{75 \times 0.6176}{1.062} = ₹\ 13.96$

Where,

C = Theoretical call premium
S = Current stock price
t = time until option expiration
K = option striking price
r = risk-free interest rate
N = Cumulative standard normal distribution
e = exponential term
σ = Standard deviation of continuously compounded annual return.
Ln = natural logarithm

Using Put - call parity theorem

$V_s + V_p = V_c + PV$ of Ex. P

$80 + Vp = 13.96 + \frac{75}{e^{0.12 \times 6/12}}$ $\therefore$ Vp = ₹ 4.58

Decision Using Data Analysis

(a) Arithmetic moving average (AMA) aka Simple Moving Average (SMA)

Trading Day	1	2	3	4	5	6	7	8	9
Airtel Share Price	480	486	492	489	505	530	535	520	490

5- days **Simple** Moving Avg

490.4

500.4

510.2

515.8

516

Use of moving average to identify trends
200 day's MA for Long term trend
60 day's MA for Intermediate term trend
10 day's MA for Short term trend

(b) Exponential Moving Average

It assigns higher weight to the latest prices

$$K \text{ or } a = \frac{2}{\text{Time Period} + 1}$$

here, 'K or a' means Multiplier or Exponent. It is the weight that would be assigned to the latest price.

Time Period means No. of days for which EMA is being calculated

Eg. K or a for 5 days EMA $= \frac{2}{5+1} = \frac{2}{6} = 0.3333$

K or a for 10 days EMA $= \frac{2}{10+1} = \frac{2}{11} = 0.1818$

K or a for 50 days EMA $= \frac{2}{50+1} = \frac{2}{51} = 0.0392$

"Author has color coded this page for better understanding. Same scheme has been adopted on various pages throughout this Booklet"

$EMA_t = a\,P_t + (1 - a)\,(EMA_{t-1})$

or

$= EMA_{t-1} + (P_t - EMA_{t-1}) \times a$

here, a means Exponent i. e. Multiplier

P_t means Prices today

EMA_{t-1} means Previous days EMA

Example

Trading Day	1	2	3	4	5	6	7	8	9
Airtel Share Price	480	486	492	489	505	530	535	520	490

5- days **Exponential** Moving Avg

first EMA is taken same as simple Moving Avg 490.4

0.3333 x 530 + (1- 0.3333) 490.4 503.6

0.3333 x 535 + (1 - 0.3333) 503.6 514.06

516.04

507.36

Tutorial Note: AMA & EMA are not calculated for the day when there is a trading holiday

Efficient Market Hypothesis | Efficient Market Theory

developed by Eugen Fama

- As per EMH, all available price sensitive information is fully reflected in securities prices i.e. no one can beat the market. It is impossible to outperform the overall market because stocks are always traded at their fair value.

✓ Means Applicable x Means Not Applicable

	Levels of Efficiency / Approach	Technical Analysis	Fundamental Analysis	Random Selection	Scope for beating Mkts
Price reflect all available info public as well as private.	Strong form Efficiency	x Poor	x Fair	Best	x
Price reflect not only all info found in the record of past prices and volumes but also all other publicly available info.	Semi - Strong Efficiency	x Poor	x Good (with insider/ private info)	Fair	✓
Price reflect all info found in the record of past Price and volumes.	Weak form Efficiency	x Poor	✓ Best (with publicly available info)	Poor	✓
Possible to earn super profits by studying Past price and volume patterns	Inefficient Markets	✓ Best	Poor	Poor	✓

Test of Weak form Efficiency

(4 Marks) Exam May 2025

Three ways to test weak form of efficiency (1) Run Test (2) Auto/ Serial Correlation (3) Filter Rules Test

Run Test

Given a series of stock price changes each price change is designated + if it represents an increase and - if it represents a decrease . The resulting series may be -,+,-,-,-,+,+.

A run occurs when there is no difference between the sign of two changes. When the sign of change differs, the run ends and new run begins. Below are the Steps in Run Test

Step 1: Assign +/- sign to the closing prices.

'+' is assigned if stock prices has increased today

'-' is assigned if stock prices has decreased today

Tutorial Note: If Q gives open Price, High Price, Low Prices & Closing Prices then ignore Open, High & Low Prices and just consider Closing Prices for assigning +/- sign

Step 2: Count

(i) No. of Positive changes (denote it by n_1)

(ii) No. of Negative changes (denote it by n_2)

(iii) Total of sign of price changes (denote it by r)

Step 3: Calculate average no. of runs (μ_r)

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

Step 4: Calculate Standard Deviation

As Per ICAI study material

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

Alternatively,

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

Step 5: Calculate lower limit & upper limit

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

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

1. Value of t at a specific level of significance & specific degree of freedom is either given in the Q or found using T- table
2. For a sample of size n, the t-distribution will have n-1 degrees of freedom. In our case, sample size is $n_1 + n_2$, hence df = $n_1 + n_2 - 1$.

Step 6: Decision

If 'r' lies between lower, & upper limit then market exhibits weak from of efficiency.

If 'r' lies outside the range then markets are inefficient.

Auto Correlation / Serial Correlation

means Correlation of a given time series with a lagged version of itself. It measures relationship b/w current stock prices and its own past stock prices.

Step to calc Auto Correlation

Step 1: Divide the given series of prices into 2 equal series eg. if 10 days prices are given then first 5 prices becomes first series, last 5 prices becomes second series

for Auto correlation for Serial correlation

Step 2: Calculate changes in prices (in ₹ or in% terms) as compared to previous price for both the series

Δ in price in first series is named as 'X' variable

Δ in price in second series is named as 'Y' variable

Step 3: Now calc correlation between X & Y

Step 4: Conclusion :

If correlation is weak (say b/w - 0.30 to + 0.30) then it is not possible to predict to prices using Technical analysis & hence market exhibits weak form of efficiency

If correlation is moderate or strong +ve / -ve then markets are inefficient

Filter Rules Test

If the price of stock increases by at least N% buy and hold it until its price decreases by at least N% from a subsequent high. When the price decreases at least N% or more, sell it. If the behaviour of stock price changes is random, filter rules should not apply in such a buy and hold strategy. By and large, studies suggest that filter rules do not outperform a single buy and hold strategy particularly after considering commission on transaction.

Challenges to the Efficient Market Theory

(a) Information Inadequacy Information is neither freely available nor rapidly transmitted to all participants in the stock market. There is a calculated attempt by many companies to circulate misinformation.

(b) Limited information processing capabilities Human information processing capabilities are sharply limited.

(c) Irrational Behaviour It is generally believed that investor's rationality will ensure a close correspondence between market prices and intrinsic values. The market seems to function largely on hit miss tactics rather then on basis of informed beliefs about the long term prospects of individual enterprises.

(d) Monopolistic Influence In practice, powerful institutions and big operators wield great influence over the market.

Misconception about Efficient Market Theory

Although price tends to fluctuate they cannot reflect fair value. This is because the future is uncertain. The market springs surprises continually and as prices reflect the surprises they fluctuate.

The random movement of stock prices suggests that stock market is irrational. Randomness and irrationality are two different things, if investors are rational and competitive, price changes are bound to be random.

Question 1

Study Material , (8 Marks) Exam Nov 2019, May 2024, MTP May 2025

Closing values of NSE Nifty from 6th to 17th day of the month of January of the year 2022 were as follows:

Days	Date	Day	Nifty
1	6	Thu	14522
2	7	Fri	14925
3	8	Sat	No Trading
4	9	Sun	No Trading
5	10	Mon	15222
6	11	Tue	16000
7	12	Wed	16400
8	13	Thu	17000
9	14	Fri	No Trading
10	15	Sat	No Trading
11	16	Sun	No Trading
12	17	Mon	18000

Calculate Exponential Moving Average (EMA) of Nifty during the above period. The 30 days simple exponential moving average of Nifty can be assumed as 15,000. The value of exponent for 31 days EMA is 0.062. Give detailed analysis on the basis of your calculations.

Solution:

Date	1 Nifty	2 EMA for Previous day	3 1-2	4 3 × 0.062	5 EMA 2 ± 4
6	14522	15000	(478)	(29.636)	14970.364
7	14925	14970.364	(45.364)	(2.813)	14967.551
10	15222	14967.551	254.449	15.776	14983.327
11	16000	14983.327	1016.673	63.034	15046.361
12	16400	15046.361	1353.639	83.926	15130.287
13	17000	15130.287	1869.713	115.922	15246.209
17	18000	15246.209	2753.791	170.735	15416.944

Conclusion – The market is bullish. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of this indicator (EMA) the investors/brokers can take long position.

Question 2

Study Material, RTP Nov 2023

The closing value of Sensex for the month of October, 2017 is given below:

Date Closing	Sensex Value	Date Closing	Sensex Value
1.10.17	2800	16.10.17	3300
3.10.17	2780	17.10.17	3450
4.10.17	2795	19.10.17	3360
5.10.17	2830	22.10.17	3290
8.10.17	2760	23.10.17	3360
9.10.17	2790	24.10.17	3340
10.10.17	2880	25.10.17	3290
11.10.17	2960	29.10.17	3240
12.10.17	2990	30.10.17	3140
15.10.17	3200	31.10.17	3260

You are required to test the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following value can be used:
Value of t at 5% is 2.101 at 18 degrees of freedom
Value of t at 10% is 1.734 at 18 degrees of freedom
Value of t at 5% is 2.086 at 20 degrees of freedom.
Value of t at 10% is 1.725 at 20 degrees of freedom.

Solve:

Date	Closing Sensex	Sign of Price Charge
1.10.17	2800	
3.10.17	2780	-
4.10.17	2795	+
5.10.17	2830	+
8.10.17	2760	-
9.10.17	2790	+
10.10.17	2880	+
11.10.17	2960	+
12.10.17	2990	+
15.10.17	3200	+
16.10.17	3300	+
17.10.17	3450	+
19.10.17	3360	-
22.10.17	3290	-
23.10.17	3360	+
24.10.17	3340	-
25.10.17	3290	-
29.10.17	3240	-
30.10.17	3140	-
31.10.17	3260	+

Total of sign of price changes (r) = 8
No of Positive changes = $n_1 = 11$
No. of Negative changes = $n_2 = 8$

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

$$\mu_r = \frac{2 \times 11 \times 8}{11 + 8} + 1 = 176 / 19 + 1 = 10.26$$

$$\overset{\Delta}{\sigma}_r = \frac{2n_1 n_2 (2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}$$

$$\overset{\Delta}{\sigma}_r = \frac{(2 \times 11 \times 8)(2 \times 11 \times 8 - 11 - 8)}{(11 + 8)^2 (11 + 8 - 1)}$$

$$= \frac{176 \times 157}{(19)^2 (18)} = 4.252 = 2.06$$

Since too few runs in the case would indicate that the movement of prices is not random. We employ a two-tailed test the randomness of prices.

Test at 5% level of significance at 18 degrees of freedom using t- table

The lower limit
$= \mu - t \times \hat{} \sigma r = 10.26 - 2.101 \times 2.06 = 5.932$

Upper limit
$= \mu + t \times \hat{} r \sigma = 10.26 + 2.101 \times 2.06 = 14.588$

At 10% level of significance at 18 degrees of freedom

Lower limit
$= 10.26 - 1.734 \times 2.06 = 6.688$

Upper limit
$= 10.26 + 1.734 \times 2.06 = 13.832$

As seen r lies between these limits. Hence, the market exhibits weak form of efficiency.
*For a sample of size n, the t distribution will have n-1 degrees of freedom.

Question 3 (8 Marks) Exam Jan 2021

Mr. X is of the opinion that market has recently shown the Weak Form of Market Efficiency. In order to test the validity of his impression he has collected the following data relating to the movement of the SENSEX for the last 20 days.

Days	Open	High	Low	Close
1	33470.94	33513.79	33438.03	33453.99
2	33453.64	33478.11	33427.82	33434.83
3	33414.06	33440.29	33397.65	33431.93
4	33434.94	33446.18	33377.78	33383.41
5	33372.92	33380.27	33352.12	33370.93
6	33375.85	33389.49	33331.42	33340.75
7	33340.89	33340.89	33310.95	33330.98
8	33326.84	33340.91	33306.17	33335.08
9	33307.16	33328.22	33296.43	33301.97
10	33298.64	33318.60	33254.28	33259.03
11	33260.04	33228.85	33241.66	33251.53
12	33255.92	33289.46	33249.46	33285.89
13	33288.86	33535.67	33255.98	33329.28
14	33335.00	33346.21	33276.72	33284.17
15	33293.83	33310.86	33278.54	33298.78
16	33300.02	33337.79	33300.02	33325.38
17	33323.36	33356.34	33322.44	33329.95
18	33322.81	33345.98	33317.44	33319.67
19	33317.51	33321.18	33294.19	33302.32
20	33290.86	33324.96	33279.62	33319.61

You are required:

To test the Weak Form of Market Efficiency using Auto-Correlation test taking time lag of 10 days.

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Call 8889246468 or 6266553342

Solve:

Period 1	Closing Prices	Change	Period 2	Closing Prices	Change
1	33453.99		11	33251.53	
2	33434.83	- 19.16	12	33285.89	34.36
3	33431.93	- 2.90	13	33329.28	43.39
4	33383.41	- 48.52	14	33284.17	- 45.11
5	33370.93	- 12.48	15	33298.78	14.61
6	33340.75	- 30.18	16	33325.38	26.6
7	33330.98	-9.77	17	33329.95	4.57
8	33335.08	4.1	18	33319.67	- 10.28
9	33301.97	- 33.11	19	33302.32	-17.35
10	33259.03	- 42.94	20	33319.61	17.29

X	Y	X^2	Y^2	XY
- 19.16	34.36	367.11	1180.61	- 658.34
- 2.90	43.39	8.41	1882.69	- 125.83
- 48.52	- 45.11	2354.19	2034.91	2188.74
- 12.48	14.61	155.75	213.45	- 182.33
- 30.18	26.6	910.83	707.56	- 802.79
-9.77	4.57	95.45	20.88	- 44.65
4.1	- 10.28	16.81	105.68	- 42.15
- 33.11	-17.35	1096.27	301.02	574.46
- 42.94	17.29	1843.84	298.94	- 742.43
$\sum X = -194.96$	$\sum Y = 68.08$	$\sum X^2 = -6848.66$	$\sum Y^2 = -6745.74$	$\sum XY = -164.68$
$X = - 21.66$	$Y = 7.56$			

$$b = \frac{\sum XY - n\bar{X}\bar{Y}}{\sum X^2 - n(\bar{X})^2} = \frac{164.68 - 9\,(-21.66)\,(7.56)}{6848.66 - 9\,(-21.66)^2} = 0.624$$

$$a = \bar{Y} - b\,\bar{X} = 7.56 - 0.624\,(-21.66) = 21.08$$

$$r^2 = \frac{a\sum Y + b\sum XY - n\,(\bar{Y})^2}{\sum X^2 - n(\bar{Y})^2} = \frac{21.08\,(68.08) + 0.624\,(164.68) - 9\,(7.56)^2}{6745.74 - 9\,(7.56)^2}$$

$r^2 = 0.164$

$r = 0.405$

There is moderate degree of correlation between the returns of two periods hence it can be concluded that the market does not show the weak form of efficiency.

Tutorial Note: ICAI has calculated Correlation using regression method in this Question. Students can calculate Correlation between X & Y in the same way as we calculate in Portfolio Management Chapter. Final answer will be the same.

Foreign Exchange Exposure & Risk Management

LDR 3 ½ Hrs
LMR 15 Mins

A Basics of Foreign Exchange
B Exchange Risk Management Techniques
C Fate of Forward contract
D Arbitrage opportunities

Basics of Foreign Exchange

Types of Quotes

Direct Quote or European Quote is expressed in terms of 'per unit of foreign currency'

$ 1 = ₹ 80

Indirect Quote or American Quote is expressed in terms of 'per unit of home currency'

₹ 1 = $ 0.0125

Inverse the rates & switch the sides of the currency

Various ways to write a quotation

- ✓ $ 1 = ₹ 80
- ✓ ₹ 80 = $ 1
- ✓ ₹ 80 per dollar
- ✓ ₹ 80 / dollar
- ✓ ₹/$ = 80

Practical knowledge - helpful in exams

Country	Currency code	Currency symbol	Approx Quotation	Updated Quote near your exams
India	INR	₹	-	
USA	USD	$	$ 1 = ₹ 85	
Europe	EUR	€	€ 1 = ₹ 95	
UK	GBP	£	£ 1 = ₹ 115	
Japan	JPY	JP¥	JP¥ 1 = ₹ 0.60	
China	CNY	CN¥	CN¥ 1 = ₹ 12	
Australia	AUD	AU$	AU$ 1 = ₹ 55	
Singapore	SGD	SG$	SG$ 1 = ₹ 65	
Canada	CAD	CA$	CA$ 1 = ₹ 60	
Russia	RUB	₽	₽ 1 = ₹ 1	
UAE	AED	د.إ	1 AED = ₹ 23	
Switzerland	CHF	₣	1 CHF = ₹ 95 to 105	

Two - way quote

$1 = ₹81 - 82
Bid rate — Ask rate or Offer rate

LHS Currency whose unit is 1 is officially called as 'Base Currency' but we will term it as 'Chocolate Currency'

Banker

Banker Buys $ @ ₹ 81	Banker sells $ @ ₹ 82
Customer sells $ @ ₹ 81	Customer buys $ @ ₹ 82

Banker buys Chocolate Currency at lower rates & sells at higher rate

Golden rule
Customer बेचारा buys Chocolate Currency at higher rates & sells at lowe
sells at lower rate

Exporter

Customer

Importer

Steps to find relevant rate (bid or ask ?) & relevant amount ?

Please read below steps twice in LDR. Also follow these steps religiously and don't attempt to skip below steps in Exams !

Step 1: Write quotation in "Our Format" i.e. where LHS currency has 1 unit of it .

Step 2: Identify LHS currency ; & now call it as a Chocolate currency

say, €1 = £0.95 - 0.99

In our case € become chocolate currency

Step 3 : What is your action on Chocolate currency (i.e. LHS currency) - Do you want to Buy or Sell Chocolate Currency ?

Step 4 : Apply golden rule on Chocolate currency (i.e. LHS currency) - Buy Chocolate @ High rates(i.e. Ask) and sell Chocolate at low rates(i.e. Bid)

Step 5 : Apply cross multiplication

Thumb rule : only Same currencies comes under each other.

$1 - ₹80 vs. $1 - ₹80
₹75000 ? ✗ ? ✓ ₹75000

Shortcut rule for cross multiplication

If Amount to be Converted & Exchange rates both are in same currency then Divide
[Sample: Convert $ 80000 into €. Given € 1 = $ 1.50. Answer: € 53333]

If Amount to be Converted & Exchange rates are in different currency then Multiply
[Sample: Convert $ 50000 into €. Given $ 1 = € 0.60. Answer: € 30000]

Alternative way for Step 1 to Step 4: Always first convert the given quote into a Direct Quote i.e. have that currency on LHS of the Quote in which you are transacting and then Buy @ High Rates(i.e. Ask) and Sell @ Low Rates(i.e. Bid). Drawback- could result in Loss of Accuracy due to quote conversion.

Example 1 : $ 1 = ₹ 83 - 83.50. If you want to purchase $ 50000, how much ₹ do you need ?

Answer: $ 1 = ₹ 83.5

∴ $ 50000 = ₹ 83.5 x 50000 = ₹ 41,75,000

Example 2 : € 1 = £ 0.95 - £ 0.99. If you wish to sell £ 47500, how many €'s you'll get in return ?

Answer by students: ~~€ 50000~~, € 47979, ~~€ 45125~~

'Sell' Action was given in the Q on RHS Currency & Student forget to think action in terms of LHS Currency i.e. Chocolate currency

At the time of Cross Multiplication $ is written below $ & ₹ is written below ₹ i.e. same currency comes under each other

Since we want to sell £, ∴ in other words we want to buy € (€ being LHS currency i.e. Cholocate Currency, action i.e. Buy / Sell needs to be thought in terms of Chocolate currency)

Relevant Rate is € 1 = £ 0.99

∵ 1 - £ 0.99

∴ ? £ 47500

$$= \frac{£\ 47500 \times €\ 1}{£\ 0.99} = €\ 47979$$

Example 3: CAD 1.0250 - 1.0340 per AUD. If you wish to get CAD 10000 then how much AUD should you have ?

Steps	What's there in the step	Result of the step
1	Our format	1 AUD = CAD 1.0250 - 1.0340
2	Chocolate currency	AUD
3	Action on Chocolate	We wish to buy CAD, hence in other words we wish to sell AUD i.e. Sell Chocolate
4	Identify relevant rate by applying golden rule	Since we have to sell chocolate, ∴ lower rate i.e. bid rate is applicable. i.e 1 AUD = CUD 1.0250
5	Calc relevant amount - using cross multiplication or Shortcut rule	∵ 1 AUD - CAD 1.0250 ∴ ? CAD 10000 $= \frac{1\ AUD \times \cancel{CAD}\ 10000}{\cancel{CAD}\ 1.0250} = AUD\ 9756.10$

Spread

is the difference between Bid rate & Ask rate. Spread is income of a banker

Spread = Ask rate - Bid rate

Say ₹ 82 ₹ 80

∴ Spread = ₹ 2

$$\text{Spread\%} = \frac{\text{Ask rate - Bid rate}}{\text{Bid rate}} = \frac{82 - 80}{80} = 2.5\%$$ [ICAI Study Mat uses this formula]

Tutorial Note: Alternatively, some authors use Ask rate in the denominator (Ans: 2.44%) or Avg rate (Ans: 2.47%)

Converting a two - way Direct Quote ⇌ Indirect Quote

$ 1 = ₹ 80 - 82

Inverse of ask becomes bid rate — Inverse of Bid becomes ask rate

₹ 1 = $ 0.0122 - 0.0125

Cross Currency rate

Case I - One-way quote

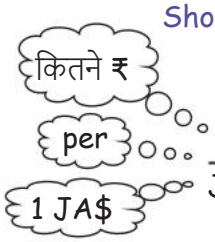
Given : $ 1 = ₹ 80

Given : $ 1 = JA$150

∵ We get JA$150 from ₹ 80

∴ To get JA$1 ? = $\frac{JA\$1 \times ₹\ 80}{JA\$150}$ = ₹ 0.5333

Shortcut - Mathematical rule



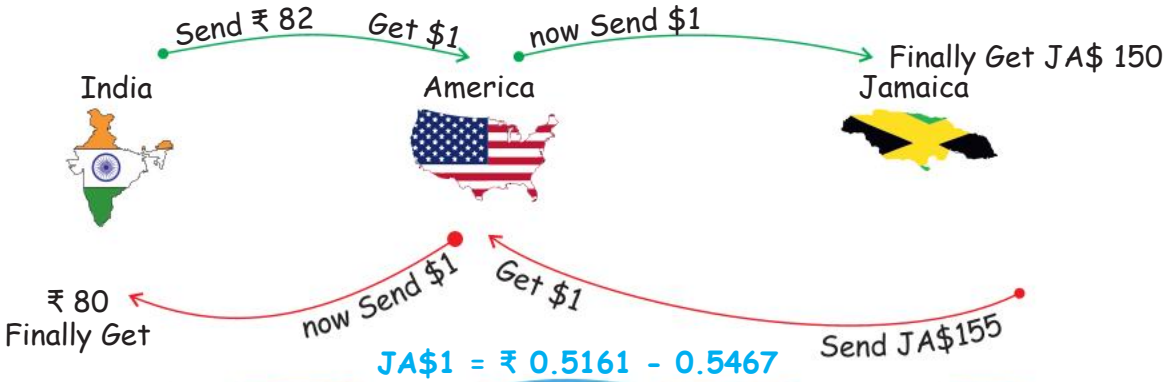
$\frac{A}{C} = \frac{A}{B} \times \frac{B}{C}$

$\frac{₹}{JA\$} = \frac{₹}{\$} \times \frac{\$}{JA\$}$ $= 80 \times \frac{1}{150} = 0.5333$ $\therefore JA\$1 = ₹\ 0.5333$

Case II - Two way quote

Given : $ 1 = ₹ 80 - 82

Given : $1 = JA$150 - 155



JA$1 = ₹ 0.5161 - 0.5467

∵ JA$155 gets converted into ₹ 80

∴ JA$1 will fetch ?

$\frac{JA\$1 \times ₹\ 80}{JA\$115}$

$= ₹\ 80/115$ or ₹ 0.5161

∵ ₹ 82 gets converted into JA$ 150

∴ ? JA$1

$\frac{JA\$1 \times ₹\ 82}{JA\$150} = ₹\ 82/150$ or ₹ 0.5467

Shortcut Mathematical rule to be used in exams

$Bid\left(\frac{₹}{JA\$}\right) = Bid\left(\frac{₹}{\$}\right) \times Bid\left(\frac{\$}{JA\$}\right)$

$= 80 \times \frac{1}{155}$

$= 0.5161$

$Ask\left(\frac{₹}{JA\$}\right) = Ask\left(\frac{₹}{\$}\right) \times Ask\left(\frac{\$}{JA\$}\right)$

$= 82 \times \frac{1}{150}$

$= 0.5467$

Telephone Format

term coined by CA, CFA (USA), CPA (USA) Praveen Khatod Sir

Replace the last digits & keep earlier digits same as bid rate.

Eg. 1 Reliance = ₹ 2614 - 2617
may be written as ₹ 2614-17

Similarly, $ 1 = ₹ 78.4925 - 78.4975
may be written as ₹ 78.4925 -75

Caution Note
Now don't make the mistake of using ₹ 75 directly as ask rate. the correct ask rate is $ 1 = ₹ 78.4975

Practice :-

1) $ 1 = ₹ 77.10 - 70
↓ is interpreted as
$ 1 = ₹ 77.10 - 77.70

Yes, it is telephone format. Format code of Ask Rate is not same as Format code of Bid Rate hence ask rate is in telephone format

2) $ 1 = ₹ 79.70 - 80

Had 80.00 been written here then ASK rate would be 80.00. But righnow it is telephone format

✓ $ 1 = ₹ 79.70 - 79.80 $ 1 = ₹ 79.70 - 80.00 ✘

3) $ 1 = ₹ 78.70 - 40
↓
is interpreted as
$ 1 = ₹ 78.70 - 79.40

Don't add 0.40 to 78.70 there is no concept of addition in case of telephone format. It's just about replacement !

4) € 1 = £ 0.8985 - 10
↓
€ 1 = £ 0.8985 - 0.9010

You might be enticed to add 10 & call ask rate as 0.8995, But once again I am repeating, telephone format is just about replacement !

5) $ 1 = ₹ 72.5000 - 75
↓
$ 1 = ₹ 72.5000 - 72.5075

6) $ 1 = ₹ 75.60 - 75.30
is ↓ interpreted as
$ 1 = ₹ 75.30 - 75.60

Not telephone format
[The correct approach is to switch the sides . Bid < Ask]

7) $ 1 = ₹ 84.60 ± 0.20
is ↓ interpreted as
$ 1 = ₹ 84.40 - 84.80

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Interbank Rates & Merchant Rates

Inter bank quote: $ 1 = ₹ 84.30 - 84.40

- Buying margin % say 0.10%

+ Selling margin % say 0.10%

Banker wants to earn 0.10% margin

SBI

Merchant bank quote $ 1 = ₹ 84.22 - 84.48

Exporter

Importer

Conclusion :

Merchant bank quote for Bid rate = Interbank Bid rate - Buying Margin %

Merchant bank quote for Ask rate = Interbank Ask rate + Selling Margin %

Tutorial Note: While calculating Merchant Bank Cross Currency Rate using Interbank quotations,

- if margin is given in % terms then first adjust such margin% in quotation having ₹ rate & then compute cross rate. Exception: In Q's related to "delay due to bank strike", ICAI first calculates cross rate & then adjust margin %
- if margin is given in ₹ or paisa terms then first calculate Inter bank cross currency rate & then adjust margin ₹ or paisa.

Format of Quotation-as per FEDAI rules

Foreign Exchange Dealers Association of India
Association of India

1. All quotations must be in terms of 1 unit of foreign currency except for Japanese yen where JPY is quoted in terms of JPY 100
2. Interbank quotations should be upto 4 decimal places with last 2 digits (3rd & 4th decimal place) in the multiple of 25

   $ 1 = ₹ 83.7525 or ₹ 83.7550 or ₹ 83.7575 or ₹ 83.7600 are correct quotes
3. Merchant bank quotations may be upto 2 decimal places.

Exam Tip

ICAI Sometimes follows / Sometimes doesn't follow FEDAI Rules. For us, the thumb Rule is

- ✓ If ICAI has followed FEDAI Rules while framing Q then Yes we also have to follow while solving
- ✓ If ICAI has not followed then we also dont't follow FEDAI Rules while solving.

Practice

1) ₹ 1 = $ 0.0125 - 0.0150 → FEDAI Rules is not followed ∵ it is not in 1 unit of foreign currency.
2) £ 1 = ₹ 89.9440 - 89.9550 → Not followed. 3rd & 4th digit are not in multiple of 25
3) £ 1 = $ 1.1125 - 1.1150 → FEDAI Rules is not applicable since none of the currency is ₹
4) €1 = ₹ 74.5050- 74.5275 → FEDAI Rules is followed

Types of Rates

Spot rate
This rate is for immediate settlement. However, practically spot rate means T+2 settlement

Cash rate or Ready rate	T i.e same day Settlement
Tom rate	T + 1
Spot rate	T + 2

Forward rate
This rate is agreed upon today for settlement on some future date.

If Q is silent then Currency Forward contracts are always settled by actual delivery & not by price difference

PIPS [Price interest point or Percentage in point]

PIPS is the smallest unit by which a currency quotation can change. Since most of international quotations are upto 4 decimal places, therefore, minimum change is 0.0001. Now this change of 0.0001 will be called as change by 1 Pips.

1 Pips = 0.0001

£ 1 = $ 1.1123

Price has changed by 4 pips

£ 1= $ 1.1127

$1 = ₹ 84.5050 - 84.5175

Spread is 125 pips

Swap Points [aka Forward points, Forward margin or Premium on forward contract]

Swap Points are the difference between spot rate & forward rate.

Example

1 m Forward	$ 1 = ₹ 86.5125	-	86.5250
Spot	$ 1 = ₹ 86.4950	-	86.5000
Swap points	175	-	250

Increasing Order

Rules for adjustment of swap points:

1. If swap points are in increasing order then add swap points to spot rate
2. If swap points are in decreasing order then deduct swap points from spot rate

Practice :

Spot £ 1	=	$ 1.1110	- 1.1250
1m swap points		80	- 40
1 m forward £ 1	=	$ 1.1030	- 1.1210

Decreasing Order

Telephone format Vs. Swap points

Spot rate	$ 1	=	₹ 84.5125	-	50
1 m forward rate	$ 1	=	₹ 84.7825	-	75

telephone; swap points; swap points; telephone

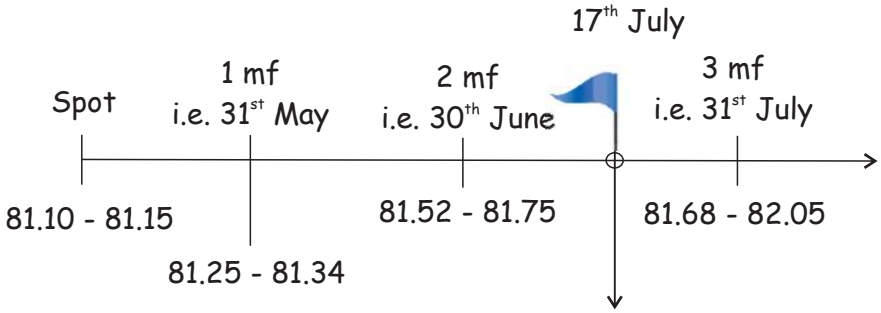
Swap points are based on the concept of 'Add / less'

Telephone format is based on the concept of 'Replacement'

Broken Period Forward Contract

Interbank Forward Rates are for Standard due dates whereas a Customer can approach Bank to enter into a forward Contract for some Non-Standard due dates. In such cases' the swap Points applicable for Standard due dates falling immediately before & immediately after non-standard due dates are interpolated.

Interbank Quotes



SBI

Merchant quote

margin is 0.12%

Calc of Broken period forward rates for delivery date of 17th July

3mf interbank $ 1 = ₹ 81.68 - 82.05

vs 2mf interbank $ 1 = ₹ 81.52 - 81.75

Difference for 31 days 16 paisa - 30 paisa

∵ 31 days — 16 paisa — 30 paisa

∴ 17 days — ? — ??

$$17 \text{ days} \times \frac{16 \text{ p}}{31 \text{ days}} = \text{Paisa } 8.77 \qquad \frac{17\text{d} \times 30\text{p}}{31 \text{ days}} = \text{Paisa } 16.45$$

Customer wishes to enter into Fwd contract dated 17th july

∴ Broken period interbank fwd rates $ 1 = ₹ 81.6077 - 81.9145

hence,

Merchant bank fwd rates for 17th july $ 1 = ₹ 81.51 (-0.12%) - 82.01 (+0.12%)

Exam Tip: Concept of broken period is applied in exams only when Q specifically asks / hints us to do so.

Currency Appreciation / Depreciation

Today 1 pen = ₹ 80

1 Year Later 1 pen = ₹ 88 — Pen has appreciated by 10%

Similarly,

Spot rate : $ 1 = ₹ 80

1 Yr Forward $ 1 = ₹ 88 — $ is appreciating by 10%

% Annualized appreciation / (depreciation) on LHS currency [i.e. on Base Currency]

$$= \frac{F - S}{S} \times 100 \times \frac{12}{n} \text{ or } \frac{365}{n}$$

$$= \frac{88 - 80}{80} \times 100 \times \frac{12}{12}$$

= +10% i.e.10% app. in $

% Annualized appreciation / (depreciation) on RHS currency [i.e. on Price Currency]

$$= \frac{S - F}{F} \times 100 \times \frac{12}{n} \text{ or } \frac{365}{n}$$

$$= \frac{80 - 88}{88} \times 100 \times \frac{12}{12}$$

= -9.09% i.e. ₹ dep by 9.09%

Tutorial Note:

1. Alternative Terminologies used in Question

Currency appreciation may also be called as
- ✓ Currency is getting strong
- ✓ Currency is gaining/ increasing/rising
- ✓ Currency is becoming expensive/costlier/ dearer
- ✓ Currency is trading at a premium

Currency depreciation may also be called as
- ✓ is getting weak
- ✓ is declining / decreasing/falling/losing
- ✓ is becoming cheaper
- ✓ is trading at a discount

Exam Tip

1. If both Bid & Ask rates are given then Prem / Disc % is calculated separately for Bid rates [F_{Bid} vs S_{Bid}] and Ask rates [F_{Ask} vs S_{Ask}]

2. If Transit Period is given in Q, then Exchange Rate will be based on prior month or next month which ever is more beneficial to the bank.

Example:

Spot Rate	$1 = ₹ 85.80 / 85.81
1 Month forward	₹ 0.15 / 0.16
2 Month forward	₹ 0.21 / 0.23
3 Month forward	₹ 0.34 / 0.37

Transit Period is 20 days. Bill Submitted by Customer of 60 days for selling $

Solve: Calculation of Rate for Buying $ by Bank [i.e. Selling $ by Customer]

	2 month	3 month
Spot Rate	$1 = ₹ 85.80	₹ 85.80
Add: Premium	₹ 0.21	0.34
	$ 1 = ₹ 86.01	$ 1 = ₹ 86.14

Final rate for buying $ by bank would be $ 1 = ₹ 86.01 being more beneficial to the bank

3. If Annual App/ Dep% is given & we need to calc say 3mF rate then first convert Annual App/ Dep% to the required period of 3 months [eg 10% pa will become 2.5% for 3m] & then add/less such periodic App/ Dep% on spot rate to arrive at forward rate

4. If % App/ Dep is given on a currency in the Q then effect of such App/ Dep is actually given on the Other Currency to calc Forward Rates.

Eg. Spot $ 1 = ₹ 80

If Q says that $ is app by 10 % then add 10% to ₹ 80 (don't add 10% to $)

Fwd rate $ 1 = ₹ 80 + 10 %

i.e. $ 1 = ₹ 88

If Q says that ₹ is dep by 9.09 % then deduct 9.09% from $ (don't deduct from ₹)

Fwd rate $ 1 - 9.09% = ₹ 80

i.e. $ 0.9091 = ₹ 80

or ∴ $1 = ₹ 88 $\left[\frac{\$1 \times ₹ 80}{\$ 0.9091}\right]$

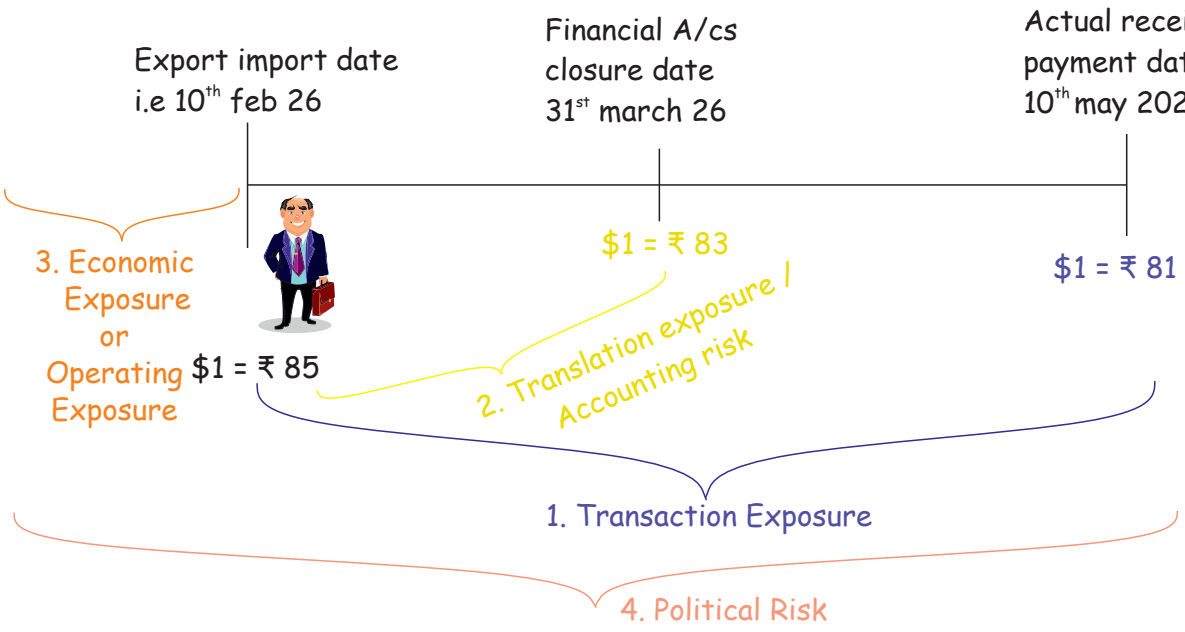
5. A General Note regarding mistake by ICAI in case of app/ dep% given

Say, $1 = ₹ 80
If ICAI says $ (LHS Currency) is appreciating by 10%, then $1 = ₹ 88
If ICAI says ₹ (RHS Currency) is depreciating by 10%, then ICAI assumes that ₹ depn = $app, hence they assume that $ is app by 10% and write the same answer $1 = ₹ 88 [Ideally it should be ₹ 88.88, but ICAI doesn't do so in many questions, specially in IFM chapter]

Conclusion: The Rule ICAI is following is (specially for IFM Chapter)
If %app is given on LHS Currency then add app% on RHS Currency value (this is conceptually correct)
If %app is given on RHS Currency then they assume that LHS Currency is dep by same% (which is conceptually incorrect, but ICAI does so) and now deduct dep% on RHS currency value.

Types of Risk

(4 Marks) Exam May 2025



1. Transaction Risk: Change in expected Cash flows arising between the Transaction date & Actual Cash flow Receipt/ Payment date due to an unexpected change in exchange rates.
2. Translation Exposure: arises due to translation of Foreign Currency assets or liabilities into the home currency.
3. Economic Exposure: refers to an extent to which economic value of a company can decline due to changes in exchange rate. Changes in exchange rates can impact firm's cost of input, prices of its outputs and its competitive position leading to a change in demand of product. Economic/ Operating exposure is calculated as Gain/ (Loss) due to Increase/ Decrease in demand at settlement date exchange rate.
4. Political Risk: when a country's government unexpectedly changes its policies e.g. trade barriers.

Note: If a company agrees to Forward Contract Rate which is less beneficial as compared to Today's Spot rate, then the difference between Forward Rate Vs. Spot Rate can also be termed as 'Probable Loss of Operating Profit' due to Transaction Exposure.

Techniques of Risk Management

Internal Hedging Techniques
- ✓ Do Nothing
- ✓ Home Currency Invoicing
- ✓ Leading & Lagging
- ✓ Exposure Netting
- ✓ Matching
- ✓ Price Variation
- ✓ Asset & Liability Matching

External Hedging Techniques
- ✓ Forward Contract
- ✓ Option Forward Exchange Rate Contract
- ✓ Money Market Hedging
- ✓ Currency Futures
- ✓ Currency Options

Do Nothing

It means not taking any kind of hedging cover on the assumption that movement in exchange rates will sometimes be adverse & sometimes favourable, offsetting each other over a period of time.

Home Currency Invoicing

It means resorting to generating/ receiving invoices in Home Currency. Eg. Indian firms start invoicing in ₹ terms.

Leading & Lagging

is a decision made by comparing Inflow/ Outflow under two situations:-

(i) If we Lead (pay / receive early) vs.

(ii) If we Lag (delay the payment / receipt)

Trick for comparison Bring outcome of both the alternative at the same point of time, say at the end of 3m or 6 months.

Format to solve: Below is the format from an importer's point of view

Particulars	(a) If lead	(b) If lag
Invoice amount due (in foreign currency)	$	$ ....
Less: Cash discount by supplier on early payment	($ ....)	-
Add: Interest Charge by supplier on delayed payment		+ $ ....
Total Amount Payable	$	$ ....
Exchange rate	Ex. rate on Lead date	Exch. rate on lag date
Outflow in ₹ terms ⚠ But these 2 outflows are on diff. dates hence not comparable	₹.. Outflow on lead date	₹.. Outflow on lag date
Add: Intt for diff no. of days b/w lead & lag date @ __%	₹.....	
Total outflow at the end	₹.....	₹.....

Whether to use @ Borrowing rate % or @ Investment rate% to add interest ?

Generally, we use Borrowing rate % for an Importer. However, if Q mentions that an importer is running Cash surplus then Inv. Rate % being opportunity cost is relevant

In case of an exporter, generally we use investment rate % However, if Q mentions that an exporter has Loan Outstanding then borrowing Rate % being intt. saved becomes relevant.

Exposure Netting

Exposure netting involves squaring-off Import exposure Vs. Export exposure & pay / receive only the net amount.

Two types of exposure netting

Bilateral Netting	Multilateral Netting
Two companies are involved	More than 2 companies (usually from the same group) are involved

Bilateral Netting

Eg. 1

TCS —has to pay $ 100000→ Microsoft

TCS ←has to receive $ 70000— Microsoft

Solve: After netting, TCS has to pay net $ 30000 to Microsoft

Eg. 2

TCS —has to pay $ 500000→ Microsoft

TCS ←has to receive ₹ 320 lakhs— Microsoft

Given, $ 1 = ₹ 80

Solve :

TCS has to pay	$ 500000
TCS has to receive	$ 400000
[₹ 320 lakhs / ₹ 80]	
Net amount TCS has to pay to Microsoft	$ 100000

Eg.3

TCS —has to pay $ 1.5 mn→ Microsoft

TCS ←has to receive ₹ 1800 lakhs— Microsoft

Given, $ 1 = ₹ 75

Solve :

TCS has to pay	$ 1500000
TCS has to receive	$ 2400000
[₹ 1800 lakhs / ₹ 75]	
Net amount TCS has to receive from Microsoft	$ 9,00,000

Since ₹ exposure > $ exposure, ∴ after netting - off, the net exposure must be expressed in ₹ terms so that net foreign currency exposure risk remains on same party who was having higher risk / exposure earlier.

Solve : TCS has to pay	₹ 1125 lakhs [$ 1.5 mn x ₹ 75]
TCS has to receive	₹ 1800 lakhs
Net amount TCS receives from Microsoft	₹ 675 lakhs

Eg. 4

TCS —(has to pay $ 200000)→ Microsoft

TCS has to receive ₹ 90 lakhs

Given, $ 1 = ₹ 78 - 80

In case of 2 way quotation , use mid rate so that savings of spread due to reduction in exposure accrues to both the parties

Solve: TCS has to pay $ 200000

TCS has to receive $ 113924 $\left[\frac{₹\ 90\ lakhs}{₹\ 79}\right]$

Net amount TCS has to pay to microsoft $ 86076

Calculation of benefit of exposure netting to both the parties when two-way quote is given

Trick to calc benefit from exposure netting

Develop two alternatives viz.

Alt1 : If exposure netting is done

Alt2 : If exposure netting is NOT done

Remember to express final benefit amount in home currency of respective company.

Calc of Net Benefit to TCS in Eg. 4

Particulars	Amount without exposure netting	Amount with exposure netting
TCS has to pay to microsoft	₹ 160 lakhs [$ 200000 x ₹ 80]	₹ 68.86 lakhs [$ 86076 x ₹ 80]
TCS has to receive from microsoft	₹ 90 lakhs	
Net amount paid	₹ 70 lakhs	₹ 68.86 lakhs

∴ Savings due to exposure netting = ₹ 1.14 lakhs

Calc of Net Benefit to Microsoft

Particulars	Amount without exposure netting	Amount with exposure netting
Microsoft has to receive	$ 200000	$ 86076
Microsoft has to pay	$ 115385 $\left[\frac{₹\ 90\ lakhs}{₹\ 78}\right]$	
Net amount received	$ 84615	$ 86076

∴ Benefit to Microsoft = $ 1461

Multilateral Netting

This process is generally adopted among two or more subsidiaries in the same group. Steps involved are:

Step 1: Decide a Common Currency. It would usually be headquarter's currency

Step 2: Convert all O/s exposure in a common currency as decided above & write in the Netting Matrix & solve it

Step 3: Summarize above Matrix & calculate Net Payment/ Receipt

Example A group of companies is controlled from the USA. This group has subsidiaries in UK, Euroland and Japan. For convenience, these are referred to as UK, EL and JP. As on 31st March, inter-company indebtedness stood as under:

Debtor	Creditor	Amount (in Million)
UK	EL	EL 240
UK	JP	¥12,000
JP	EL	EL 120
EL	UK	Sterling 75
EL	JP	¥12,000

US Headquarters follow the multi-lateral netting policy, and adopt the following exchange rates:
US $1 = € 0.90; Sterling 0.70; ¥ 120.

Compute and show net payments to be made by subsidiaries, after netting off.

Solve: Netting Matrix

Amount in $ millions

Receivable / Payables	UK	EL	JP	Total Payables
UK		266.67	100	366.67
EL	107.14		100	207.14
JP		133.33		133.33
Total Receivables	107.14	400	200	**707.14**

Conclusion Table

Amount in $ millions

Company	Total Payables	Total Receivables	Net Payables	Net Receivables
UK	366.67	107.14	259.53	-
EL	207.14	400	-	192.86
JP	133.33	200	-	66.67

Answer: UK pays $ 259.53 mn, EL receives $192.86 mn, JP receives $66.67 mn

Matching

Matching is a mechanism whereby a company matches its foreign currency inflows with its foreign currency outflows in respect of amount and approximate timing.

Natural matching-> Receipts in a particular currency are used to make payments in that same foreign currency thereby reducing the need for a group of companies to go through the foreign exchange markets to the unmatched portion of foreign currency cash flows.

Parallel matching -> in which the matching is achieved with receipt and payment in different currencies but these currencies are expected to move closely together, near enough in parallel.

Price Variation

Price variation involves increasing selling prices to counter the adverse effects of exchange rate change.

Asset and Liability Management

This technique can be used to manage balance sheet, income statement or cash flow exposures.

Aggressive postures -> the firm simply increases exposed cash inflows denominated in currencies expected to be strong or increases exposed cash outflows denominated in weak currencies.

Defensive postures-> matching cash inflows and outflows according to their currency of denomination, irrespective of whether they are in strong or weak currencies.

Forward Contract

Under forward contract, an importer/exporter agrees to buy/sell foreign currency on some specified future date at rates agreed upon today.

Ex- Ante Analysis

Today: $ 1 = ₹ 80 — Due date: 3mF $ 1 = ₹ 82

Exporter has to take a decision today

Receivable after 3 month

If hedging is done vs If hedging is NOT done

Estimated spot rate on due date

- if $ 1 = ₹ 81.5 → It is better to hedge i.e. enter into forward contract
- if $ 1 = ₹ 82.5 → It is better to stay unhedged. However, it is always recommended to enter into forward contract since it results in guaranteed outcome

Ex. Post analysis

Decision was already taken earlier. Now we have to comment on decision taken. Hence, Compare 3 mf vs actual spot rates on due date

Exporter

Compare 3mF $ 1 = ₹ 82 Vs. if Actual spot rate on due date

$ 1 = ₹ 80 ← → $ 1 = ₹ 85

Gain due to hedging = ₹ 2 per $ | Loss due to hedging = ₹ 3 per $

Standard Comment: In either case, decision to take Forward Cover was justified. This is so because decision was taken on some prior date when the actual spot rates on due date were not known. No CFO can predict with certainty as to what would be the exchange rate on some future date. Forward Cover provides one way protection & the justification of decision lies in that protection. It will be wrong to question the correctness of decision on hind-sight basis.

Option Forward Exchange Rate Contract

It is a kind of forward contract but with an added flexibility as far as execution date is concerned.

Suppose, Customer wants to enter into 3m to 5m option forward contract

Today — 3m — 4m — 5m

3mF $ 1 = ₹ 84 | 4mF $ 1 = ₹ 84.2 | 5mF $ 1 = ₹ 84.60

Banker

The banker will quote the worst rate [Worst rate means a rate which is worst for an importer/exporter & hence most beneficial for a banker]

Exporter — Rate quoted to Exporter will be $ 1 = ₹ 84

Importer — Rate quoted to Importer will be $ 1 = ₹ 84.60

Money Market Hedging

Underlying concept - "Asset - Liability Currency Matching" concept

Tesla Inc (an American firm's - investment in India)

Liab		Assets	
		Today $ 1 = 80	
Borrow in America	$ 1 billion	Investment in India	₹ 8000 crores
		After 1yr $ 1 = ₹ 100	
		Co. decides to windup India operations	
Borrow	$ 1 billion	Sale of Investment	₹ 8000 crores

on conversion we get $ 0.80 billion

Loss of $ 0.20 bn or $ 200 million due to Asset & Liab. currency mismatch

American firm could have saved itself from loss by borrowing in the same currency in which it is investing.

Steps	Action	Issue Involved	Case of Exporter	Case of Importer
1	Identify	Whether FC asset or liability?	Foreign Currency Asset	Foreign Currency liability
2	Create	Create appropriate position	Create a FC liability	Create a FC asset
3	Borrow	Money is required to be borrowed	Borrow in FC equivalent to PV of FC asset, discounted at FC borrowing rate. Note: Rate to be adjusted for the period of loan.	Borrow domestic currency, equivalent to PV of FC liability, discounted at the FC deposit rate. Note: Rate is to be adjusted for the period of deposit.
4	Convert	Convert borrowed money into the required currency	FC so borrowed will be converted into domestic currency at spot rate	Domestic currency into FC at the spot rate. Now importer has FC
5	Invest	Borrowed money will be invested	Invest the domestic currency to earn intt on domestic deposits	Invest FC as a deposit, carrying interest. Investment becomes an asset.
6	Future Value	Compute FV of liability/ asset	FV of domestic deposit	FV of DC Borrowing
7	Settle	Encash Asset & settle the liability	Receive from FC Customer & settle the FC liability	Receive maturity proceeds of FC asset & settle FC payables.

Example 1 Case of an Exporter

SBI

Intt. rate = 9% / 10% pa

Spot $1 = ₹ 80 - 81

Step 4 Convert borrowed amt @ spot rates

Step 1 identify whether FC asset or FC Liab ?

Virus Exporters

Receivable $ 100000 after 3 month

Bank of America

Intt. rate = 3% / 4% pa

Step 5 Invest

Amount Invested Today	₹ 7920800 [$99010 x ₹ 80]
Add. Intt @ 9 % pa for 3 m	178218 [₹ 7920800 x 9% pa x 3/12]

Step 2 Create - FC liab

Borrow $ 99010

Step 3 Calc amt to borrow $\left[\frac{\$100000}{1 + 0.04 \times 3/12}\right]$

Add: Intt on borrowing @ 4% pa for 3m	$990 [$ 99010 x 4% x3/12]
Amount payable after 3m	$100000

Step 6 Future value

Amount available under MMH ₹ 80,99,018

Vs.

Forward contract

3mf $ 1 = ₹ 80.40 - 80.80

Amount available under 3mf = ₹ 8040000

Step 7 Settle

Repay Loan using Export realizations at the end of 3m

Advice: Since inflow under MMH is more, therefore, Exporter should prefer MMH.

"Author has color coded the relevant rates with green color for better understanding. Same scheme has been adopted on all the next pages of this Booklet"

Example 2 : Case of an Importer

SBI

Intt. rate = 9% / 10% pa

Spot $1 = ₹ 80 - 81

Step 4 Convert borrowed amt @ spot rates

Step 1 identify whether FC asset or FC Liab ?

Virus Importers

Bank of America

Intt. rate = 3% / 4% pa

Step 3 Borrow

Amount to be borrowed	₹ 8039736 [$99256 x ₹ 81]
Add. Intt @ 10% pa for 3 m	200993 [₹ 8039702 x 10% pa x 3/12]

Payable $ 100000 after 3 month

Step 2 Create - FC Asset

Invest $ 99256 $\left[\frac{\$100000}{1 + 0.03 \times 3/12}\right]$

Step 5 Invest

Add: Intt @ 3% pa for 3m $744 [$99256 x 3% pa x 3/12]

Future Value of Investment at the end of 3m $100000

Step 6 Future value

Amount payable under MMH ₹ 82,40,729

Vs.

Forward contract

3mf $ 1 = ₹ 80.40 - 80.80

Amount payable under 3mf = ₹ 80,80,000

Step 7 Settle

Pay import obligation using investment realizations at the end of 3m

Advice: Since Outflow under forward cover is lesser, therefore, Importer should prefer hedging using forward contract

Currency Futures

	Currency Forward	Currency Futures
Place of contract	Bank	Stock exchange
Mode of settlement	By actual delivery	By price difference • If futures contract rate on due date is given then use it to square off your position • If futures contract rate on due date is not given then use spot rate on due date to square off your position.

Steps in hedging through Futures

1. Deciding on whether Futures Contracts should be bought or sold
   Rule of thumb:
   a. If you are going to Buy Spot $ on the due date, then Buy $ Futures today
   b. If you are going to Sell Spot $ on the due date, then Sell $ Futures today

2. Determining the number of contracts (this is necessary, since contract size is standardized)

$$= \frac{\text{Transaction Size}}{\text{Contract Size}} \text{ or } \frac{\text{Transaction Size}}{\text{Equivalent Contract Size}} \text{ (Prefer) or } \frac{\text{Equivalent Transaction Size}}{\text{Contract Size}}$$

   Use 'Agreed Rate' today under future contract for conversion to equivalent size

3. Closing out futures position and evaluating profit or loss on Futures transaction

4. Calculate Total Inflow/ Outflow [Actual Outcome in Spot +/- Gain/ (Loss) on Futures]
   Also incorporate Interest on Margin blocked (if any)

Example 1

SBI

Estimating target outcome

Today

Spot $ 1 = ₹ 80 - 80.80

Calculate actual outcome

After 3m

Spot $ 1 = ₹ 75 - 75.50

Step 4 Total inflow / outflow on due date

In spot [@ 3m Spot]	₹ 75,00,000 [$ 100000 x ₹ 75]
Add: Gain on futures	₹ 4,77,750
Total inflow at the end	₹ 79,77,750

Tutorial Note This amount is now comparable against outcome of other hedging tools such as Currency forward, MMH etc.

Receivable $ 100000 after 3 month

P/(L) in spot as if no hedging is done

= (₹ 75 - 80) x $100000

= ₹ 500000 Loss in spot

Hedge efficiency ratio (if specifically asked in Q)

$$= \frac{\text{Gain on futures contract}}{\text{Loss in spot against target outcome}}$$

$$= \frac{₹\ 477750}{₹\ 500000} \quad ₹\ 500000 = 95.55\%$$

Lot size = $ 35000

Step 1 Action on futures contract

Today

Sell 3mf $ 1 = ₹ 79.80 - 79.90

₹ Inflow

After 3m

Buy 3mf $ 1 = ₹ 75.10 - 75.25

₹ Outflow

Gain on futures contract per $ = ₹ 4.55

Step 2 No. of Future contract

Transaction size	$ 100000
Contract Size	$ 35000
No. of futures contract	2.86 ~ 3 contracts

Step 3 Closing out futures position & evaluating g/(l) on futures

Gain on futures contract ₹ 4,77,750[Gain ₹ 4.55 per [Gain ₹ 4.55 per $x $ 35000 x 3 contracts] x $ 35000 x 3 contracts]

Example. 2

Estimating target outcome

Today

Spot $ 1 = ₹ 80 - 80.80

Calculate actual outcome

After 3m

Spot $ 1 = ₹ 75 - 75.50

Step 4 Total inflow / outflow on due date

In spot [@ 3m Spot]	₹ 75,00,000 [$ 100000 x ₹ 75]
Add: Gain on futures	₹ 425250 [$ 5670 x ₹ 75]
Total inflow at the end	₹ 7925250

Tutorial Note This amount is now comparable against outcome of other hedging tools such as Currency forward, MMH etc.

Receivable $ 100000 after 3 month

P/(L) in spot as if no hedging is done

= (₹ 75 - 80) x $100000

= ₹ 500000 Loss in spot

Hedge efficiency ratio

$$= \frac{\text{Gain on futures contract}}{\text{Loss in spot against target outcome}}$$

$$= \frac{425250}{500000} \times 100000 = 85.05\%$$

Lot size = ₹ 100000

Step 1 Action on futures contract

Today

Buy 3mf ₹ 1 = $ 0.0123 - 0.0124

$ Outflow

After 3m

Sell 3mf ₹ 1 = $ 0.0131 - 0.0132

$ Inflow

Gain on futures contract per ₹ 1 = $ 0.0007

Step 2 No. of contract

Transaction size	$ 100000
Contract Size	₹ 100000
Agreed futures price today	₹ 1 = $ 0.0124
Equivalent contract size contract size	$ 1240
No. of futures contract	80.65 ~ 81 contracts [$ 100000/ $ 1240]

Step 3 Closing out futures position & evaluating g/(l) on futures

Gain on futures contract $ 5670[Gain $ 0.0007 p

[Gain $ 0.0007 per ₹ 1 x ₹ 100000 x 81 contracts]

x ₹ 100000 x 81 contracts]

Currency Options

Currency Futures	Vs.	Currency Option
(1) No premium amount is payable		Premium is to be paid upfront and is non-refundable.
(2) It is settled compulsorily on due date irrespective of whether we are making gain or loss.		we have an option whether we want to exercise / lapse
		If spot rate is more beneficial than agreed under the options contract (i.e. Exercise Price) then Lapse the options contract & Convert your exposure at spot rate on due date.
		If spot rate is Less beneficial then Exercise the options contract.
(3) Futures contract are settled by price difference		Option contract are settled by actual delivery not by price difference (In forex chapter while hedging)

Steps under Hedging using Options Contract

1 Decide on Buy Call or Buy Put options (i.e. whether to buy or sell a currency)

In Forex chapter while hedging generally Buy an Option [call/put]. We don't sell an option because we need protection which we generally get by Buying Option.

Now how to decide whether Buy call or Buy put ?

	If $ Denominated Option Contract	If ₹ Denominated Option contract
Exporter	Need 'Right to sell' $ Buy $ denominated put option	Need 'Right to Buy' ₹ Buy ₹ denominated call option
Importer	Need 'Right to Buy' $ Buy $ denominated call option	Need 'Right to Sell' ₹ Buy ₹ denominated put option

2 Select an acceptable exercise price

Lucky you ! Since it is a subjective matter therefore it will be given by ICAI itself.

3 Determine the number of contracts

Formulas

$$= \frac{\text{Transaction Size}}{\text{Contract Size}} \quad \text{or} \quad \frac{\text{Transaction Size}}{\text{Equivalent Contract Size}}$$

If both Transaction size & contracts size are in same currency

If both Transaction size & contract size are not in same currency. Then convert Contract size to Equivalent Contract size at agreed rate under the options contract i.e. exercise price.

4 Enter into above calculated no. of contracts & pay the premium

5 On maturity,
(i) if market rate is less favourable than rate under options contract, exercise your Option contract, and
(ii) if market rate is more favourable than rate under options contract, ignore the contract and buy or sell in the market

Exam Tip

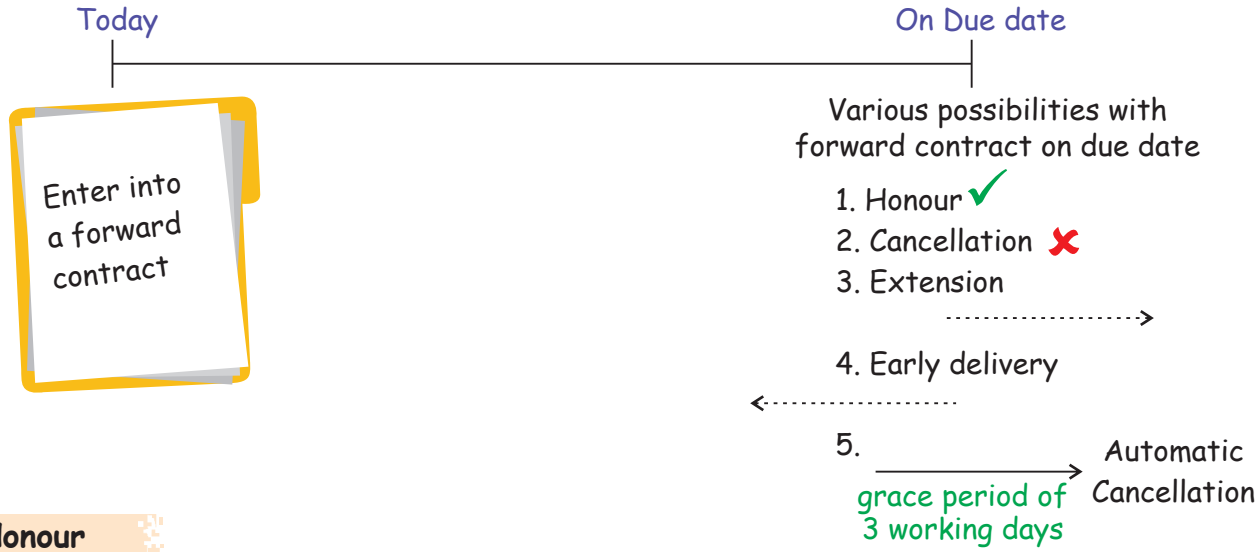
1. Remember to Add Interest on Option Premium Amount because Option Premium is paid today whereas Maturity amount occur on due dates.
2. If Q doesn't give spot rate on maturity date then default assumption is to Exercise the Options Contract (in Forex Chapter).
3. If Range of Expected Price on Maturity Date is given in Q, then compare strike Price with each expected price individually & calculate Payment accordingly.
4. Whether interest rate is pa. or for the corresponding period

6 month Libor is 2% Vs. Libor for 6 month period is 2 %
is ↓ interpreted as — is ↓ interpreted as
i.e. 2% p.a. — 2% for 6 months
i.e. 4% pa

Fate of Forward Contract

This topic is better understood from the point of view of a Banker.
Hence imagine yourself to be a Banker

A forward contract once entered into b/w bank & exporter / importer can face any of the below 5 situations : -



Honour

means to execute the forward contract on due date at agreed price.
Nothing special ! Simply meet your obligations @ Agreed Rates.

Cancellation of Forward Contract

Relevant Rates (Bid or ask) here have been shown in green & red color

Interbank Market

Interbank Rate: 3mF $1 = ₹ 84.25 - 84.30
Banker agrees to sell $

Spot rate on due date = $1 = ₹ 85.50 - 85.60
Not relevant for calculation of amount recoverable

Margin = 25 paisa

SBI

Today — Due date

On cancellation, Banker enters into opposite action with the customer

Merchant bank Rate: Banker agrees to buy $ 3mf $ 1 = ₹ 84.00 - 84.55

Banker sells $ to square - off position
Spot rate $1 = ₹ 85.25 - 85.85
on due dt

Customer requests cancellation

Exporter
$ 50000 Receivable

Exporter

Original action: Buy 3mf $1 = ₹ 84
Opposite action: Sell spot $1 = ₹ 85.85
Exchange Difference = ₹ 1.85 per $
Total Amount recoverable by Bank from customer
Bank from customer ₹ 92,500

Conclusion: Simply enter into opposite action with the customer at merchant bank rates.

- ✓ If it results in gain then recover amount from the customer.
- ✓ If it results in loss then pay to the customer.

If cancellation on due date - Take opposite action @ spot rates on due dt.
If cancellation before due date - Take opposite action @ remaining months forward contract rate

Extension of Forward Contract

it can be decomposed into 2 parts

(1) Cancellation of original contract (as per concepts taught in case of cancellation)
(2) Entering into a fresh forward contract with new maturity date

Early Delivery

Interbank Rate: 3mF $1 = ₹ 84.25 - 84.30
Banker agrees to sell $

Swap Difference = ₹ 55,000
Buy 1mf $1 = ₹ 84.65 - 84.70 to square-off original contract
Sell spot $1 = ₹ 84.15 - 84.25 to dispose-off $ recd early

Bank sells $ in spot
Bank receives ₹ 84,15,000 from interbank

Margin = 25 paisa
SBI

Today
Early delivery
Due date 3m later
2 months

Merchant bank Rate: Banker agrees to buy $ 3mf $ 1 = ₹ 84.00 - 84.55

$
Early delivery of $ to bank by Exporter
Exporter receives ₹ 84,00,000 [@ Originally agreed rates]
₹

Exporter
$ 100000 Receivable after 3m

Customer requests early delivery

Exporter

Exam Presentation

Calc of Swap Difference

Buy 1mF $1	= ₹ 84.70Sell Spot $1
Sell Spot $1	= ₹ 84.15Swap Difference
Swap Difference	= ₹ 0.55Contract
Contract	$1,00,000Total Swap Difference
Total Swap Difference	₹ 55000 recoverable

Calc of interest to be paid / recovered

Amt recd. from interbank = ₹ 84.15	₹ 8415000
Less: Amt paid to customer = ₹ 0.55	₹ 8400000
$1,00,000 Net inflow	₹ 15000
Interest @ say 9% pa for 1m	₹ 112.50

Banker pays to customer

Answer : Banker will receive ₹ 54887.50 [₹ 55000 Recover - ₹ 112.50 pay] from the customer as early delivery charges. Net amount Exporter receives = ₹ 83,45,112.5 [8400000 - 54887.5]

Automatic Cancellation

Interbank Rate: 3mF $1 = ₹ 84.25 - 84.30
Banker agrees to sell $

Swap Difference = ₹ 55,000
Buy Spot $1 = ₹ 84.65 - 84.70
Sell Forward $1 = ₹ 84.15 - 84.25

Interbank
Exch rate $1=₹__
on due date+3d
Not relevant for our purpose

- Bank Buys $ in spot & delivers $ to honour interbank original forward contract original forward contract
- Bank sells Fwd to continue the cover

Margin = 25 paisa
SBI

Today — Due Date — 3 months

Due date +3days grace

Merchant bank Rate:
Banker agrees to buy $
3mf $ 1 = ₹ 84.00 - 84.55

Banker sells $
Spot rate $1 = ₹ 85.25 - 85.70
on due dt+3 days

Original action: Buy 3mf $1 = ₹ 84.00
Opposite action: Sell spot $1 = ₹ 85.70
Exchange Difference = ₹ 1.70 per $
Amount recoverable by Bank from customer
Bank from customer ₹ 1,70,000

Exporter
$ 100000 Receivable after 3m

Exporter

Exam Presentation

Calc of Exchange Difference
Buy 3mF $1 = ₹ 84
Sell Spot $1 = ₹ 85.70
Exchange Diff = ₹ 1.70 Contract
Contract $1,00,000 Total Exchange
Total Exchange Diff ₹ 1,70,000 recoverable

Calc of Swap Difference
Buy Spot $1 = ₹ 84.70
Sell Fwd $1 = ₹ 84.15
Swap Diff = ₹ 0.55 Contract
Contract $1,00,000 Total Swap Diff
Total Swap Diff ₹ 55000 recoverable

Calc of interest to be recovered
Amt recd. from IB ₹ 8425000
Less: Amt paid to IB ₹ 8470000
Net outflow ₹ 45000 Intt @say 12%pa for 3days ₹ 44
Banker recovers from customer

Answer : Banker will receive ₹ 2,25,044 from the customer as automatic cancellation charges.

Fate of Forward Master Chart

Cancellation

Simple enter into opposite action with the customer at merchant bank rates i.e. bank will recover / pay the Exchange difference

1. Cancellation on due date
   Use merchant Banks spot rates on due date
2. Cancellation before due date
   Use remaining months merchant Bank forward rates

If above process results into gain to the banker - Recover from the customer

If above process results into loss to the Banker - Pay to the customer

Extension

It is simply a case of "Cancellation of original contract
+
entering into a new forward contract for the extended period"

Early Delivery

Banker will Recover/ pay the following amounts:

1. Swap difference*
2. Interest on Outflow/ Inflow of funds**

'*Swap difference' means the two opposite actions between bank & interbank entered into on the same date (in the present case on early delivery date)

It means banker will either:-
Buy forward & sell in Spot or
Sell Forward & buy in Spot

**It is interest for the remaining period on the net difference between 2 real cash transactions

Automatic Cancellation

If customer doesn't honour /cancel /extend the forward contact until the due date then banker grants grace period of 3 working days. If Customer still doesn't honour the contract then bank initiates automatic cancellation procedure & will recover (doesn't pay) the following amounts:-

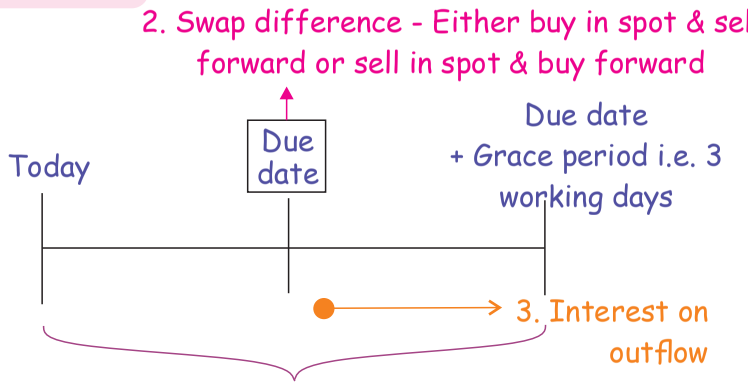
1. Exchange difference
2. Swap difference.
3. Interest on Outflow /inflow of funds

1. In all the above 4 cases, Banker may also recover some flat charges (say ₹ 100).
2. If Customer approaches Bank for Cancellation/ Delivery/ Extension after due date, still all the charges under Automatic Cancellation will be recovered.
3. If in Q. Contracted rate or booked rate is given, then it is obviously a merchant rate (already inclusive of exchange margin%)
4. Interpretation of different Types of of Rates given in Q

Example: On 10th September, following Rates are quoted

Spot	$1 = ₹ 82/82.50	← means Spot Rate for 10th Sep
Spot/Sep	$1 = ₹82.25/82.70	← means Forward Rate for Any Other Day of Sep
Spot/Oct	$1 = ₹82.60/82.75	← means Forward Rate for Any Day of Oct

Automatic Cancellation Summary Diagram



Arbitrage Opportunities

Step 1: Calc Fair Forward Price

Step 2: If Actual Forward Price, ≠ Fair forward price, then arbitrage opportunity exists

1. Interest rate parity theorem
2. Purchasing power parity theorem or Inflation rate parity theorem
3. International Fisher Effect

Interest rate parity theorem

Spot rate $ 1 = ₹ 80

Intt rate @8% pa	
Invest	₹ 80
Add. Intt @8% pa	₹ 6.4
Total receivable	₹ 86.4

Intt rate 4% pa	
Borrow	$ 1
Add: Intt @ 4% pa	$ 0.04
Total payable	$ 1.04

In order to break-even, ₹ 86.4 must be convertible into $1.04

∴ per $ exchange rate after 1 year should be $\frac{₹\ 86.4}{\$\ 1.04}$ = ₹ 83.08

i.e. 1 year fair forward rate = ₹ 83.08

Shortcut formulas for exam

For direct quote

$$\frac{1 + rh_{(₹)}}{1 + rf_{(\$)}} = \frac{F_1}{S_0}$$

$$\frac{1 + 0.08}{1 + 0.04} = \frac{F_1}{80}$$

∴ F_1 = ₹ 83.08

For indirect quote

$$\frac{1 + rh}{1 + rf} = \frac{S_0}{F_1}$$

$$\frac{1 + 0.04}{1 + 0.08} = \frac{80}{F_1}$$

∴ F_1 = ₹ 83.08

1. Some students mistakenly always apply first formula without checking whether given quote is direct quote or indirect quote. In Exams, first check whether it is a direct quote or an indirect quote & apply the correct formula.
2. Both rh & rf period must be equal to the period of Forward Contract

here, Rh means rate of Intt in Home Country
Rf means rate of Intt in Foreign Country
$E(S_1)$ may be used in place of F1 in case of Uncovered Intt Rate Parity

Exam Tip: If one of the country is India then you are always based in India. If Q doesn't have India & Q is silent about which Country you are based in, then assume yourself to be in such a country from where given quotation' appears to be a direct quote. Eg. £ 1 = € .... is given then assume your home country as Europe.

If actual forward rate ≠ fair forward rate then it will give rise to arbitrage opportunities

How to identify direction of arbitrage [ie. from which country to borrow & in which country to invest]

As done by ICAI -

Comparison of difference b/w Interest rate differential = Exchange rate differential

Both rh & rf must be for the same period as the period of forward contract

rh - rf = % Prem/ (disc) on LHS currency based on actual forward rates & spot rates

Derivation

$$\frac{1 + rh}{1 + rf} = \frac{F_1}{S_0}$$

Subtracting 1 from both the sides

$$\frac{1 + rh}{1 + rf} - 1 = \frac{F_1}{S_0} - 1$$

← This is Actual Forward Rate (NOT fair forward rate)

$$\frac{1 + rh - 1 - rf}{1 + rf} = \frac{F_1 - S_0}{S_0}$$

$$\frac{rh - rf}{1 + rf} = \%\ \text{App / (dep) on LHS currency}$$

Ignored as it doesn't have a big effect

Q Evaluate arbitrage opportunities if actual forward rate is $ 1 = ₹ 82

Solve:

rh-rf	=	% app/(dep) on LHS currency
i.e. intt rate differential		i.e. exchange rate differential
8% - 4%	=	$\frac{82 - 80}{80}$
+4%	≠	+2.5%

Since Exchange rate differential < Intt Rate Differential, therefore, an arbitrageur should Borrow in $ & invest in ₹ to earn risk free arbitrage gain.

Trick to know correct direction of arbitrage

Use Trial & Error method — Simply assume Borrowing some amount from any one of the country & invest in other country. Now run the arbitrage on calculator.

- ✓ If it results in gain then above direction is correct.
- ✓ If it results in loss then opposite direction is correct.

Steps in Arbitrage

1 Step 1: Borrow in country from where money should flow out

Borrow $ 100000 *

Exam Tip

*Default assumption by ICAI is to borrow 100000 or 1mn (10,00,000) units of the currency in which borrowing is done.

2 Step 2: Convert at spot rate

Spot rate $ 1 = ₹ 80

Converted amount = ₹ 80 x $ 100000

= ₹ 80,00,000

3 Step 3: Invest in converted currency

Invest ₹ 80 lakhs @ 8% pa for 1 year

4 Step 4: Enter into forward contract

Enter into 1 year forward contract @ $1 = ₹ 82

This Step 4 is reqd only if wish to enter into Covered Intt rate Arbitrage

5 Step 5: FV of investment

Investment	₹ 80 lakhs
Add: Interest@ 8 %pa for 1 yr.	₹ 6.4 lakhs
	₹ 86.4 lakhs

6 Step 6: Reconvert above proceeds at agreed forward rates

= $\frac{₹ 86,40,000}{₹ 82}$ = $ 105366

7 Step 7: Future value of borrowing & its re payment

Amt borrowed	$ 100000
Add. Intt @4% pa for 1 yr.	$ 4000
Amount to repay	$ 104000

8 Step 8: Count arbitrage gain

= $ 105366 - $ 104000

= $ 1366 or ₹ 112012 [$ 1366 x ₹ 82]

Note: If not already in home currency terms then above gain in your home currency terms

Overlapping Exchange Rates / Two-Point Arbitrage / Geographical Arbitrage

HDFC Bank

$1 = ₹ 83.40 - 83.80

SBI

$1 = ₹ 83.25 - 83.70

Oh wow! Exchange Rates are different between HDFC bank & SBI. Let's Arbitrage.....

So Sorry ! there's NO Arbitrage opportunity between HDFC bank and SBI

ICICI Bank

$1 = ₹ 84.50 - 84.55

But Yes! Arbitrage Opp exists now between SBI & ICICI !

Despite different Exchange rates being quoted by various Banks still these rates are so arranged that

BID Rates of All the Banks < Lowest Ask Rate

Ask Rates of All the Banks > Highest of the Bid Rate

In other words, Highest Bid Rate < Lowest Ask Rate

If it is NOT so then only Arbitrage opportunities exists !

Exchange rates of various bank

SBI	$1 = ₹	82.50 -	83.40
ICICI	$1 = ₹	82.40 -	83.20
HDFC	$1 = ₹	83.10 -	83.70
Axis	$1 = ₹	82.75 -	83.55
Canara	$1 = ₹	82.90 -	83.35

No arbitrage opportunity exits

Steps in Arbitrage

1. Find Lowest Ask Rate among all the Banks quotations.
2. Find Highest Bid Rate among all the Quotations.
3. Check whether
   Highest Bid Rate < Lowest Ask Rate
   if so then Arbitrage Opportunity doesn't exist .
   if not so then Buy LHS currency @ Lowest Ask Rate & Sell LHS Currency @ Highest Bid Rate .

Triangular Arbitrage / Three Point Arbitrage / Cross Currency Arbitrage

Eg 1: One - way Quote

£1 = ₹ 70

£1 = $ 1.20 $1 = ₹ 60

Identify Triangular Arbitrage Opp ?

Solve :

Step 1 : Pick any two quotations & calc cross currency rate. Cross Currency rate so calculated will be comparable with the third quotation

£1 = ₹ 70 & £1 = $ 1.20

$$\frac{₹}{\$} = \frac{₹}{£} \times \frac{£}{\$}$$

$$= 70 \times \frac{1}{1.20} = 58.33 \text{ i.e. } \$1 = ₹ 58.33$$

Step 2: Compare both the quotations

Cross Currency Quotation i.e. $1 = ₹ 58.33 ≠ Actual Quotation given in the Q i.e. $1 = ₹60

therefore, Arbitrage Opp exists !

Step 3: Determine Arbitrage path/direction.

An arbitrageur should follow below path to earn risk-free arbitrage gain

$ → ₹ → £ → $

$ → ₹ → £ → $

How did we identified the direction ?

Simply compare, Actual Quotation $1 = ₹ 60 vs Cross Quotation $1 = ₹ 58.33

Now think under which Quotation it is beneficial to convert $ to ₹. सोचो सोचो !

In our case actual quotation rates are more beneficial

$ → ₹

Now move ahead to a different currency & there is no looking back.

Step 4: Run the Arbitrage process.

Proof of Arbitrage : Let us assume that we start with ₹ 100000		
Convert ₹ to £	@ £1 = ₹ 70 [₹ 100000/₹ 70]	£ 1428.57
Convert £ to $	@ £1 = $1.20 [₹ 1428.57 x $1.2]	$ 1714.29
Convert $ to ₹	@ $1 = ₹ 60 [₹ 1714.29 x ₹ 60]	₹ 102857

Ans : Net Arbitrage Gain is ₹ 2857 per ₹ 100000 transacted.

Eg 2: Two - way Quote

£1 = ₹74 - 76

£1 = $1.20 - 1.25 $1 = ₹ 60 - 63

Tutorial Note: If Interbank Quote & Margin % are given then first calc Merchant bank rates for all the Quotations and then apply cross currency & arbitrage concept. This is so because we are a customer and every quotation that we will face while taking arbitrage action will be a Merchant quote

Solve:

Step 1: Pick any of the two Quotations & Calc Cross Currency Rates. Cross currency rate so calculate will be comparable to the third quotation

£1 = ₹ 74 - 76

£1 = $ 1.20 - 1.25

$$\text{Bid}\left(\frac{₹}{\$}\right) = \text{Bid}\left(\frac{₹}{£}\right) \times \text{Bid}\left(\frac{£}{\$}\right)$$

$$= 74 \times \frac{1}{1.25}$$

$$= 59.20$$

$$\text{Ask}\left(\frac{₹}{\$}\right) = \text{Ask}\left(\frac{₹}{£}\right) \times \text{Ask}\left(\frac{£}{\$}\right)$$

$$= 76 \times \frac{1}{1.20}$$

$$= 63.33$$

∴ Cross Currency Quotation is $1 = ₹ 59.20 - 63.33

Step 2: Comparing both the quotations

Don't make the mistake of comparing Bid with Bid & Ask with Ask

Correct Concept: Apply concept of Overlapping Exchange Rate & compare your cross currency quotation vs 3rd actual quotation

Cross $1 = ₹ 59.20 - 63.33

Actual $1 = ₹ 60 - 63

Step (a) Lowest of Ask Rate $1 = ₹ 63

Step (b) Highest of Bid Rate $1 = ₹ 60

Step (c) Check Arbitrage Opp

Since Highest Bid Rate < Lowest Ask Rate, ∴ no triangular arbitrage opp exists.

(i.e. ₹ 60) (i.e. ₹ 63)

Q What if in above Eg Actual 3rd Quotation is $1 = ₹ 64 - 65 (instead of $1=60-63)

Step 1: Same as above

Cross $1 = ₹ 59.20 - 63.33

Actual $1 = ₹ 64 - 65

Step 2: (a) Lowest Ask rate $1 = ₹ 63.33

(b) Highest Bid Rate $1 = ₹ 64

(c) Since bid rate ₹ 64 > ask rate ₹ 63.33, Therefore arbitrage opportunity exits

Step 3: Direction of Arbitrage

₹ → £ → $ → ₹

Step 4: Run the arbitrage process

Let's assume we have ₹ 100000

Convert ₹ to £	₹ 100000 / ₹ 76	£ 1315.79
Convert £ to $	£ 1315.79 x $ 1.20	$ 1578.95
Convert $ to ₹	$ 1578.95 x ₹ 64	₹ 101052.63

Ans: Net Arbitrage Gain is ₹ 1052.63 per ₹ 100000 transacted.

Purchasing Power Parity Theorem (PPPT) or Inflation Rate Parity Theorem / or Constant Prices Parity Theorem

Absolute form | Relative form

Absolute form aka Law of one Price

According to law of One Price. a single commodity must have same price across the world.

If No Transportation Cost & No Taxes

$$\text{Spot}\left(\frac{₹}{\$}\right) = \frac{P_D}{P_F}$$

here, P_D means Price level in domestic country
P_F means Price level in Foreign country

Eg. One Parker Pen in India is selling @₹1300 & in America @ $15 then Fair Spot Rates should be:-

$$= \frac{₹\ 1300}{\$\ 15} = ₹\ 86.67 \text{ per } \$$$

If Transportation Cost & Taxes Exist

$$\text{Spot}\left(\frac{₹}{\$}\right) = \alpha \times \frac{P_D}{P_F}$$

here, α means Sectoral Constant

Sectoral Constant is used to adjust the difference in price-levels due to existence of Transportation cost & Taxes.

Let us assume the Parker Pen that sells for $15 in America involves a transportation cost of ₹ 25 & Taxes of ₹ 75 after which it sells for ₹ 1300 in India

$$\alpha \text{ i.e. Sectoral Constant} = \frac{₹\ 1200}{₹\ 1300} = 0.923$$

(₹ 1200 ← Price in India Excl. Taxes & Transportation.)

$$\therefore \text{Spot}\left(\frac{₹}{\$}\right) = 0.923 \times \frac{₹\ 1300}{\$\ 15} = ₹\ 80$$

Relative form {it is just like Interest Rate Parity Theorem}

Spot rate $ 1 = ₹ 80

Inflation rate @ 8% pa		1 Parker Pen Price	Inflation rate @ 2% pa	
Today, 1 Pen =	₹ 1200		Today, 1 Pen =	$ 15
Inflation Rate	8%		Inflation Rate	2%
1 Year later	₹ 1296		1 Year later	$ 15.30

Ideally, ₹ 1296 must be convertible into $ 15.30 so as to discourage arbitrage i.e. 1 year fair forward rate $1 = ₹ 84.71

Direct Quote	Indirect Quote
$\frac{1+Ih}{1+If} = \frac{F_1}{S_0}$	$\frac{1+Ih}{1+If} = \frac{S_0}{F_1}$

here, Ih means Infl. Rate in Home
If means Infl. Rate in foreign

Note: We can write I_D in place of Ih
We can use $E(S_1)$ in place of F_1 & there by use these formulas to calc Estimated spot rates instead of forward rates.

International Fisher Effect

Nominal Interest Rates contains (i) a real rate of return and (ii) anticipated Inflation. If investors across all countries require same real return, the nominal interest rate differentials between any two countries may be the result of differential in expected inflation rates only.

Basic Concept

$$(1 + \text{Nominal Interest Rate}) = (1 + \text{Inflation Rate})(1 + \text{Real Intt Rate})$$

$$1.07 = 1.05\,(1 + \text{Real Intt})$$

$$\therefore \text{Real Intt Rate} = 1.905\% \sim 1.91\%$$

Proof of International Fisher Effect

$$\frac{(1 + rh)}{(1 + rf)} = \frac{(1 + Ih)\,(1 + RRh)}{(1 + If)\,(1 + RRf)}$$

Since Real interest rate across the world will be same hence

$$\frac{(1 + rh)}{(1 + rf)} = \frac{(1 + Ih)}{(1 + If)}$$

it can now be observed that Differences in Interest Rates between any two countries is purely because of differences in Inflation Rates

Nostro, Vostro & Loro Account

NOSTRO	VOSTRO	LORO ACCOUNT
"Our Account With you"	"Your Account With us"	"Their Account with them"
Eg. SBI's A/c with Bank of America	Eg. BOA's A/c with SBI	Eg. ICICI Bank 's A/c with BOA

Accounting in Nostro A/c

Transaction	Purchase	Sell	Receipt	Payment
	Exchange Position {It is just like Accrual A/c}		Cash Position {It is just like Receipt & Pymnt A/c}	
1. Spot Purchase	Purchase		Receipt	
2. Spot Sell		Sell		Payment
3. Forward Purchase	Purchase		-	-
4. Execution of forward Purchase	-	-	Receipt	
5. Forward Sale	-	Sell	-	-
6. Execution of Forward Sale	-	-	-	Payment
7. DD (Demand Draft) Purchased	Purchase	-	-	-
8. Purchased DD sent for realization	-	-	Receipt	-
9. DD Issued	-	Sell	-	-
10. DD Honoured	-	-	-	Payment
11. DD Cancelled	Purchase	-	-	-
12. Purchase of Export Bill	Purchase	-	-	-
13. Honour / Realization of Export Bill	-	-	Receipt	-
14. Remitted by TT	-	Sell	-	Payment

1. If Open Position Overbought is given then write Op Bal of Exchange position on 'Net Purchases' side.
2. If Balance in Nostro A/c Credit is given then write Op Bal of Cash position on 'Net Receipts' side
3. If Q gives some requirement to maintain some Closing balances then -
   - To maintain credit balance in Nostro A/c - An appropriate amt should be Purchase/Sell in Spot. [Important: Remember to give effect of your Spot Action in Exchange position as well]
   - To maintain Overbought position - An appropriate amt should be Purchase/ Sell in Forward.

Question 1

Study Material, Practice Manual, Exam May 2005(Similar), MTP Apr 2024

On January 28, 2020 an importer customer requested a Bank to remit Singapore Dollar (SGD) 25,00,000 under an irrevocable LC. However due to Bank strikes, the Bank could effect the remittance only on February 4, 2020. The inter Bank market rates were as follows:-

	Jan 28	Feb 4
USD 1	INR 45.85 / 45.90	45.91 / 45.97
London Pound 1	USD 1.7840 / 1.7850	1.7765 / 1.7775
London Pound 1	SGD 3.1575 / 3.1590	3.1380 / 3.1390

The Bank wishes to retain an exchange margin of 0.125%. How much does the customer stand to gain or lose due to the delay? (Calculate rate in multiples of 0.0001)

Solution: The importer requested to remit SGD 25 lakhs therefore we have to consider sell rate for the bank:

On January 28, 2020 the rates are

US $	₹ 45.90
Pound 1	US $ 1.7850
Pound 1	SGD 3.1575
Therefore, SGD 1	₹ 45.90 x 1.7850 / SGD 3.1575
SGD 1	₹ 25.9482
Add: Exchange margin (0.125%)	₹ 0.0324
	₹ 25.9806

On February 4, 2020 the rates are

US $	₹ 45.97
Pound 1	US $ 1.7775
Pound 1	SGD 3.1380
Therefore, SGD 1	₹ 45.97 x 1.7775 / SGD 3.1380
SGD 1	₹ 26.0394
Add: Exchange margin (0.125%)	₹ 0.0325
	₹ 26.0719

Hence, loss to the importer

= SGD 25,00,000 (₹ 26.0719 - ₹ 25.9806) = ₹ 2,28,250

Question 2

Study Material

An importer customer of your bank wishes to book a forward contract with your bank on 3rd September for sale to him of SGD 5,00,000 to be delivered on 30th October.

The spot rates on 3rd September are USD/INR 49.3700/3800 and USD/SGD 1.7058/68. The swap points are:

USD/₹		USD/SGD	
Spot/ September	0300/0400	1st month forward	48/49
Spot/ October	1100/1300	2nd month forward	96/97
Spot/ November	1900/2200	3rd month forward	138/140
Spot/ December	2700/3100		
Spot/ January	3500/4000		

Calculate the rate to be quoted to the importer by assuming an exchange margin of 5 paisa.

Solution:

USD/ ₹ on 3rd September	49.3800
Swap Point for October	0.1300
	49.5100
USD/ SGD on 3rd September	1.7058
Swap Point for 2nd month Forward	0.0096
	1.7154
SGD/ ₹ (49.5100/ 1.7154)	28.8621
Add: Exchange Margin	0.0500
	28.9121

Thus, Cross Rate for SGD/ ₹ of 30th October shall be = ₹ 28.9121

Question 3 Study Material

You have following quotes from Bank A and Bank B:

	Bank A	Bank B
SPOT 3 months 6 months	USD / CHF 1.4650/55 5/10 10/15	USD/ CHF 1.4653/60
SPOT 3 months 6 months	GBP / USD 1.7645 / 60 25/20 35/25	GBP / USD 1.7640/50

Calculate:

a. How much minimum CHF amount you have to pay for 1 million GBP spot?

b. Considering the quotes from Bank A only, for GBP/CHF what are the Implied Swap points for Spot over 3 months?

Tutorial Note: It has been intrepretated that "/" is not to be read as "per" in this Q due to practical interpretation of rates b/w GBP & USD

Solution: Given

	Bank A	Bank B
Spot :	1USD = CHF 1.4650 - 1.4655	1USD = CHF 1.4659 - 1.4660
	1 GBP = USD 1.7654 - 1.7660	1 GBP = USD 1.7640 - 1.7650

(i) To Buy 1 Million GBP Spot against CHF

1. First to Buy USD against CHF at the cheaper rate i.e. from Bank A.
   1 USD = CHF 1.4655
2. Then to Buy GBP against USD at a cheaper rate i.e. from Bank B
   1 GBP= USD 1.7650

By applying chain rule, Buying rate would be

$$\text{Ask}\left(\frac{\text{CHF}}{\text{GBP}}\right) = \text{Bank A's Ask}\left(\frac{\text{CHF}}{\text{USD}}\right) \times \text{Bank B's Ask}\left(\frac{\text{USD}}{\text{GBP}}\right) = 1.4655 \times 1.7650 = 2.5866$$

Minimum CHF reqd. to get 1 mn GBP = 2.5866 CHF per GBP x 1mn GBP
= CHF 2.5866 mn or CHF 25,86,600

(ii) Spot Rates

$$\text{Bid}\left(\frac{CHF}{GBP}\right) = \text{Bid}\left(\frac{CHF}{USD}\right) \times \text{Bid}\left(\frac{USD}{GBP}\right)$$

$$= 1.4650 \times 1.7645$$

$$= 2.5850$$

$$\text{Ask}\left(\frac{CHF}{GBP}\right) = \text{Ask}\left(\frac{CHF}{USD}\right) \times \text{Ask}\left(\frac{USD}{GBP}\right)$$

$$= 1.4655 \times 1.7660$$

$$= 2.5881$$

Spot 1 GBP = CHF 2.5850 - 2.5881

3m Forward

$$\text{Bid}\left(\frac{CHF}{GBP}\right) = 1.4655 \times 1.7620$$

$$= 2.5822$$

$$\text{Ask}\left(\frac{CHF}{GBP}\right) = 1.4655 \times 1.7620$$

$$= 2.5869$$

3mf 1 GBP = CHF 2.5822 - 2.5869

Calculation of Implied Swap Points

3mf 1 GBP =	CHF	2.5822	-	2.5869
Spot 1 GBP =	CHF	2.5850	-	2.5881
3m Swap Point		28	-	12

Therefore, 3 month swap points are at discount of 28/12.

Question 4 Study Material, (8 Marks) MTP Oct 2019

Your forex dealer had entered into a cross currency deal and had sold US $ 10,00,000 against EURO at US $ 1 = EURO 1.4400 for spot delivery.

However, later during the day, the market became volatile and the dealer in compliance with his management's guidelines had to square - up the position when the quotations were:

Spot US $ 1	INR 31.4300/4500
1 month margin	25/20
2 months margin	45/35
Spot US $ 1	EURO 1.4400/4450
1 month forward	1.4425/4490
2 months forward	1.4460/4530

What will be the gain or loss in the transaction?

Solution: The amount of EUR bought by selling US$

USD 10,00,000 x 1.4400 = EUR 14,40,000

The amount of EUR sold for buying US$

USD 10,00,000 x 1.4450 = EUR 14,45,000

Net Loss in the Transaction = EUR 5,000

To acquire EUR 5,000 from the market @

(a) USD1= EUR1.4400 &

(b) USD1 = INR 31.4500

Cross Currency buying rate of EUR/INR is ₹ 31.4500 / 1.440 ie.₹ 21.8403

Loss in the Transaction ₹ 21.8403 x 5000 = ₹ 1,09,201.50

Question 5 (8 Marks) Exam Jan 2021

M/s. Sky products Ltd., of Mumbai, an exporter of sea foods has submitted a 60 days bill for EUR 5,00,000 drawn under an irrevocable Letter of Credit for negotiation. The company has desired to keep 50% of the bill amount under the Exchange Earners Foreign Currency Account (EEFC). The rates for ₹/USD and USD/EUR in inter-bank market are quoted as follows :

	₹/USD	USD/EUR
Spot	67.8000 - 67.8100	1.0775 - 1.8000
1 month forward	10/11 Paise	0.20/0.25 Cents
2 months forward	21/22 Paise	0.40/0.45 Cents
3 months forward	32/33 Paise	0.70/0.75 Cents

Transit Period is 20 days. Interest on post shipment credit is 8% p.a.
Exchange Margin is 0.1%. Assume 365 days in a year.

You are required to calculate :
(i) Exchange rate quoted to the company
(ii) Cash inflow to the company
(iii) Interest amount to be paid to bank by the company.

Solution: (i) Transit and usance period is 80 days. It will be rounded off to the lower of months and @ months forward bid rate is to be taken

₹/USD	₹ 67.8000
Add: Premium for 2 months	₹ 0.2100
	₹ 68.0100
Less: Exchange margin @ 0.1%	₹ 0.0680
Bid rate for USD	₹ 67.9420
USD/EUR	USD 1.0775
Add: Premium	USD 0.0040
	USD 1.0815
₹/EUR Rate (67.942 x 1.0815)	₹ 73.4793
Amount of Export Bill	EUR 5,00,000
Less: EEFC	EUR 2,50,000
	EUR 2,50,000
Exchange Rate	₹ 73.4793

(ii) Cash Inflow ₹1,83,69,825
(iii) Interest for 80 days @ 8% ₹3,22,101

Question 6 Study Material, (12 Marks) Exam Nov 2009, RTP May 2025

M/s Omega Electronics Ltd. exports air conditioners to Germany by importing all the components from Singapore. The company is exporting 2,400 units at a price of Euro 500 per unit. The cost of imported components is S$ 800 per unit. The fixed cost and other variables cost per unit are ₹ 1,000 and ₹ 1,500 respectively. The cash flows in Foreign currencies are due in six months. The current exchange rates are as follows:

₹/Euro	51.50/55
₹/S$	27.20/25

After six months the exchange rates turn out as follows:

₹/Euro	52.00/05
₹/S$	27.70/75

(1) You are required to calculate loss/gain due to transaction exposure.

(2) Based on the following additional information calculate the loss/gain due to transaction and operating exposure if the contracted price of air conditioners is ₹ 25,000:

(i) the current exchange rate changes to

₹/Euro	51.75/80
₹/S$	27.10/15

(ii) Price elasticity of demand is estimated to be 1.5

(iii) Payments and receipts are to be settled at the end of six months.

Solution:

(1) Profit at current exchange rates

2400 units x [€ 500 x ₹ 51.50 - (S$ 800 x ₹ 27.25 + ₹ 1,000 + ₹ 1,500)]

2400 units x [₹ 25,750 - ₹ 24,300] = ₹ 34,80,000

Profit after change in exchange rates

2400 units x [€ 500 x ₹ 52 - (S$ 800 x ₹ 27.75 + ₹ 1000 + ₹ 1500)]

2400 units x [₹ 26,000 - ₹ 24,700] = ₹ 31,20,000

LOSS DUE TO TRANSACTION EXPOSURE

₹ 34,80,000 - ₹ 31,20,000 = ₹ 3,60,000

(2) Profit based on new exchange rates

2400 units x [₹ 25,000 - (S$800 x ₹ 27.15 + ₹ 1,000 + ₹ 1,500)]

2400 units x [₹ 25,000 - ₹ 24,220] = ₹ 18,72,000

Profit after change in exchange rates at the end of six months

2400 units x [₹ 25,000 - (S$800 x ₹ 27.75 + ₹ 1,000 + ₹ 1,500)]

2400 units x [₹ 25,000 - ₹ 24,700] = ₹ 7,20,000

DECLINE IN PROFIT DUE TO TRANSACTION EXPOSURE

₹ 18,72,000 - ₹ 7,20,000 = ₹ 11,52,000

Current price of each unit is € = $\frac{₹\ 25,000}{₹\ 51.50}$ € = 485.44

Price after change in exch. rate = $\frac{₹\ 25,000}{₹\ 51.75}$ € = 483.09

Change in Price due to change in Exch. Rate

€ 485.44 – € 483.09 = € 2.35

or (-) 0.48%

Price elasticity of demand = 1.5

Increase in demand due to fall in price 0.48 x 1.5 = 0.72%

Size of increased order = 2400 x 1.0072 = 2417 units

Profit = 2417 [₹ 25,000 – (S$800 x ₹ 27.75 + ₹ 1,000 + ₹ 1,500)]

= 2417 [₹ 25,000 – ₹ 24,700] = ₹ 7,25,100

Therefore, decrease in profit due to operating exposure

₹ 18,72,000 - ₹ 7,25,100 = ₹ 11,46,900

Alternatively, If it is assumed that fixed cost shall not be changed with change in units then answer will be as follows :

Fixed cost = 2400 (₹ 1000) = ₹ 24,00,000

Profit = 2417 [₹ 25,000 - (S$800 x ₹ 27.75 + ₹ 1,500)] - ₹ 24,00,000

= 2417 (₹ 1,300) -₹ 24,00,000 = ₹ 7,42,100

Therefore, decrease in profit due to operating exposure

₹ 18,72,000 - ₹ 7,42,100 = ₹ 11,29,900

Question 7 (8 Marks) Exam July 2021, MTP Nov 2023

XP Pharma Ltd., has acquired an export order for ₹ 10 million for formulations to a European company. The Company has also planned to import bulk drugs worth ₹ 5 million from a company in UK. The proceeds of exports will be realized in 3 months from now and the payments for imports will be due after 6 months from now. The invoicing of these exports and imports can be done in any currency i.e. Dollar, Euro or Pounds sterling at company's choice. The following market quotes are available.

	Spot Rate	Annualised Premium
₹/$	67.10/67.20	$ - 7%
₹ /Euro	63.15/63.20	Euro - 6%
₹ /Pound	88.65/88.75	Pound - 5%

Advice XP Pharma Ltd. about invoicing in which currency.
(Calculation should be upto three decimal places).

Solution: (i) Proceeds of Exports in INR = ₹ 10 Million

Position of Inflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 3-months	Conversion in INR after 3-months
$	₹ 100,00,000/ ₹ 67.10 = $ 149031.297	₹ 67.10 (1 + 0.07/4) = ₹ 68.27	₹ 68.27 x $ 149031.297 = ₹ 1,01,74,367
€	₹ 100,00,000/ ₹ 63.15 = € 1,58,353.127	₹ 63.15 (1 + 0.06/4) = ₹ 64.10	₹ 64.10 x € 1,58,353.127 = ₹ 1,01,50,435
£	₹ 100,00,000/ ₹ 88.65 = £ 1,12,803.158	₹ 88.65 (1 + 0.05/4) = ₹ 89.76	₹ 89.76 x £ 1,12,803.158 = ₹ 1,01,25,211

(ii) Payment of Import in INR = ₹ 5 Million

Position of outflow under three currencies will be as follows:

Currency	Invoice at Spot Rate	Expected Rate after 6-months	Conversion in INR after 6-months
$	₹ 50,00,000/ ₹ 67.20 = $ 74404.762	₹ 67.20 (1 + 0.07/2) = ₹ 69.55	₹ 69.55 x $ 74404.762 = ₹ 51,74,851
€	₹ 50,00,000/ ₹ 63.20 = € 79,113.924	₹ 63.20 (1 + 0.06/2) = ₹ 65.10	₹ 65.10 x € 79,113.924 = ₹ 51,50,316
£	₹ 50,00,000/ ₹ 88.75 = £ 56,338.028	₹ 88.75 (1 + 0.05/2) = ₹ 90.97	₹ 90.97 x £ 56,338.028 = ₹ 51,25,070

Advice: Since cash inflow is highest (1,01,74,367) in case of $ hence invoicing for Export should be in $. However, cash outflow is least (51,25,070) in case of £ the invoicing for import should be in £.

Question 8

4 Questions Merged, Study Material, (8M) Exam N12, M15(Similar), N11(Similar), RTP N21

Z Ltd. importing goods worth USD 2 million, requires 90 days to make the payment. The overseas supplier has offered followings payment terms

(i) 1% discount if full amount is paid immediately

(ii) A 60 days interest free credit period and for additional credit for 30 days an interest of 8% per annum.

Z Ltd. has ₹ 25 lakh available and for remaining amount, the bankers of Z Ltd offer a 30 days loan at 10% per annum and upto 90 days loan @ 11% per annum and their quote for foreign exchange is as follows:

Spot 1 USD	₹ 57.80 - 57.95
60 days forward swap points for 1 USD	90/85
90 days forward swap points for 1 USD	55/45

Further presume that the cash available with Z Ltd. will fetch a return of 4 % p.a. in india till it is utilized.
You are required to evaluate the following options:

(i) Pay immediately

(ii) Pay the supplier in 60 days, or

(iii) Avail the supplier's offer of 90 days credit.

Assume year has 360 days

Solution: (i) Pay immediatey availing discount

Spot Rate	₹ 57.95
Amount required in US $ [$2mn less 1% discount]	$19,80,000
Amount required in ₹ [$19,80,000 x ₹ 57.95]	₹ 11,47,41,000
Cash available	₹ 25,00,000
Loan required	₹ 11,22,41,000
Interest for 90 days @ 11%	₹ 30,86,628
Total Outflow	₹ 11,53,27,628

(ii) Pay the supplier in 60 days

If the payment is made to supplier in 60 days the applicable forward rate for 1 USD	₹ 57.10
Payment Due	USD 2,000,000
Outflow in Rupees (USD 2000000 x ₹ 57.10)	₹ 114,200,000
Less: Cash available	25,00,000
Less: Interest earned on cash for 60 days @ 4% p.a.	16,667
Loan required	₹ 11,16,83,333
Add: Interest on loan for 30 days @10% p.a.	₹ 9,30,694
Total Outflow in ₹	₹ 11,26,14,027

(iii) Availing supplier's offer of 90 days credit

Amount Payable	USD 2,000,000
Add: Interest on credit period for 30 days@8% p.a.	USD 13,333
Total Outflow in USD	USD 2,013,333
Applicable forward rate for 1 USD	USD ₹ 57.50
Amount Required in ₹ (USD 2,013,333 x ₹ 57.50)	₹ 11,57,66,648
Less: Cash available	2,50,00,000
Less: Interest earned on cash for 90 days	25000
Total Outflow	11,32,41,648

Alternative 2 is better i.e. Pay the supplier in 60 days as it entails lower cash outflow.

Question 9 Study Material (Similar), (8 Marks) Exam May 2008, Nov 2016, Dec 2021

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st January, 2008 for which it has to make a payment of US $ 50,000 on September 30, 2008. The present exchange rate is 1 US $ = ₹ 40. It can purchase forward 1 US $ at ₹ 39. The company will have to make an upfront premium of 2% of the forward amount purchased. The cost of funds to the company is 10% per annum and the rate of Corporate tax is 50%. Ignore taxation. Consider the following situations and compute the Profit/ Loss the company will make if it hedges its foreign exchange risk:

(i) If the exchange rate on September 30, 2008 is ₹ 42 per US $

(ii) If the exchange rate on September 30, 2008 is ₹ 38 per US $

Solution:

	(₹)
Present Exchange Rate ₹ 40 = 1 USD	
If company purchases USD 50000 forward premium is 50000 × 39 × 2%	39,000
Interest on ₹ 39,000 for 9 months at 10% p.a.	2,925
Total hedging cost	41,925
If exchange rate is ₹ 42	
Then gain (₹ 42 – 39) for USD 5000	1,50,000
Less : Hedging cost	41,925
Net gain	1,08,075
If USD = ₹ 38	
Then loss (39 – 38) for USD 50000	50,000
Add: Hedging Cost	41,925
Total Loss	91,925

Question 10 3 Q Merged, Study Material, (5 Marks) Exam Nov 2013

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Danish Kroner 10,00,000 at the rate of Danish Kroner 1 = ₹ 6.5150. You are required to cover the transaction either in London or New York market.

The rates on that date are as under :

Mumbai - London	₹ 74.3000	₹ 74.3200
Mumbai - New York	₹ 49.2500	₹ 49.2625
London - Copenhagen	DKK 11.4200	DKK 11 .4350
New York - Copenhagen	DKK 7.5670	DKK 7.5840

In which market will you cover the transaction, London or New York, and what will be the exchange profit or loss on the transaction under following situations:

(i) Ignore brokerages

(ii) Total brokerages = ₹ 2500 each in London & in New York.

Solution:

Amount realized on selling Danish Kroner 10,00,000 at ₹ 6.5150 per Kroner = ₹ 65,15,000.

Cover at London:

Bank buys Danish Kroner at London at the market selling rate.

Pound sterling required for the purchase (DKK 10,00,000 ÷ DKK 11.4200) = GBP 87,565.67 Bank buys locally GBP 87,565.67 for the above purchase at the market selling rate of ₹ 74.3200.

The rupee cost will be	= ₹ 65,07,88
Profit Ignoring brokerages (₹ 65,15,000 - ₹ 65,07,881)	= ₹ 7,119
Less : brokerage	(₹ 2500)
	₹ 4619

Cover at New York:

Bank buys Kroners at New York at the market selling rate.

Dollars required for the purchase of Danish Kroner (DKK10,00,000/7.5670)

= USD 1,32,152.77

Bank buys locally USD 1,32,152.77 for the above purchase at the market selling rate of ₹ 49.2625.

The rupee cost will be	= ₹ 65,10,176
Profit Ignoring brokerages (₹ 65,15,000 - ₹ 65,10,176)	= ₹ 4,824
Less : brokerage	(₹ 2500)
	₹ 2324

The transaction would be covered through London which gets the maximum profit of ₹ 4,619 or lower cover cost at London Market by ₹ 2,295

Tutorial Note : If Q also asks to calc cover rate then simply apply the concept of cross currency rates to calc cover rate. Hint cover rate in London

$= ₹ 74.32 \times \frac{1}{11.42} = ₹ 6.5079$ & Cover rate in NY $= ₹ 49.2625 \times \frac{1}{7.5670} = ₹ 6.5102$

Question 11 Study Material, (8 marks) Exam Nov 2007, Nov 2019

Following information relates to AKC Ltd. which manufactures some parts of an electronics device which are exported to USA, Japan and Europe on 90 days credit terms.

Cost and Sales Information:

	Japan	USA	Europe
Variable cost per unit	₹ 225	₹ 395	₹ 510
Export sale price per unit	Yen 650	US$ 10.23	Euro 11.99
Receipts from sale due in 90 days	Yen 78,00,000	US$ 1,02,300	Euro 95,920

Foreign exchange rate information:

	Yen/₹	US$/₹	Euro/₹
Spot Market	2.417 -2.437	0.0214 - 0.0217	0.0177 - 0.0180
3 months forward	2.397 - 2.427	0.0213 - 0.0216	0.0176 - 0.0178
3 months spot	2.423 - 2.459	0.02144 - 0.02156	0.0177 - 0.0179

Advice AKC Ltd. by calculating average contribution to sales ratio whether it should hedge it's foreign currency risk or not.

Solution: If foreign exchange risk is hedged.

				Total (₹)
Sum due	Yen 78,00,000	US$1,02,300	Euro 95,920	
Unit input price	Yen 650	US$10.23	Euro 11.99	
Unit sold	12000	10000	8000	
Variable cost per unit	₹225	395	510	
Variable cost	₹27,00,000	₹39,50,000	₹40,80,000	₹1,07,30,000
Three months forward rate for selling	2.427	0.0216	0.0178	
Rupee value of receipts	₹32,13,844	₹47,36,111	₹53,88,764	₹1,33,38,719
Contribution	₹5,13,844	₹7,86,111	₹13,08,764	₹26,08,719
Average Contribution to sale ratio				19.56%

If risk is not hedged

Rupee value of receipt	₹31,72,021	₹47,44,898	₹53,58,659	₹1,32,75,578
Total contribution				₹25,45,578
Average contribution to sale ratio				19.17%

AKC Ltd. is advised to hedge its foreign currency exchange risk.

Question 12

2 Questions Merged | Study Material, MTP Sep 2025

Columbus Surgicals inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for £ 480,000, payable in 3 months. It has also exported surgical goods to India and France.

The Indian customer has been invoiced for £ 138,000, payable in 3 months, and the French customer has been invoiced for Euro 590,000, payable in 4 months. Current spot and forward rates are as follows:

£/US$

Spot: 0.9850 - 0.9830

Three months forward: 0.9520 — 0.9545

Tutorial Note: Since always Bid Rate < Ask Rate, therefore Spot Rates have been interpreted as Bid Rate 0.9830 - Ask Rate 0.9850

US$ /Euro

Spot: 1.8905 ± 0.0015

Four months forward: 6.2¢ - 6.2¢ (Premium)

Tutorial Note: Interpreted as
1.8890 — 1.8920
1.9510 — 1.9540

Current money market rates are as follows:

UK: 10.0% — 12.0% p.a.

France: 14.0% — 16.0% p.a.

USA: 11.5% — 13.0% p.a.

You as Treasury Manager are required to show how the company can hedge its foreign exchange exposure using Forward markets and Money markets hedge and suggest which the best hedging technique is.

Solution:

£ EXPOSURE

Since Columbus has a £ receipt (£ 138,000) and payment of (£ 480,000) maturing at the same time i.e. 3 months, it can match them against each other leaving a net liability of £ 342,000 to be hedged.

(i) Forward market hedge

Buy 3 months' forward contract accordingly, amount payable after 3 months will be

£ 342,000 / 0.9520 = US$ 359,244

(ii) Money market hedge

To pay £ after 3 months' Columbus shall requires to borrow in US$ and translate to £ and then deposit in £.

For payment of £ 342,000 in 3 months (@2.5% interest) amount required to be deposited now (£ 342,000 ÷ 1.025) = £ 333,658

With spot rate of 0.9830 the US$ loan needed will be = US$ 339,429

Loan repayable after 3 months (@3.25% interest) will be = US$ 350,460

Decision: In this case the money market hedge is a cheaper option.

EURO RECEIPT

Amount to be hedged = Euro 590,000

Now we Convert exchange rates to home currency

Euro / US$

Spot	0.5285 - 0.5294
4 months forward	0.5118 - 0.5126

(i) Forward market hedge

Sell 4 months' forward contract accordingly, amount receivable after 4 months will be Euro 590,000 x 1.9510 = US$ 11,51,090

(ii) Money market hedge

For money market hedge Columbus shall borrow in Euro and then translate to US$ and deposit in US$

For receipt of Euro 590,000 in 4 months (@ 5.33% interest) amount required to be borrowed now (Euro 590,000 ÷ 1.0533) = Euro 560,144

With spot rate of 1.8890 the US$ deposit will be = US$ 1,058,113

Deposit amount will increase over 4 months (@3.83% interest) will be = US$ 1,098,639

Decision: In this case, more will be received in US$ under the forward hedge

Question 13 RTP May 2005 (Similar), RTP Nov 2016, Nov 2022, Study Material

A company in UK will need to make a payment of $ 364897 in six month's time. Following market info is available.

	Forex (Indirect quote)	FX Options
Spot	$ 1.5617-1.5773	
Six months forward	$ 1.5455-1.5609	
Exercise Price		1.70
Six months call		$ 0.037 ¢ per Pound
Six months Put		$ 0.096 ¢ per Pound
Contract size		Assume: Pound 12500

Money Market Rates

	Deposit	Borrow
US $	4.50	6
UK Pounds	5.50	7

The company is considering, forward rates, money market hedge and Options. Give your reasoned recommendations on the best alternative.

Solution:

(A) Forward Market

(i) Exposure = $ 364897
(ii) Forward Rate 1£ = $1.5455
(iii) Outflow (6 month later) = £ 236103

(B) Cash (Money Market)

(i) Maturity in $ after 6 months = $ 364897
(ii) Present value of {$364897/(1 +(0.045/2))} = $ 356867
(iii) Borrow at spot to make up $356867 (at 1£ = $1.5617) = £ 228512
(iv) Amount to be discharged including interest (1 + 0.07/2) = £ 236510

(C) Currency options

(i) Number of contracts 364897/21250 (can be rounded off to 17 contracts) = 17.17 contracts
(ii) Exposure covered through put option 17 x 21250 = $ 361250
(iii) Balance to be covered through forward market $ 3647
(iv) Premia payable in $ (17 x 12,500 x .096) $ 20400
(v) Premia payable in £ [use spot Bid] ($20,400/1.5617) £ 13063

	Put option	Forward
Exposure covered	$361250	$3647
	£	£
Premia	13063	–
17 contract exercised (17 x 12500)	212500	–
Forward contract ($ 3647/1.5455)		2360
	225563	2360
Total outflow	£ 227923	

Tutorial Note: If Interest on Options is considered then Interest on options = £ 457. Total outflow = £ 228380

Strategy: Choose currency option because of lower cash outflow

ICAI Note: Even interest on option premium can also be considered in the above solution.

Tutorial Note: Suppose Exposure amount in the above Q is given as $ 377000. It will result in $377000 / $21250 = 17.74 ~ 18 contracts. Now it would result in excess dollars of $5500 on exercising the option contract. These excess $ 5500 would be sold at 6mf @ £ 1 = $ 1.5609 leading to inflow of £ 3524

Question 14

Study Material, Practice Manual, Exam May 15, Nov 16, May 23, RTP May 21, MTP Nov 24

XYZ Ltd. is an export oriented business house based in Mumbai. The Company invoices in customers' currency. Its receipt of US $ 1,00,000 is due on September 1, 2017.

Market information as at June 1, 2017 is:

Exchange Rates		Currency Futures	Contract size ₹4,72,000
	US $/₹		US $/₹
Spot	0.02140	June	0.02126
1 Month Forward	0.02136	September	0.02118
3 Months Forward	0.02127		

	Initial Margin	Interest Rates in India
June	₹10,000	7.50%
September	₹15,000	8.00%

On September 1, 2017 the spot rate US $/Re. is 0.02133 and currency future rate is 0.02134.
Comment which of the following methods would be most advantageous for XYZ Ltd.

(a) Using forward contract
(b) Using currency futures
(c) Not hedging currency risks.

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

Solution:

Receipts using a forward contract (1,00,000/0.02127)	= ₹ 47,01,457
Receipts using currency futures	
The number of contracts needed is (1,00,000/0.02118)/4,72,000 = 10	
Initial margin payable is 10 x ₹ 15,000 = ₹ 1,50,000	
On September 1 Close at 0.02134	
Receipts (US$1,00,000/0.02133)	= 46,88,233
Variation Margin = [(0.02134 - 0.02118) x 10 x 472000/-] /0.02133	
OR (0.00016 x 10 x 472000)/. 02133 = 755.2/0.02133	35,406
	47,23,639
Less: Interest Cost (1,50,000 x 0.08 x 3/12)	₹ 3,000
Net Receipts	₹ 47,20,639
Receipts under different methods of hedging	
Forward contract	₹ 47,01,457
Futures	₹ 47,20,639
No hedge	
US$ 1,00,000/0.02133	₹ 46,88,233
The most advantageous option would have been to hedge with futures.	

Question 15 Study Material,(8 Marks) Exam Nov 2013, MTP Sep 2022

An American firm is under obligation to pay interests of Can$ 1010000 and Can$ 705000 on 31st July and 30th September respectively. The Firm is risk averse and its policy is to hedge the risks involved in all foreign currency transactions. The Finance Manager of the firm is thinking of hedging the risk considering two methods i.e. fixed forward or option contracts.

It is now June 30. Following quotations regarding rates of exchange, US$ per Can$, from the firm's bank were obtained:

Spot	1 Month Forward	3 Months Forward
0.9284 - 0.9288	0.9501	0.9556

Price for a Can$ / US$ option on a U.S. stock exchange (cents per Can$, payable on purchase of the option, contract size Can$ 50000) are as follows:

Strike Price	Calls		Puts	
(US$/Can$)	July	Sept.	July	Sept.
0.93	1.56	2.56	0.88	1.75
0.94	1.02	NA	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of finance manager if options are to be used, one month option should be bought at a strike price of 94 cents and three month option at a strike price of 95 cents and for the remainder uncovered by the options the firm would bear the risk itself. For this, it would use forward rate as the best estimate of spot. Transaction costs are ignored.

Recommend, which of the above two methods would be appropriate for the American firm to hedge its foreign exchange risk on the two interest payments.

Solution:

Forward Market Cover

Hedge the risk by buying Can$ in 1 and 3 months time will be:

July	- 1010000 X 0.9501	= US $ 959601
Sept.	- 705000 X 0.9556	= US $ 673698

Option Contracts

July Payment	= 1010000/ 50,000 = 20.20
September Payment	= 705000/ 50,000 = 14.10

Company would like to take out 20 contracts for july and 14 contracts for september respectively. Therefore, costs if the options were exercised will be :

	July		Sept.	
	Can$	US$	Can$	US$
Covered by contracts	1000000	940000	700000	665000
Balance bought at spot rate	10000	9501	5000	4778
Option Costs:				
Can $50000 x 20 x 0.0102		10200	---	
Can $50000 x 14 x 0.0164	---			11480
Total cost in us$ of using option contract		959701		681258

Decision: As the firm is stated as risk averse and the money due to be paid is certain, a fixed forward contract, being the cheapest alternative in both the cases, would be recommended.

Question 16 (8 Marks) Exam Nov 2023

A Japanese company imports hi-tech printer cartridges from US worth $ 1 million. The chief financial officer of the company wishes to know the best strategy for protection against uncertainty, for the payment that has to be made at the end of 3 months. Financial team of the company has collected the following options for evaluation :

Table-1: Exchange rates quoted in FOREX Market:

¥/$ Quotations	Bid Price	Offer/Ask Price
Spot Rates	146.03	146.63
3M - Forward Rates	144.03	145.00
6M - Forward Rates	146.35	146.70

Table - 2: Options Market rates for European options with 3 months expiry:

Type of Option	Strike Price (X) (¥/$)	Premium % for Call & Put Option
Call & Put	145.20	1.6766% (Call) & 1.7414% (Put)
Call & Put	146.00	1.3505% (Call) & 2.1006% (Put)

The expected spot price at expiry is ¥/$: 144.90 / 145.05

Suggest the best strategy for CFO of the Japanese Company to protect against uncertainty, with respect to the following alternatives :

(i) Forward Hedge
(ii) Buy 3 months call, X = 145.20
(iii) Sell 3 months put, X = 145.20
(iv) Buy call & sell put both having X 146.00

Solution:

(i) Forward Hedge

Amount payable after 3 months	$ 1000000
3 month applicable buying rate	¥ 145/$
Amt. payable in Yen	¥ 145 million

(ii) Buy 3 month call option X = ¥ 145.20
If expected spot price after 3 month is ¥ 145.05
Then company would not exercise its option. Accordingly the cost of import will be

Buying Yen in spot Market after 3 month	¥ 145.05 million
Add: Premium Paid ¥ 145.20 x 1.6766%x $ 1 million	¥ 2.43 million
	¥ 147.48 million

(iii) Selling 3 month Put at X = ¥ 145.20
If expected spot price after 3 month ¥ 144.90 , then Put Option buyer will exercise his /her option.
Accordingly the import Bill will be :

Buying Yen in under option after 3 month	¥ 145.20 million
Less: Premium Receipt ¥ 145.20 x 1.7414%x $ 1 million	¥ 2.53 million
	¥ 142.67 million

(iv) Buying Call and selling Put at X = ¥ 146
Net Premium receipt

Premium paid on call option = ¥ 146.00 x 1.3505%	¥ 1.9717 million
Premium Receipt on Put option = ¥ 146.00 x 2.1006%	¥ 3.0669 million
	¥ 1.0952 million

If expected spot Rate expiry happens to be ¥ 144.90/145.05, then call option will be lapsed and Put option by buyer will be exercised. Accordingly, the import bill will be:

Buying US$ under Put Option	¥ 146.00 million
Less: Receipt of Net Premium	¥ 1.09520 million
	¥ 144.905 million

Decision: Since expected outflow is least in case of selling Put option, the same strategy is recommended.

Question 17

Study Material,(8 Marks) Exam Nov 11, RTP May 20, RTP May 21, MTP May 25, MTP Sep 25

Zaz plc, a UK Company is in the process of negotiating an order amounting €2.8 million with a large German retailer on 6 month's credit. If successful, this will be first time for Zaz has exported goods into the highly competitive German Market. The Zaz is considering following 3 alternatives for managing the transaction risk before the order is finalized.

(a) Mr. Peter the Marketing head has suggested that in order to remove transaction risk completely Zaz should invoice the German firm in Sterling using the current €/£ average spot rate to calculate the invoice amount.

(b) Mr. Wilson, CE is doubtful about Mr. Peter's proposal and suggested an alternative of invoicing the German firm in € and using a forward exchange contract to hedge the transaction risk.

(c) Ms. Karen, CFO is agreed with the proposal of Mr. Wilson to invoice the German first in €, but she is of opinion that Zaz should use sufficient 6 month sterling further contracts (to the nearest whole number) to hedge the transaction risk.

Following date is available	
Spot Rate	€1.1960 - €1.1970/£
6 months forward points	0.60-0.55 Euro Cents
6 months future contract is currently trading at	€1.1943/£
6 months future contract size is	£ 62,500
After 6 months Spot rate and future rate	€1.1873/£

You are required to

(i) Calculate (to the nearest £) the £ receipt for Zaz plc, under each of 3 above proposals.

(ii) In your opinion which alternative you consider to be most appropriate.

Solution:

(i) Receipt under three proposals

(a) Invoicing in Sterling

$$= \frac{€\ 2.8 \text{ million}}{1.1965} = £\ 2.340 \text{ million}$$

Tutorial Note: If Q didn't mention about using Average spot rate then relevant rate would be €1.1970 for conversion.

(b) Use of Forward Contract

Forward Rate = € 1.1970 - 0.0055 = 1.1915

Using forward market hedge sterling receipt would be $\frac{€\ 2.8 \text{ million}}{1.1915} = £\ 2.35 \text{ million}$

(c) Use of Future Contract

The equivalent sterling of the order placed based on future price (€ 1.1943)

$$= \frac{€\ 2.8 \text{ million}}{1.1943} = £\ 2,344,470 \text{ (rounded off)}$$

Number of contracts = $\frac{€\ 2,344,470}{62,500}$ = 37 Contracts (to the nearest whole number)

Ideally, it should be 38 contracts.

Thus, € amount hedged by future contract will be = 37 x £ 62,500 = £ 23,12,500

Buy Future at	€ 1.1943
Sell Future at	€ 1.1873
	€ 0.0070

Total profit on Future Contracts = 37 x £ 62,500 x € 0.0070 = € 16,188

After 6 months

Amount Received	€ 28,00,000
Less: Loss on Future Contracts	€ 16,188
	€ 27,83,812

Sterling Receipts

On sale of € at spot = $\frac{€\ 27,83,812}{1.1873} = £\ 2.3446 \text{ million}$

(ii) Proposal of option (b) is preferable because the option (a) & (c) produces least receipts. Further, in case of proposal (a) there must be a doubt as to whether this would be acceptable to German firm as it is described as a competitive market and Zaz is moving into it first time.

Question 18 Study Material, (16M) Exam M 07, N 15 (Similar), M 19 (Similar), MTP Sep 25

XYZ Ltd. a US firm will need £3,00,000 in 180 days. In this connection, the following information is available:
Spot rate 1 £=$2.00
180 days forward rate of £ as of today = $1.96

Interest rates are as follows:	U.K	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

Tutorial note : In this specific Q, ICAI always assumed that intt rates given in the table are NOT per annum but these rates correspond to 180 days period only .

A call option on £ that expires in 180 days has an exercise price of $1.97 & a premium of $0.04
XYZ Ltd. has forecasted the spot rates 180 days hence as below:

Future rate	Probability
$ 1.91	25%
$1.95	60%
$2.05	15%

Which of the following strategies would be most preferable to XYZ Ltd.?
(a) A forward contract;
(b) A money market hedge;
(c) An option contract;
(d) No hedging.
Show calculations in each case

Solution: (a) Forward contract: Dollar needed in 180 days = £3,00,000 x $ 1.96 = $5,88,000

(b) Money market hedge: Borrow $, convert to £, invest £, repay $ loan in 180 days
Amount in £ to be invested = 3,00,000/1.045 = £ 2,87,081
Amount of $ needed to convert into £ = 2,87,081 x 2 = $ 5,74,162
Interest and principal on $ loan after 180 days = $5,74,162 x 1.055 = $ 6,05,741

(c) Call option:

Expected Spot rate in180days	Prem/ unit	Exercise Option	Total price per unit	Total price for £3,00,000 (Xi)	Prob. (Pi)	Pi x Xi
1.91	0.04	No	1.95	5,85,000	0.25	1,46,250
1.95	0.04	No	1.99	5,97,000	0.60	3,58,200
2.05	0.04	Yes	2.01*	6,03,000	0.15	90,450
						5,94,900
				Add: Interest on Premium @ 5.5% (12,000 x 5.5%)		660
* ($1.97 + $0.04)						5,95,560

(d) No hedge option :

Expected future spot rate	Dollar needed (Xi)	Prob. (Pi)	Pi Xi
1.91	5,73,000	0.25	1,43,250
1.95	5,85,000	0.60	3,51,000
2.05	6,15,000	0.15	92,500
			5,86,500

The probability distribution of outcomes for no hedge strategy appears to be most preferable because least number of $ are needed under this option to arrange £3,00,000.

Question 19

3 Questions Merged | Study Material, (5 Marks) Exam Nov 15, MTP Nov 23, Practice Manual

A bank enters into a forward purchase TT covering an export bill for Swiss Francs 1,00,000 at ₹ 32.4000 due 25th April and covered itself for same delivery in the local inter bank market at ₹32.4200. However, on 25 March, exporter sought for extension of the contract as the tenor of the bill is changed.

Tutorial Note: ICAI assumed that tenor is changed to 25th June.

In Singapore market, Swiss Francs were quoted against dollars as under:

Spot	USD 1 = Sw. Fcs.	1.5076/1.5120
One month forward		1.5150/1.5160
Two months forward		1.5250/1.5270
Three months forward		1.5415/1.5445

and in the interbank market US dollars were quoted as under :

Spot	USD 1 = ₹	49.4302/.4455
Spot / April		.4100/.4200
Spot / May		.4300/.4400
Spot / June		.4500/.4600

Calculate the cancellation charges, payable by the customer if exchange margin required by the bank is 0.08% & 0.10% on buying and selling respectively . Also quote rate for fresh forward contract .

Solution:

First the contract will be cancelled at TT Selling Rate

USD/ Rupee Spot Selling Rate	₹ 49.4455
Add: Premium for April	₹ 0.4200
	₹ 49.8655
Add: Exchange Margin @ 0.10%	₹ 0.04987
	₹ 49.91537 Or 49.9154
USD/ Sw. Fcs One Month Buying Rate	Sw. Fcs. 1.5150
Sw. Fcs. Spot Selling Rate (₹49.91537/1.5150)	₹ 32.9474
Rounded Off	₹ 32.9475
Bank buys Sw. Fcs. Under original contract	₹ 32.4000
Bank Sells under Cancellation	₹ 32.9475
Difference payable by customer	₹ 00.5475

Exchange difference for Sw. Fcs. 1,00,000 payable by customer = ₹ 54,750 (Sw. Fcs. 1,00,000 x ₹ 0.5475)

Caln of merchant bank bid rate for June forward contract

$$\text{Bid}\left(\frac{₹}{\text{SwF}}\right) = \text{Bid}\left(\frac{₹}{\$}\right) \times \text{Bid}\left(\frac{\$}{\text{SwF}}\right)$$

$$= (49.8802 \text{ less } 0.08\% \text{ margin}) \times \left(\frac{1}{1.5445}\right)$$

$$= ₹ 32.2695$$

Question 20 Study Material, (9 Marks) Exam May 2015

An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ ₹ 64.4000. The bank covered its position in the market at ₹ 64.2800.

The exchange rates for dollar in the interbank market on 10th June and 13th June were:

	10th June	13th June
Spot USD 1 =	₹ 63.8000/8200	₹ 63.6800/7200
Spot/June	₹ 63.9200/9500	₹ 63.8000/8500
July	₹ 64.0500/0900	₹ 63.9300/9900
August	₹ 64.3000/3500	₹ 64.1800/2500
September	₹ 64.6000/6600	₹ 64.4800/5600

Exchange Margin 0.10% and interest on outlay of funds @ 12%. The importer requested on 14th June for extension of contract with due date on 10th August.

Rates to be rounded off to 4 decimals in multiples of 0.0025.

On 10th June, Bank Swaps by selling spot and buying one month forward.

Calculate:

(i) Cancellation rate
(ii) Amount payable on $ 2,00,000
(iii) Swap loss
(iv) Interest on outlay of funds, if any
(v) New contract rate
(vi) Total Cost

Solution:

(i) Cancellation Rate:

The forward sale contract shall be cancelled at Spot TT Purchase for $ prevailing on the date of cancellation as follows:

$/ ₹ Market Buying Rate	₹ 63.6800
Less: Exchange Margin @ 0.10%	₹ 0.0636
	₹ 63.6163

Rounded off to ₹ 63.6175

(ii) Amount payable on $ 2,00,000

Bank sells $2,00,000 @ ₹ 64.4000	₹ 1,28,80,000
Bank buys $2,00,000 @ ₹ 63.6175	₹ 1,27,23,500
Amount payable by customer	₹ 1,56,500

(iii) Swap Loss

On 10th June the bank does a swap sale of $ at market buying rate of ₹ 63.8000 and forward purchase for June at market selling rate of ₹ 63.9500.

Bank buys at	₹ 63.9500
Bank sells at	₹ 63.8000
Amount payable by customer	₹ 0.1500

Swap Loss for $ 2,00,000 in ₹ = ₹ 30,000

(iv) Interest on Outlay of Funds

On 10th June, the bank receives delivery under cover contract at ₹ 64.2800 and sell spot at a ₹ 63.8000.

Bank buys at	₹ 64.2800
Bank sells at	₹ 63.8000
Amount payable by customer	₹ 0.4800

Outlay for $ 2,00,000 in ₹ 96,000

Interest on ₹ 96,000 @ 12% for 3 days = ₹ 96

(v) New Contract Rate

The contract will be extended at current rate

$/ ₹ Market forward selling Rate for August	₹ 64.2500
Add: Exchange Margin @ 0.10%	₹ 0.0643
	₹ 64.3143

Rounded off to ₹ 64.3150

(vi) Total Cost

Cancellation Charges	₹ 1,56,500
Swap Loss	₹ 30,000
Interest	₹ 96
	₹ 1,86,596

Question 21 Study Material, (8 Marks) Exam May 2012 (Similar), MTP Oct 2019

NP and Co. has imported goods for US$ 7,00,000. The amount is payable after three months. The company has also exported goods for US$ 4,50,000 and this amount is receivable in two months. For receivable amount a forward contract is already taken at ₹ 48.90.

The market rates for ₹ and Dollar are as under:

Spot	₹ 48.50 / 70
Two months	25 / 30 points
Three months	40 / 45 points

The company wants to cover the risk and it has two options as under:

a. To cover payables in the forward market, and

b. To lag the receivables by one month and cover the risk only for the net amount. No interest for delaying the receivables is earned. Evaluate both the options if the cost of Rupee Funds is 12%. Which option is preferable?

Solution: (a) To cover payable and receivable in forward market

Amount payable after 3 months	$ 7,00,000
Forward Rate	₹ 48.45
Thus Payable Amount (₹) (A)	₹ 3,39,15,000
Amount receivable after 2 months	$ 4,50,000
Forward Rate	₹ 48.90
Thus Receivable Amount (₹) (B)	₹ 2,20,05,000
Interest @ 12% p.a. for 1 month (C)	₹ 2,20,050
Net Amount Payable in (₹) (A) - (B) - (C)	₹ 1,16,89,950

(b) Assuming that since the forward contract for receivable was already booked it shall be cancelled if we lag the receivables. Accordingly any profit/ loss on cancellation of contract shall also be calculated and shall be adjusted as follows.

Amount Payable ($)	$ 7,00,000
Amount receivable after 3 months	$ 4,50,000
Net Amount payable	$ 2,50,000
Applicable Rate	₹ 48.45
Amount payable in (₹) (A)	₹ 1,21,12,500
Profit on cancellation of Forward contract	₹ 2,70,000
(48.90 – 48.30) x 4,50,000 (B)	
Thus net amount payable in (₹) (A) + (B)	₹ 1,18,42,500

Since net payable amount is least in case of first option, hence the company should lag receivables

ICAI Note:

1. In the question it has not been clearly mentioned that whether quotes given for 2 and 3 months (in points terms) are premium points or direct quotes. Although above solution is based on the assumption that these are direct quotes, but students can also consider them as premium points and solve the question accordingly.
2. Alternatively, students can also consider the interest element on the profit earned due to cancellation of forward contract.

Question 22 Study Material, RTP Nov 2006

Spot rate 1 US $ = ₹ 48.0123
180 days Forwards rate for 1 US $ = ₹ 48.8190
Annualised interest rate for 6 months – Rupees = 12%
Annualised interest rate for 6 months – US $ = 8%

Is there any arbitrage possibility? If yes how an arbitrageur can take advantage of the situation, if he is willing to borrow ₹ 40,00,000 or US $ 83,312. Further should arbitrageur go for Covered Interest Rate Arbitrage if he has forecasted the spot rates 180 days hence as below:

Future rate for 1 US	Probability
₹ 48.7600	25%
₹ 48.8000	60%
₹ 48.8200	15%

Solution:

Spot Rate = ₹ 4000000 /83312 = 48.0123
Forward Premium on US$ = [(48.8190 — 48.0123)/48.0123] x 12/6 x 100
= 3.36%
Interest rate differential = 12% - 8%
= 4% (Negative Interest rate differential)

Since the negative Interest rate differential is greater than forward premium there is a possibility of arbitrage inflow into India.

The advantage of this situation can be taken in the following manner:

1. Borrow US$ 83312 for 6 months
   Amount to be repaid after 6 months
   = US $ 83312 (1 + 0.08 x 6/12) = US $ 86644.48
2. Convert US$ 83312 into Rupee and get the principal i.e. ₹ 40,00,000
   Interest on Investments for 6 months = ₹ 4000000 x 0.06
   = ₹ 240000
   Total amount at the end of 6 months = ₹ (4000000 + 240000)
   = ₹ 4240000
   Converting the same at the forward rate = ₹ 4240000 / ₹ 48.8190
   = US $ 86851.43
   Hence the gain is US $ (86851.43 - 86644.48) = US$ 206.95 or
   ₹ 10103 i.e., ($ 206.95 x ₹ 48.8190)

Evaluation of Decision to take Covered Interest Rate Arbitrage OR Uncovered Interest Rate Arbitrage

Expected Rate spot after 180 days

Future rate for 1 US $ (X_i)	Probability (P_i)	$X_i P_i$
₹ 48.7600	25%	12.19
₹ 48.8000	60%	29.28
₹ 48.8200	15%	7.323
		48.7930

Converting the amount of investment and interest at the expected forward rate as follows:
= ₹ 42,40,000/ ₹ 48.7930 = US$ 86,897.71

Hence the gain is US $ (86,897.71 - 86,644.48) = US$ 253.23 OR
₹ 12,356 i.e., ($253.23 x ₹ 48.7930)

Since the expected gain is more in case of uncovered interest arbitrage the arbitrageur may go for same. However, this gain is not certain and since it just slightly higher than the gain under Covered Interest Arbitrage therefore he may chose not go for uncovered interest arbitrage as there as also chances of actual spot rate turning adverse.

Question 23 Study Material

ABC Ltd. of UK has exported goods worth Can $ 5,00,000 receivable in 6 months. The exporter wants to hedge the receipt in the forward market. The following information is available:

Spot Exchange Rate	can $ 2.5/£
Interest Rate in UK	12%
Interest Rate In Canada	15%

The forward rates truly reflect the interest rates differential. Find out the gain/loss to UK exporter if Can $ spot rates (i) declines 2%, (ii) gains 4% or (iii) remains unchanged over next 6 months.

Solution:

Forward Rate = $\frac{2.50\ (1 + 0.075)}{(1 + 0.060)}$ = Can $ 2.535 / £

(i) If spot rate decline by 2%
spot Rate = can$ 2.50 x 1.02 = can$ 2.55/£

	£
£ receipt as per Forward Rate (Can $ 5,00,000 / Can $ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000 / Can $ 2.55)	1,96,078
Gain due to forward contract	1,161

(ii) If spot rate gains by 4%
spot Rate = Can $ 2.50 x 0.96 = Can $ 2.40 / £

	£
£ receipt as per Forward Rate (Can $ 5,00,000 / Can $ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000 / Can $ 2.40)	2,08,333
Loss due to forward contract	11,094

(iii) If spot rate remains unchanged

	£
£ receipt as per Forward Rate (Can $ 5,00,000 / Can $ 2.535)	1,97,239
£ receipt as per Spot Rate (Can $ 5,00,000 / Can $ 2.50)	2,00,000
Loss due to forward contract	2,761

Question 24 Practice Manual, RTP Nov 2023

The following table shows interest rates for the United States Dollar and French Franc. The spot exchange rate is 7.05 Franc per Dollar. Complete the missing entries:

	3 Months	6 Months	1 Year
Dollar interest rate (annually compounded)	11 ½%	12 ¼%	?
Franc interest rate (annually compounded)	19 ½%	?	20%
Forward franc per dollar	?	?	7.5200
Forward discount per franc per cent per year	?	6.3%	

Solution: For computing the missing entries in the table we will use Interest Rates Parity (IRP) theorem

i.e. $\frac{(1 + r_f)}{(1 + r_d)} = \frac{S_{f/d}}{F_{f/d}}$

Where, r_f is the rate of interest of country F (say the foreign country)
r_d is rate of interest of country D (say domestic country)
$S_{f/d}$ is the spot rate between the two countries F and D and
$F_{f/d}$ is the forward rate between the two countries F and D.

(i) 3 months

(1) Dollar interest rate = 11 ½ % (annually compounded)
Franc interest rate = 19 ½ % (annually compounded)

$$= 7.05 \left(\frac{1 + \frac{0.195}{4}}{1 + \frac{0.115}{4}} \right) = 7.05 \left(\frac{1 + 0.04875}{1 + 0.02875} \right)$$

= Franc 7.19 per US Dollar

(2) Further Forward discount per Franc per cent per year = Interest Differential i.e.
= 19 ½ % - 11 ½ % = 8%

Alternatively, more precisely it can also be computed as follows:
Spot per Franc Rate = 1 / 7.05 = US Dollar 0.142 per Franc

One Year Forward Rate = $0.142 \left(\frac{1 + 0.115}{1 + 0.195} \right)$ = US Dollar 0.132 per Franc

Accordingly, the discount per annum will be = $\frac{0.142 - 0.132}{0.142} \times 100 = 7.04\%$

Alternatively, it can also be computed using forward rate computed above as follows:
Forward per Franc Rate = 1/7.19 = 0.139

Accordingly, the discount per annum will be = $\frac{0.142 - 0.139}{0.142} \times \frac{12}{3} \times 100 = 8.45\%$

(ii) **6 months**

(1) Forward discount on Franc % per year = – 6.3% or – 3.15% for 6 months
Spot per Franc Rate = US$ 0.142
Forward per Franc Rate = US$ 0.142 × (1 – 0.0315)
= US$ 0.138
Accordingly, Forward Francs per US$ = 1/0.138 = 7.25
Alternatively, it can also be computed as follows:
6 months Forward rate = 7.05/ (100% – 3.15%)
Forward Francs per Dollar = 7.28 Francs

(2) Let r be the Franc interest rate (annually compounded) then as per IRP Theory:

$$7.05\left(\frac{1+\frac{r}{2}}{1+\frac{0.1225}{2}}\right) = \text{Franc } 7.25 \text{ per Dollar}$$

On solving the equation, we get the value r = 18.27% i.e. Franc Interest rate (annually compounded)

Alternatively, it can also be computed as follows:

$$7.05\left(\frac{1+\frac{r}{2}}{1+\frac{0.1225}{2}}\right) = \text{Franc } 7.28 \text{ per Dollar}$$

On solving the equation we get the value of r = 19.17% i.e. Franc interest rate (annually compounded)

(iii) **1 Year**

Franc interest rate = 20% (annually compounded)
Forward Franc per Dollar = 7.5200

As per Interest Rate Parity the relationship between the two countries rate and spot rate is

$$7.52 = 7.05\left(\frac{1 + \text{Franc Interest Rate}}{1 + \text{Dollar Interest Rate}}\right)$$

$$\text{i.e.} = \frac{1 + \text{Dollar Interest Rate}}{1 + 0.20} = \frac{7.05}{7.52}$$

Accordingly, the Dollar interest rate = 1.20 x 0.9374 – 1 = 1.125 – 1 = 0.125 or 12.5%

The completed Table will be as follows:

	3 Months	6 Months	1 Year
Dollar interest rate (annually compounded)	11 ½%	12 ¼%	12.50%
Franc interest rate (annually compounded)	19 ½%	19.17% or 18.27%	20%
Forward Franc per Dollar	7.19	7.25 or 7.28	7.5200
Forward discount per Franc percent per year	8% or 7.04% or 8.45%	6.3%	

Question 25 2Q Merged | Study Material, Exam N05, (8 Marks) Exam N24 (Similar), RTP N24

You as a dealer in foreign exchange have the following position in Swiss Franc on 31st October 2024:

	Sw. Fcs.
Balance in the Nostro A/c Credit	1,00,000
Opening position overbought	50,000
Purchased a bill on Zurich	80,000
Sold forward TT	60,000
Forward purchase contract cancelled	30,000
Remitted by TT	75,000
Draft on Zurich cancelled	30,000

What steps would you take, if you are required to

(i) maintain a credit balance of Sw. Fcs. 30,000 in the Nostro A/c and keep as overbought position on Sw. Fcs. 10,000.

(ii) maintain a credit balance of Sw Fcs 65000 in the Nostro A/c and keep oversold position on Sw Fcs 20000

Solution: Exchange position:

Particulars	Purchase Sw. Fcs.	Sale Sw. Fcs.
Opening balance overbought	50,000	
Bill on Zurich	80,000	
Forward sales - TT		60,000
Cancellation of forward contract		30,000
TT Sales		75,000
Draft on zurich Cancellation	30,000	---
	1,60,000	**1,65,000**
Closing balance Oversold	5,000	---
	1,65,000	**1,65,000**

Cash Position (Nostro A/c)

	Credit	Debit
Opening balance Credit	1,00,000	---
TT Sales	—	75,000
	1,00,000	**75,000**
Closing balance (Credit)	---	25,000
	1,00,000	**1,00,000**

(i) The Bank has to buy spot TT Sw. Fcs. 5,000 to increase the balance in Nostro account to Sw. Fcs. 30,000. This would bring down the oversold position on Sw. Fcs. as Nil.
Since the bank requires an overbought position of Sw. Fcs. 10,000, it has to buy forward Sw. Fcs. 10,000.

(ii) The Bank has to buy spot TT Sw. Fcs. 40,000 to increase the balance in Nostro account to Sw. Fcs. 65,000. This would bring the overbought position on SwF to 35000.
Since the bank requires an oversold position of Sw. Fcs. 20,000, it has to sell forward SwF. 55,000.

Question 26 Study Material

In International Monetary Market an international forward bid for December, 15 on pound sterling is $ 1.2816 at the same time that the price of IMM sterling future for delivery on December, 15 is $ 1.2806. The contract size of pound sterling is £ 62,500. How could the dealer use arbitrage to profit from this situation and how much profit is earned?

Solution:

Buy £ 62500 x 1.2806	= $ 80037.50
Sell £ 62500 x 1.2816	= $ 80100.00
Profit	$ 62.50

Alternatively, if the market comes back together before December 15, the dealer could unwind his position (by simultaneously buying £ 62,500 forward and selling a futures contract. Both for delivery on December 15) and earn the same profit of $ 62.5.

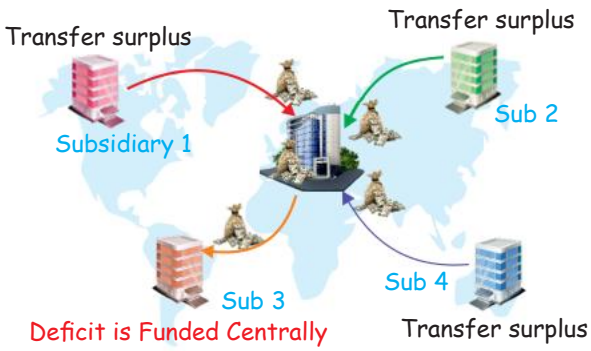
LDR 1 Hrs
LMR 5 Mins

A International Working Capital Management
B International Sources of Finance
C International Capital Budgeting

International Working Capital Management

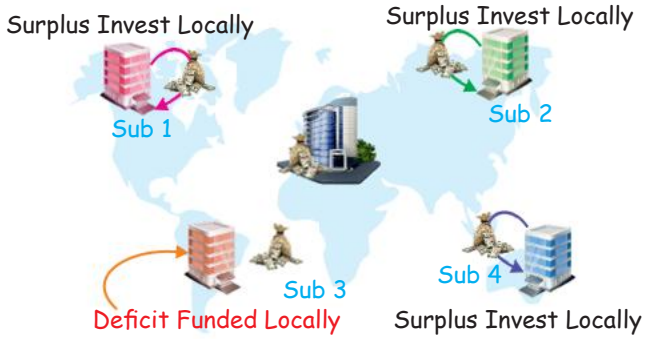
mainly we have to study about international cash management in MNC's. There are two kind of policies between which MNC's has to decide

Centralized Cash Management



Vs.

Decentralized Cash Management



Surplus Cash of All Subsidiaries should be pooled immediately in Company's Home Currency & Invest here

Each Subsidiary should Invest its own Surplus Cash in their respective currency

To decide which policy is better, Compare Amount Received on Maturity in Company's Home Currency' under both the policies

Format for 'Immediate Cash Pooling Method / Centralized cash management'

Country	Surplus Amount in respective currency to be Invested	Amount in Home Currency
Home Country, say, India	₹	₹
Foreign Country, say, USA	$	₹
Foreign Country, say, UK	£	₹
Total Principal Amount to be Invested in Home Currency		₹₹₹
Add : Interest @Home Currency rates		₹
Amount Received on Maturity in Home Currency		₹₹₹

Convert Surplus Amount at today's Spot rate

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Call 8889246468 or 6266553342

Format for 'Acting Independently Method / Decentralized cash management'

Country	Initial Principal Investment of Surplus Cash of in their respective Currency	Interest in respective currency	Amount received on Maturity in respective Currency	Amt received on Maturity in Home currency
Home Country, say, India	₹	₹	₹	₹
Foreign Country, say, USA	$	$	$	₹
Foreign Country, say, UK	£	£	£	₹
				₹₹₹

Convert in Company's Home currency @ Forward Rates

International Sources of Finance

International Investments

Case (i) If exchange rates are given

Step ① Amount Invested = $ 100mn

Today Spot $ 1 = ₹ 75.10 - 75.40

Step ② FII's investment in ₹ terms = ₹ 7510 mn

Foreign Institutional Investor

Step ③ FV of investment

$$= ₹\ 7510\ mn \times \frac{17000}{15700} = ₹\ 8131.85\ mn$$

Step ④ After 1 year $1 = ₹ 76.10 - 76.20

$ 106.72mn

Step ⑤

$$\text{Nominal rate of return} = \frac{₹\ 106.72 - ₹\ 100\ mn}{\$\ 100} = 6.72\%$$

Today Nifty = 15700 pts

After 1 year Nifty = 17000 pts

Suppose inflation rate in USA is 2%

Calc real return earned by FII ?

(1 + Nominal rate) = (1 + infl. rate) (1 + real rate)

1.0672 = 1.02 (1 + Real rate)

∴Real return = 4.63%

Amount Invested = ₹ 100000

Domestic Indian Investor

FV of investment

$$= ₹\ 100000 \times \frac{17000}{15700} = ₹\ 108280$$

∴Nominal Return earned by a domestic investor

$$= \frac{108280 - 100000}{100000} = 8.28\%$$

Suppose Infl in India = 6%

Calc real return earned by DII ?

1.0828 = 1.06 (1+real rate)

∴ Real return = 2.15%

Calc of Std. deviation for International Investments

Risk faced by an international investor - comprises of two elements

(1) Foreign currency fluctuations risk (2) Stock market fluctuations risk

$$\sigma_{FII} = \sqrt{(\sigma_{FC})^2 + (\sigma_{SM})^2 + 2\,\sigma_{FC}\,\sigma_{SM}\,corr_{FC,SM}}$$

here, FC means foreign currency, SM means stock mkt

Why weights have been ignored ?

As far as Weights are concerned, unlike Portf mngt where say 60% amt is invested in sec A & rest 40% in Sec B, in case of FII it has to face - FC risk on it 100% investment as well as Stk mkt risk again on full 100% of investment. Hence, there is no such concept of weights

Example If σ in Indian Stock Mkt is 7% & σ in Foreign currency is 3% . Corr $_{FC\ \&\ SM}$ is 0.30

Solve : $\sigma_{FII} = \sqrt{(7\%)^2 + (3\%)^2 + 2 \times 7\% + 3\% \times 0.30} = 8.40\%$

Case (ii) If App/ Depn% in currency is given

Step 1: Calculate Return on Investment in security for Domestic Investor

$$\text{Return for Domestic Investor} = \frac{D_1 + P_1 - P_0}{P_0} \times 100$$

here,

D_1 = Dividend / Interest Income on Security for the year
P_1 = Market Price of Security at end of the year
P_0 = Market Price of Security at beginning of the year

Step 2: Calculate Return on Investment in Security for Foreign Investor

- If Appreciation / Depreciation % in Foreign Currency is given.

$$\text{Return for Foreign Investor} = \left[1 + \text{Return for Domestic Investor}\right] \times \left[1 \pm \text{Appreciation /(Depreciation)\% in Foreign Currency}\right] - 1$$

- If Appreciation / Depreciation % in Home Currency is given

$$\text{Return for Foreign Investor} = \left[1 + \text{Return for Domestic Investor}\right] \times \left[1 \pm \text{(Appreciation) /Depreciation \% in Home Currency}\right] - 1$$

Tutorial Note: This is as is done by ICAI

International Fund Raising

Case (i) Borrowings

Example: An Indian co. borrows $ 10mn @ LIBOR + 2% for 3 yrs.

The loan is to be repaid in the following manner:

Yr.		
	1	$ 2mn
	2	$ 3mn
	3	$ 5mn

Estimated LIBOR for next 3 years

Yr.		
	1	7.5%
	2	7%
	3	6%

Expected Infl. rates

	India	USA
Year 1	5%	2%
2	4%	2.25%
3	3%	2.5%

Given: Spot rate $ 1 = ₹ 80

Calculate Effective cost of borrowing (or effective cost of borrowing in ₹ terms) ?

In case of complex loan structure (i.e. in case of uneven cf's) we always use IRR to calc Cost% or Return %

Cal ^{n} of forward (or expected spot) rates using inflation rate parity theorem

$$\frac{1 + Ih}{1 + If} = \frac{F_1 \text{ or } E(S_1)}{S_0}$$

Year 1: $\frac{1.05}{1.02} = \frac{F_1}{80}$ ∴ F_1 = ₹ 82.35

Year 2: $\frac{1.04}{1.0225} = \frac{F_2}{82.35}$ ∴ F_2 = ₹ 83.76

Year 3: $\frac{1.03}{1.025} = \frac{F_3}{83.76}$ ∴ F_3 = ₹ 84.17

Cal ^{n} of IRR - using trial & error

Amount in millions

Yr	Cf's (in mn $)			Exch. rate	Cf's (in ₹ mn)	PV @ 11%	PV @ 12%
	Interest	Principal repayment	Total				
1	0.95 [$10mn x 9.5%]	2	2.95	82.35	242.93	.	
2	0.72 [$8mn x 9%]	3	3.72	83.76	311.59	.	
3	0.40 [$5mn x 8%]	5	5.40	84.17	454.52	.	
					PV Outflows	(804.09)	(788.82)
					PV Inflow [$10mn x ₹80]	+ 800	+ 800
					NPV	(4.09)	11.18

Using interpolation: $= LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times (HR - LR)$ $= 11\% + \frac{-4.09}{-4.09 - 11.18} \times (12\% - 11\%)$ $= 11.27\%$

Ans: Effective cost of borrowing = 11.27%

Case (ii) Equity / GDR issue

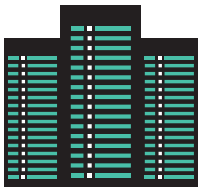
An Indian Company wants to raise funds in US$

Foreign Investors [Eg: USA Investors]

issue Shares

Transfer raised funds after deducting commission (floatation Cost)

Issue GDR & Raise Foreign Funds



communicates receipt of shares to

Local Custodian of Depository's Bank [Eg: Bank of America]

Overseas Depository Bank [Eg: Bank of America]

Cost of GDR (Ke)

$$\text{Cost of GDR (Ke)} = \frac{D_1}{P_0} + g$$

here,

g = Growth Rate

D_1 = Expected Dividend per GDR at the end of 1st year

P_0 = Net Proceeds per GDR i.e. Issue Price per GDR x (1 - Floatation Cost%)

Issue Price per GDR = No. of shares underlying each GDR x Market Price per underlying share x (1 - Discount on issue %)

$$\text{Number of GDR to be issued} = \frac{\text{Amount required for Investment in the Project}}{\text{Net Proceeds per GDR}}$$

International Capital Budgeting

International capital budgeting = ① Domestic capital budgeting + ② Effects of exchange rate + ③ Treatment of repatriation restrictions

① Domestic Capital Budgeting

0 ——— 5th Year

Initial investment

- Cost of asset [incl. Installation cost]
- Investment in working capital

Total Ini. inv. [outflow]

Annual CF's

Sales	₹₹
Less: Variable cost	₹
Contribution	₹₹
Less: Cash operating fixed cost	₹
CFBT	₹₹
Less : Depn	₹
PBT	₹₹
Less : Taxes @	₹
PAT or NOPAT	₹₹
Add : Depn	₹
CFAT	₹₹
Less: Purchase of Addl. equipment	₹
Less: Incremental Investment in working capital	₹
Net CF's	₹₹

Terminal CF's

- Sale proceeds on sale of assets xxx
- +/- Tax treatment on cap g/(l) xx
  [Outflow of Tax, if cap gain
  Inflow of tax benefit, if cap loss]
- Recapture of working capital xx

Total xxx

NPV
+ / -
Accept Reject

Discounting @ K_o

Note: Allocation/ Apportionment of Fixed overheads and historical cost/ sunk cost are irrelevant hence not considered in computing cash flows

② Effects of Exchange Rate

While Calculating NPV of the project in International Capital Budgeting, Cash Flows & Discount Rate should be of same Currency. So, NPV can be calculated using following 2 Approaches:

(i) Foreign Currency Approach

Step1: Calc Cash Flows in Foreign Currency.

Step2: Calc Discount Rate of foreign Currency.

$$= \left[\frac{(1 + \text{Rf Rate in Foreign Currency})}{1 + \text{Rf Rate in Home Currency}} \times (1 + \text{Required Return in Home Currency})\right] - 1$$

Step3: Calc NPV. NPV so calculated will be in Foreign Currency

Step4: Convert NPV in Home Currency using Spot Exchange Rate at the beginning

(ii) Home Currency Approach Default assumption if Q is silent

Step1: Calc Cash flows in Home Currency [By converting foreign Currency Cash Flows into Home Currency using Estimated Exchange Rate of different years].

To calc Exch Rates for Yr 1/2/3..n, either
- ✓ Currency App / (Dep) % is given in the Q
- ✓ or use Intt Rate Parity Theorem / Infl Rate Parity Theorem

Step2: Calc NPV using Discount Rate of Home Currency.

If Q is Silent, given Discount rate is assumed to be of Home Currency

③ Treatment of Repatriation restrictions

If Q says that only 40% (say) of the CFAT can be remitted back, then remaining 60% CF's are kept in FC terms until the end of repatriation restriction period & then converted to Home Currency

If Investment rate % in Foreign Country is given then invest the blocked amount. Now calc Interest income thereon and also remember to give effect of tax implications on such Interest Income.

Decision making for Foreign Company developing Product (software) in India

Computation of Repatriation Amount

Particulars	Amount (in ₹)
Transfer Price	xxx
(-) Costs [Example : Rent, Manpower, Administration Cost, etc.]	(xxx)
EBT	xxx
(-) Corporate Tax	(xxx)
EAT	xxx
(-) Witholding Tax [Only if it is not eligible for Tax Credit]	(xxx)
Repatriation Amount [in ₹]	xxx
Repatriation Amount [Converted in Currency of Foreign Company]	xxx

Computation of Total Cost incurred on Product development [Minimum Amount to be charged for Product by Foreign Company from Foreign Customer]

Particulars	Amount (in Foreign Currency)
Transfer Price Paid	xxx
(-) Repatriation Amount Received	(xxx)
	xxx

Advice on viability of the Project:

Particulars	Amount (in Foreign Currency)
Selling Price of Product/ Software to the Customer	xxx
(-) Total Cost incurred on Product development	(xxx)
Profit / (Loss)	xxx / (xxx)

Question 1

(8 Marks) Exam May 2007

AMK Ltd. an India based company has subsidiaries in U.S. and U.K.

Forecasts of surplus funds for the next 30 days from two subsidiaries are as below:

U.S. $ 12.5 million

U.K. £ 6 million

The following exchange rate information are obtained:

	$ / ₹	£ / ₹
Spot	0.0215	0.0149
30 days forward	0.0217	0.0150

Annual borrowing/ deposits rate (simple) are available.

₹	6.4% / 6.2%
$	1.6% / 1.5%
£	3.9% / 3.7%

The Indian operation is forecasting a cash deficit of ₹ 500 million.

It is assumed that interest rates are based on a year of 360 days.

1. Calculate the cash balance at the end of the 30 days period in ₹ for each company under each of the following scenarios ignoring transaction costs and taxes:
   a. Each company invests/finances its own cash balances/deficits in local currency independently.
   b. Cash balances are pooled immediately in India and the net balances are invested/borrowed for the 30 days period.
2. Which method do you think is preferable from the parent company's point of view?

Solution:

Cash Balances - Acting Independently

	Capital	Interest	₹ In 30 days
India	- 5,00,000	- 2,666.67	- 5,02,667
U.S.	12,500	15.63	5,76,757
U.K.	6,000	18.50	4,01,233
			4,75,323

Cash Balances - Immediate Cash pooling

India		- 5,00,000
U.S.	$\frac{12,500}{0.1215}$	5,81,395
U.K.	$\frac{6,000}{0.0149}$	4,02,685
		4,84,080

Immediate cash pooling is preferable as it maximizes interest earnings

ICAI Note: If the company decides to invest pooled amount of ₹ 4,84,080 @ 6.2% p.a. for 30 days an interest of ₹2,501 will accrue. Hence, Total amount available = ₹ 486581.

Question 2

Study Material, (8 Marks) Exam Nov 2013, RTP Nov 2021, MTP Nov 2023

Your bank's London office has surplus funds to the extent of USD 5,00,000/- for a period of 3 months. The cost of the funds to the bank is 4% p.a. It proposes to invest these funds in London, New York or Frankfurt and obtain the best yield, without any exchange risk to the bank.

The following rates of interest are available at the three centres for investment of domestic funds there at for a period of 3 months.

London	5% p.a.
New York	8% p.a.
Frankfurt	3% p.a.

The market rates in London for US dollars & Euro are as under

London on New York		London on Frankfurt	
Spot	1.5350/90	Spot	1.8260/90
1 month	15/18	1 month	60/55
2 month	30/35	2 month	95/90
3 month	80/85	3 month	145/140

At which centre, will the investment be made & what will be the net gain (to nearest £) to the bank on invested funds?

Solution: (i) If investment is made at London

Convert US$ 5,00,000 at Spot Rate (5,00,000/1.5390)		= £ 3,24,886
Add: £ Interest for 3 months on £ 324,886 @ 5%		= £ 4,061
		= £ 3,28,947
Less: Amount Invested	$ 5,00,000	
Interest accrued thereon	$ 5,000	
	= $ 5,05,000	
Equivalent amount of £ required to pay the above sum ($ 5,05,000/1.5430*) * Due to conservative outlook.		= £ 3,27,285
Arbitrage Profit		= £ 1,662

(ii) If investment is made at New York

Gain $ 5,00,000 (8% - 4%) x 3/12	= $ 5,000
Equivalent amount £ 3 months ($ 5,000/1.5475)	£ 3,231

(iii) if investment is made at Frankfurt

Convert US$ 500,000 at Spot Rate (Cross Rate) 1.8260/1.5390	= € 1.1865
Euro equivalent US$ 500,000	= € 5,93,250
Add: Interest for 3 months @ 3%	= € 4,449
	= € 5,97,699
3 month Forward Rate of selling € (1/1.8150)	= £ 0.5510
Sell € in Forward Market € 5,97,699 x £ 0.5510	= £ 3,29,332
Less: Amounted invested and interest thereon	= £ 3,27,285
Arbitrage Profit	= £ 2,047

Since out of three options the maximum profit is in case investment is made in New York. Hence it should be opted.

Question 3 (8 Marks) Exam Nov 18, May 23, MTP May 21, RTP Sep 25, MTP Sep 25

The Treasury desk of a global bank incorporated in UK has raised GBP 400 million on 1st January, 2019. Half of the amount will be required after six month's time. It is considering following two options:

(1) The Equity Trading desk in Japan wants to invest the entire GBP 200 million in high dividend yielding Japanese securities that would earn a dividend income of JPY 1,182 million. The dividends are declared and paid on 29th June. Post dividend, the securities are expected to quote at a 2% discount. The desk also plans to earn JPY 10 million on a stock borrow lending activity because of this investment. The securities are to be sold on June 29 with a T+1 settlement and the amount remitted back to the Treasury in London.

(2) The Fixed Income desk of US proposed to invest the amount in 6-month G-Secs that provides a return of 5% p.a.

The exchange rates are as follows:

Currency Pair	1-Jan-2019 (Spot)	30-Jun-2019 (Forward)
GBP- JPY	148.0002	150.0000
GBP- USD	1.28000	1.30331

As a treasurer, advise the bank on the best investment option from risk perspective.
You may ignore taxation.

Solution: (1) Yield from Investment in Equity Trading Index in Japan

Conversion of GBP 200 million in JPY (148.0002) JPY 29600.04 Million

Dividend Income	JPY 1182.00 Million
Stock Lending	JPY 10.00 Million
Investment Value at End	JPY 29008.0392 Million
Amount available at End	JPY 30200.0392 Million
Forward Rate of 30.06.2019	JPY 150/ GBP
Amount to be Remitted back to London	GBP 201.3336 Million
Gain = GBP 201.3336 - GBP 200	GBP 1.3336 Million

(2) Fixed Income Desk of US

Conversion of GBP 200 million in USD (1.28000)	USD 256.00 Million
Add: Interest@ 5% p.a. for 6 months	USD 6.40 Million
Amount available at End	USD 262.40 Million
Forward Rate of 30.06.2019	USD 1.30331/ GBP
Amount to be Remitted back to London	GBP 201.3335 Million
Gain = GBP 201.3335- GBP 200	GBP 1.3335 Million

Decision: The equivalent amount at the end of 6 months shall be almost same in both the options- The bank can go for any of the options.

However, from risk perspective, the investment in fixed income desk of US is more beneficial as the chance of variation in fixed income securities is less as compared to Equity Desk.

Question 4 Study Material, (8 Marks) Exam May 22, Nov 08, RTP May 23, MTP May 25

Sun Ltd. is planning to import an equipment from Japan at a cost of 3,400 Lakh yen. The company may avail loans at 18 percent per annum with quarterly rests with which it can import the equipment. The company has also an offer from Osaka branch of an India based bank extending credit of 180 days at 2 percent per annum against opening of an irrevocable letter of credit.

Additional information:

Present exchange rate ₹ 100 = 340 yen

180 day's forward rate ₹ 100 = 345 yen

Commission charges for letter of credit at 2 percent per 12 months.

Advise the company whether the offer from the foreign branch should be accepted.

Solution: Option I (To finance the purchases by availing loan at 18% per annum):₹ In lakhs

Cost of equipment	₹ In lakhs
3400 lakh yen at ₹ 100 = 340 yen	1000
Add: Interest at 4.5% I Quarter	45
Add: Interest at 4.5% II Quarter (on ₹ 1045 lakhs)	47.03
Total outflow Rupees	1092.03
Alternatively, interest may also be calculated on compounded basis, i.e., ₹ 1000 × $[1.045]^2$	₹ 1092.03

Option II (To accept the offer from foreign branch):

Cost of letter of credit	
At 1% on 3400 lakhs yen at ₹ 100 = 340 yen	₹ 10.00 lakhs
Add: Interest @ 18% pa for 6 months	₹ 0.90 lakhs
(A)	₹ 10.90 lakhs
Payment at the end of 180 days;	
Cost	3400.00 lakhs yen
Interest at 2% p.a. [3400 × 2/100 × 180/365]	33.53 lakhs yen
	3433.53 lakhs yen
Conversion at ₹ 100 = 345 yen [3433.53/345 × 100] (B)	= ₹ 995.23
Total outflow under option II [(A) + (B)] = 10.90 + 995.23	= ₹ 1006.13 lakhs

Tutorial Note: In our opinion, ICAI has made a small error in calculating interest. 18% pa is compounded quarterly rate ∴ Correct intt should be 0.45 & 0.47 = 0.92 We recommend Students to follow ICAI Solution because ICAI has repeated this mistake even in May 2022 Attempt.

Comments: Option no. 2 is cheaper by (1092.03 – 1006.13) lakh or ₹ 85.90 lakh

Hence, the offer may be accepted.

Question 5

2 Questions Merged | RTP Nov 2020 (Similar)

Suppose you are a treasurer of XYZ Plc in the UK. XYZ have two overseas subsidiaries, one based in Amsterdam and one in Switzerland. The Dutch subsidiary has surplus Euros in the amount of 725,000 which it does not need for the next three months but which will be needed at the end of that period (91 days). The Swiss subsidiary has a surplus of Swiss Francs in the amount of 998,077 that, again, it will need on day 91. The XYZ plc in UK has a net balance of £75000 that is not needed for the foreseeable future.

Given the rates below, what is the advantage of swapping Euros and Swiss Francs into Sterling?

Determine the minimum interest rate per annum that should be offered by the Bank in UK so that your organization is ready to undertake the swapping of Euros and Swiss Francs into Sterling ?

Spot Rate (€)	£ 0.6858 – 0.6869
91 day Pts	0.0037 – 0.0040
Spot Rate (£)	CHF 2.3295 – 2.3326
91 day Pts	0.0242 – 0.0228

Interest rates for the Deposits

Amount of Currency	91 day Interest Rate % p.a.		
	£	€	CHF
0 – 100000	1	¼	0
100001 – 500000	2	1 ½	¼
500001 – 1000000	4	2	½
Over 1000000	5.375	3	1

Note: Assume 360 days in a year.

Solution: Individual Basis

	Interest	Amt. after 91 days	Conversion in £
Holland € 725000 x 0.02 x 91/360	3665.28	€ 728665.28	£ 502414.71 (728665.28 x 0.6895)
Switzerland CHF 998077 x 0.005 x 91/360	CHF 1261.46	CHF 999338.46	£ 432651.51 (999338.46 / 2.3098)
UK £ 75000 x 0.01 x 91/360	£ 189.58	£ 75189.58	£ 75189.58
Total GBP at 91 days			£ 1010255.8

Swap to Sterling Basis

Sell € 725000 (Spot at 0.6858) buy £	£ 497205.00
Sell CHF 998077 (Spot at 2.3326) buy £	£ 427881.76
Independent GBP amount	£ 75000.00
	£ 1000086.76
Interest (£ 1000086.76 x 0.05375 x 91/360)	£ 13587.98
Total GBP at 91 days	£ 1013674.74
Less: Total GBP at 91 days as per individual basis	£ 1010255.8
Net Gain on Swap to Sterling basis	£ 3418.94

Total GBP on Individual basis £ 1010255.80
Total GBP on swap to Sterling basis £ 1000086.76
Interest Required £ 10169.04

Required Interest Rate on Per Annum basis $= \frac{10169.04}{1000086.76} \times \frac{360}{91} \times 100 = 4.023\%$

Tutorial Note: If Q doesn't mention to assume 360 days in a year in this particular Question, then ideally the solution should be done using 365 days.

Question 6

Study Material, (5 Marks) Exam 2012, RTP May 2022, (6 Marks) MTP Oct 2022

Mr. Mammen, an Indian investor invests in a listed bond in USA. If the price of the bond at the beginning of the year is USD 100 and it is USD 103 at the end of the year. The coupon rate is 3% payable annually.

Find the return on investment in terms of home country currency if:

(i) USD is Flat.
(ii) USD appreciates during the year by 3%.
(iii) USD depreciates during the year by 3%.
(iv) Indian Rupee appreciates during the year by 5%.
(v) Will your answer differ if Mr. Mammen invests in the bond just before the interest payable.

Solution: (i) If USD is flat

$$\text{Return} = \frac{(\text{Price at end} - \text{Price at beginning}) + \text{interest}}{\text{Price at beginning}} = \frac{(103 - 100) + 3}{100} = \frac{3 + 3}{100} = 0.06 \text{ say } 6\%$$

(ii) If USD appreciates by 3%
$(1 + 0.06)(1 + 0.03) - 1 = 1.06 \times 1.03 - 1 = 0.0918$ i.e. 9.18%

(iii) If USD depreciates by 3%
$(1 + 0.06)(1 - 0.03) - 1 = 1.06 \times 0.97 - 1 = 0.0282$ i.e. 2.82%

(iv) If Indian Rupee is appreciated by 5%
$(1 + 0.06)(1 - 0.05) - 1 = 1.06 \times 0.95 - 1 = 0.007$ i.e. 0.7%

(v) No, our answer will not differ even if Mr. Mammen invests in bond just before the interest is payable.

Question 7 (10 Marks) MTP April 2019

With the relaxation of investment norms in India in international market upto $2,50,000, Mr. X wants to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few years decided to diversify into International Market.

Accordingly, Mr. X invested a sum of ₹ 1.58 crore on 1.1.20 x 1 in Standard & Poor Index. On 1.1.20 x 2 Mr. X sold his investment. The other relevant data is given below:

	1.1.20 x 1	1.1.20 x 2
Index of Stock Market in India	7395	?
Standard & Poor Index	2028	1919
Exchange Rate	62.00/62.25	67.25/67.50

(i) Determine the return for a US investor.
(ii) Determine return of Mr. X of holding period.
(iii) Determine the value of Index of Stock Market in India as on 1.1.20x2 at which Mr. X would be indifferent between investment in Standard & Poor Index and Indian Stock Market.

Solution: (i) Return for a US Investor

$$\left(\frac{\text{Ending Price - Initial Price}}{\text{Initial}}\right) \times 100 = \left(\frac{1919 - 2028}{2028}\right) \times 100 = (-)\ 5.37\%$$

(ii) Return of Mr. X

Initial Investment (₹)	1.58 Crore
Applicable Exchange Rate on 1.1.20x1	₹ 62.25
Equivalent US$	US$ 2,53,815.26
Purchase Price of Standard & Poor Index	2028
No. of Standard & Poor Indices Purchased	125.16
Ending Price of Standard & Poor Index	1919
Proceeds realised in US$ on sale of Standard & Poor Index	US$ 2,40,182.04
Applicable Exchange Rate on 1.1.20x2	₹ 67.25
Proceeds realised in INR on sale of Standard & Poor Index	₹ 1,61,52,242

$$\text{Rate of Return} = \left(\frac{161,52,242 - 158,00,000}{158,00,000}\right) \times 100 = 2.23\%$$

(iii) Rate of Return had the amount been invested in India

Initial Investment (₹)	1.58 Crore
Purchase Price of Indian Index	7395
No. of Standard & Poor Indices Purchased	2136.58
Let Ending Price of Indian Index	X

Then to be indifferent with return in International Market

$$\left(\frac{2136.58 \times X - 158,00,000}{158,00,000}\right) \times 100 = 2.23$$

Price of Indian Index to be indifferent 7559.90 say 7560

Question 8

Study Material, (8 Marks) Exam Nov 14 (Similar), May 22, May 2024 (Similar), RTP May 22, Nov 23

M/s. Raghu Ltd. is interested in expanding its operation and planning to install manufacturing plant at US. It requires 8.82 million USD (net of issue expenses/ floatation cost) to fund the proposed project. GDRs are proposed to be issued to finance this project. The estimated floatation cost of GDRs is 2%.

Additional information:

(i) Expected market price of share at the time of issue of GDR is ₹ 360 (Face Value ₹ 100)
(ii) Each GDR will represent two underlying Shares.
(iii) The issue shall be priced at 10% discount to the market price.
(iv) Expected exchange rate is INR/USD 72.
(v) Dividend is expected to be paid at the rate of 20% with growth rate of 12%.

(1) You, as a financial consultant, are required to compute the number of GDRs to be issued and cost of the GDR.
(2) What is your suggestion if the company receives an offer from a US Bank willing to provide an equivalent loan with an interest rate of 12%?
(3) How much company can save by choosing the option as recommended by you?

Solution: Workings

Net Issue Size = $ 8.82 million

Gross Issue = $\frac{8.82}{0.98}$ = $ 9.00 million

Issue Price per GDR in ₹ (360 x 2 x 90%)	₹ 648
Issue Price per GDR in $ (₹ 648 / ₹ 72)	$ 9.00
Dividend Per GDR (D_1) = ₹ 20 x 2 =	₹ 40
Net Proceeds Per GDR = ₹ 648 x 0.98 =	₹ 635.04

(1) (a) Number of GDR to be issued $\frac{\$\ 9.00 \text{ million}}{\$\ 9}$ = 1.00 million

(b) Cost of GDR

$$k_e = \frac{40.00}{635.04} + 0.12 = 18.30\%$$

(2) If the company receives an offer from US Bank willing to provide an equivalent amount of loan with interest rate of 12%, it should accept the offer.

(3) If the offer is accepted there will be net saving of 6.30%.

Question 9

Study Material, (10 Marks) Exam M14, N19, J21, RTP M23, MTP O22, N24, M25, S25

A multinational company is planning to set up a subsidiary company in India (where hitherto it was exporting) in view of growing demand for its product and competition from other MNCs. The initial project cost (consisting of Plant and Machinery including installation) is estimated to be US$ 500 million. The net working capital requirements are estimated at US $ 50 million. The company follows straight line method of depreciation. Presently, the company is exporting two million units every year at a unit price of US $ 80, its variable cost per unit being US $ 40.

The Chief Financial Officer has estimated the following operating cost & other data in respect of proposed project:

(i) Variable operating cost will be US $ 20 per unit of production;
(ii) Additional cash fixed cost will be US $ 30 million p.a. and project's share of allocated fixed cost will be US $ 3 million p.a. based on principle of ability to share;
(iii) Production capacity of the proposed project in India will be 5 million units;
(iv) Expected useful life of the proposed plant is five years with no salvage value;
(v) Existing working capital investment for production & sale of two million units through exports was US $ 15 million;
(vi) Export of the product in the coming year will decrease to 1.5 million units in case the company does not open subsidiary company in India, in view of the presence of competing MNCs that are in the process of setting up their subsidiaries in India;
(vii) Applicable Corporate Income Tax rate is 35%, and
(viii) Required rate of return for such project is 12%.

Assuming that there will be no variation in the exchange rate of two currencies and all profits will be repatriated, as there will be no withholding tax, estimate Net Present Value (NPV) of the proposed project in India.

Present value Interest Factors (PVIF) @ 12% for five years are as below:

Year	1	2	3	4	5
PVIF	0.8929	0.7972	0.7118	0.6355	0.5674

Solution: Financial Analysis whether to set up the manufacturing units in India or not may be carried using NPV technique as follows:

I. Incremental Cash Outflows

	$ Million
Cost of Plant and Machinery	500.00
Working Capital	50.00
Release of existing Working Capital	(15.00)
	535.00

II. Incremental Cash Inflow after Tax (CFAT)

(a) Generated by investment in India for 5 years

	$ Million
Sales Revenue (5 Million x $80)	400.00
Less: Costs	
Variable Cost (5 Million x $20)	100.00
Fixed Cost	30.00
Depreciation ($500Million/5)	100.00
EBIT	170.00
Taxes@35%	59.50
EAT	110.50
Add: Depreciation	100.00
CFAT (1-5 years)	210.50

(b) Cash flow at the end of the 5 years
(Release of Working Capital) 35.00

(c) Cash generation by exports (Opportunity Cost)

	$ Million
Sales Revenue (1.5 Million x $80)	120.00
Less: Variable Cost (1.5 Million x $40)	60.00
Contribution before tax	60.00
Tax@35%	21.00
CFAT (1-5 years)	39.00

(d) Additional CFAT attributable to Foreign Investment

	$ Million
Through setting up subsidiary in India	210.50
Through Exports in India	39.00
CFAT (1-5 years)	171.50

III. Determination of NPV

Year	CFAT ($ Million)	PVF@12%	PV($ Million)
1-5	171.50	3.6048	618.2232
5	35	0.5674	19.8590
			638.0822
Less: Initial Outflow			535.0000
			103.0822

Since NPV is positive the proposal should be accepted.

ADVANCED CAPITAL BUDGETING

LDR 1 ½ Hrs
LMR 10 Mins

A Effects of inflation in capital budgeting
B Risk analysis in capital budgeting
C Real Options in capital budgeting
D Replacement decisions

Effects of Inflation

- Nominal CF's are Cf's including effects of Inflation
- Real Cf's are Cf's excluding effects of inflation i.e. Cf's of future years but corresponds to price levels of yr 0
- Nominal Discounting rate is a discounting rate including inflation component
- Real Discounting rate excludes inflation component

eg. In year 0, Volume = 1000 units ; SP = ₹ 10

No Inflation World

	0	1	2
Volume	1000	1040	1100
SP	₹ 10	₹ 10.80 (real growth @8%)	₹ 11.664 (real growth @8%)
Sales (Real CF)		₹ 11232	₹ 12830.4
		₹ 10211 (discounted @ Real discounting rate of 10%)	₹ 10604

vs

World with Inflation @ say 5%

	0	1	2
Volume	1000	1040	1100
SP (Real)	₹ 10	₹ 10.80 (real growth @8%)	₹ 11.664 (real growth @8%)
		infl @5%	infl @5% for 2 years
SP (Nominal)		₹ 11.34	₹ 12.86 (x 1.08 x 1.05)
Sales (Nominal CF)		₹ 11794	₹ 14146
		₹ 10211 (discounted @ nominal discounting rate of 15.5% (1.10 x 1.05 - 1))	₹ 10604

Observe that PV is same in either case

- ✓ Nominal Cf's are discounted using Nominal discounting rates.
- ✓ Real Cf's are discounted using Real discounting rates.
- ✓ When preparing Statement of Cf's, remember that Nominal Cf's can be added to or subtracted from Nominal Cf's only. Similarly Real Cf's can be added to or subtracted from Real Cf's only.

Two formulas are relevant here

$\text{Nominal Cf's}_n = \text{Real CF } (1 + \text{Infl. rate})^n$

$(1 + \text{Nominal Disc rate}) = (1 + \text{Real Disc rate})(1 + \text{Infl. rate})$

Tutorial Note: In case of Cf's we use 'Power n'. However, in case of converting discounting rates from Nominal ⇌ Real, there is no concept of 'Power n' since rates are per annum.

Let's consider an Example

Project life = 3 years
Ini Inv = ₹ 8 lakhs
SP = ₹ 10 (in real terms)
Cost_{pu} = ₹ 4 (in real terms)
No. of units = 60000 per year
Real discounting rate = 10 %
Rate of inflation = 5 %

Solve: NPV using Real Cf's disc @ Real disc rate (RDR)

Year	0	1	2	3
Cost of machine (₹ 800000)				
Sales		600000	600000	600000
(-) Cost		240000	240000	240000
		360000	360000	360000
	327273			
@ RDR = 10%	297521			
	270473			
NPV	95267			

NPV using Nominal Cf's disc @ Nominal disc rate (NDR)

	0	1	2	3
(₹ 800000)				
Sales		630000 [10.50 x 60000]	661500 [11.025 x 60000]	694575 [11.57625 x 60000]
(-)Cost		252000 [4.20 x 60000]	264600 [4.41 x 60000]	277830 [4.6305 x 60000]
		378000	396900	416745
	327273			
@ NDR = 15.5%	297521			
	270473			
NPV	95267			

$\left(1 + \frac{\text{Nominal}}{\text{Disc rate}}\right) = \left(1 + \frac{\text{Real}}{\text{Disc rate}}\right)\left(1 + \text{Inflation rate}\right)$

$1 + NDR = 1.10 \times 1.05$

$\therefore NDR = 15.5\%$

Observe that PV of Cf's is same, you just need to use the correct discounting rate corresponding to the CF !

Let's make some modifications in the above example to understand the implications of depn related info

eg.. Cost of machine = ₹ 10 lakhs
SP (in real terms) = ₹ 10
VC is 30 % of SP

Cash FC (in real terms) = ₹ 60000
No. of Units = 60000
Salvage value = ₹ 7 lakhs (Nominal CF)

Life = 3 Yrs
Real Disc rate = 10 %
Infl. rate = 5 %
Tax rate = 30 %

Solve:

Particulars	0	1	2	3
Initial Investment - Cost of Asset	(10,00,000)			
Annual Cf's				
No. of units		60000	60000	60000
Sales Rev. @ 10 pu		6,00,000	6,00,000	6,00,000
Less: VC @ 3 pu		1,80,000	1,80,000	1,80,000
Less: Cash FC		60,000	60,000	60,000
CFBT [in real terms]		3,60,000	3,60,000	3,60,000
Less : Depn $\left(\frac{10 \text{ Lakhs} - 7 \text{ lakhs}}{3 \text{ Yrs}}\right)$	[is always in nominal terms]	1,00,000	1,00,000	1,00,000
PBT [in कुछ तो भी terms]		2,60,000	2,60,000	2,60,000
CFBT [in Nominal terms]		3,78,000	3,96,900	4,16,745
Less : Depn $\left(\frac{10 \text{ Lakhs} - 7 \text{ lakhs}}{3 \text{ Yrs}}\right)$		1,00,000	1,00,000	1,00,000
PBT [in Nominal terms]		2,78,000	296900	316745
Less : Taxes @ 30 %		83400	89070	95024
PAT		194600	207830	221721
Add: Depn		1,00,000	1,00,000	1,00,000
CFAT [in Nominal terms]		294600	307830	321721
PV @ Nominal disc rate i.e. 15.5%		255065	230753	208801

We would first need to convert CFBT to Nominal terms if we wish to deduct Depn

Depn is always a Nominal item, hence it can only be added to or subtracted from Nominal Cf's.

alternative way to calc CFAT
CFAT = CFBT (1 - t) + Depn x t

PV of Annual Cf's 694620

Alternatively, PV of Annual CF's can be calc as below

$CFBT_{1-3}$ = ₹ 360000

$CFBT\ (1-t)_{1-3}$ = ₹ 360000 x (1 - 0.3) = ₹ 252000 (in real terms)

PV of CFBT (1 - t) = 252000 (in real terms) x $PVAF_{@\ 10\%,\ 3\ Yrs}$ (Real disc. rate)

= ₹ 626687

PV of tax benefit on depn = ₹ 100000 x 30 % x $PVAF_{@15.5\%,3yrs}$ (Nominal CF; Nominal disc rate)

= ₹ 67933

Since depn is a nominal item hence tax benefit on depn will always be a Nominal CF.

∴ PV of Annual Cf's = 626687 + 67933 = ₹ 694620 (same as calc earlier)

Terminal Cf's

Salvage value (nominal)	7,00,000
PV of Terminal CF @ 15.5 %	454310

NPV = (-) ₹ 10 lakhs + ₹ 694620 + ₹ 454310

= + ₹ **148930**

Techniques of Risk Analysis in Capital Budgeting

Statistical Techniques

1. Probability
2. Variance or Standard Deviation
3. Coefficient of Variation
4. Hillier's Model

Conventional Techniques

5. Risk - adjusted Discount Rate
6. Certainty Equivalent Approach

Others Techniques

7. Sensitivity Analysis
8. Scenario Analysis
9. Simulation
10. Decision Tree
11. Cashflow utility approach

Statistical Techniques

Probability

Eg.1 Initial Investment = ₹ 10 lakhs

Annual Cf 's

Year 1		Year 2		Year 3	
Prob.	Cashflows	Prob.	Cashflows	Prob	Cashflows
0.30	₹ 500000	0.20	₹ 400000	0.10	₹ 300000
0.40	₹ 600000	0.60	₹ 600000	0.20	₹ 400000
0.30	₹ 700000	0.20	₹ 800000	0.30	₹ 500000
				0.40	₹ 600000

Q . Calc Expected Cf 's in each of the 3 Years

Solve: Expected Cash flows = Σ Prob. x Cashflows

Year 1

Prob (P)	CF's (CF)	P x CF
0.30	₹ 500000	₹ 150000
0.40	₹ 600000	₹ 240000
0.30	₹ 700000	₹ 210000
		$\overline{X}$ = ₹ 600000

Similarly

Expected CF's of Yr 2 = ₹ 600000

Expected CF's of Yr 3 = ₹ 500000

Variance or Standard Deviation

When directly various NPVs are given

Calc σ of NPV's in usual manner. {Refer Eg 2}

when Annual Cash Flows are given

Hilliers Model (aka Hillier's Hertz Model)

Independent / Uncorrelated CFs

Default assumption if Q is silent

CF's of suceeding years are not dependent on earlier periods i.e. No Correlation

$$\sigma_{PV} = \sqrt{\sum_{t=1}^{n} \frac{\sigma_{CF_t}^2}{(1+r)^{2t}}}$$

or

$$\sqrt{\sum_{t=1}^{n} \left(\frac{\sigma_{CF_t}}{(1+r)^t}\right)^2}$$

{Refer Eg 3 case (i)}

Dependent/ Perfectly correlated CF's

CF's of suceeding years are perfectly correlated to earlier periods

$$\sigma_{PV} = \sum_{t=1}^{n} \frac{\sigma_{CF_t}}{(1+r)^t}$$

{Refer Eg 3 case (ii)}

CF's are given against specific scenarios or Q mentions that these are the only possible stream of CF's {Refer Eg 4}

OR

CF's of next year are Conditional upon previous Year CF's {Refer Eg 5}

In all the above cases

Step 1: Calc a separate NPV under each possible Scenario / Stream of CF by using Decision tree path and

Step 2: Calc σ of NPV's in usual manner.

Eg2. A Project might end up with any of the 3 Scenarios

Scenarios	Prob.	NPV
Optimistic	0.20	+ 15000
Moderate	0.70	+ 6000
Pessimistic	0.10	- 3000

Calculate Risk (i.e. Std. Deviation) of the Project?

Solve:

Prob (P)	NPV (X)	P x X	dx	dx^2	pd_x^2
0.20	+15000	3000	8100		
0.70	+6000	4200	-900		
0.10	-3000	-300	-9900		
		$\overline{X}$ = 6900			Σpdx^2 = 23490000

Remember d_x means $(X - \overline{X})$ Not $(P \times X - \overline{X})$.

i.e. Risk σ = $\sqrt{23490000}$ = 4846.65

Eg3. Calculate Standard Deviation/ Risk of project for data given in eg1. assuming discounting rate of 10%

Solve: Step1: Calc std dev of CF's for each year

Year 1

Prob. (P)	CF (x)	P x X	$d_x = X - \overline{X}$	$dx^2 = (X - \overline{X})^2$	Pdx^2
0.30	₹ 500000	150000	- 100000	10000000000	3000000000
0.40	₹ 600000	240000	0	0	0
0.30	₹ 700000	210000	+ 100000	10000000000	3000000000
		$\overline{X}$ = 600000		ΣPdx^2 i.e. Variance	= 6000000000

Standard deviation (σ) = $\sqrt{\text{Variance}} = \sqrt{6000000000}$ = 77460

Similarly, Year 2 σ = 126491 ; Year 3 σ = 100000

Step 2: Use formula to calc Risk/ std dev of project

Case (i) Cf's are Independent

Year	σ_{cf}	PV of σ_{cf}	PV of σ_{cf}^2
1	77460	70418	4958694724
2	126491	104538	10928193444
3	100000	75131	5644667161
			21531555329

$\sigma_{project} = \sqrt{21531555329} = 146736$

Case (ii) If Cf's are Dependent

Year	σ_{cf}	PV of σ_{cf}
1	77460	70418
2	126491	104538
3	100000	75131
		250087

$\sigma_{project}$ = 250087

Eg4. If two projects are under consideration. Decide which project should be accepted based on Risk & Return.

Proj A [Initial Inv = 2500]

		CF	
	Prob	Year 1	Year 2
Opt	0.20	5000	4500
Mod	0.30	3000	1500
Pessi	0.50	1000	(1000)

Proj B [Initial Inv = 5000]

		CF	
	Prob	Year 1	Year 2
Opt	0.40	10000	8000
Mod	0.20	6000	5000
Pessi	0.40	(2000)	(4000)

Disc. Rate = 10%

(i) Calc Expected CF's for Yr 1 & 2

(ii) Calc NPV for both the Projects under each of the 3 scenarios.

(iii) Calc Risk i.e. Standard deviation for both the Proj.

(iv) Decide which Project to accept using Coefficient of Variation criteria .

Solve: (i) Proj A

Year 1			Year 2		
Prob	CF	P x CF	Prob	CF	P x CF
0.20	5000	1000	0.20	4500	900
0.30	3000	900	0.30	1500	450
0.50	1000	500	0.50	(1000)	(500)
	Expected CF_1 =	2400		Expected CF_2 =	850

Similarly, Proj B
Expected CF_1 = 4400
Expected CF_2 = 2600

(ii) Cal^{-n} of NPV under each of the three situations

Project A

	Cash Flows		PV_I @10%	NPV = PV_I - 2500	Prob	Prob x NPV
Situation	Year 1	Year 2				
Opt	5000	4500	8264	5764	0.20	1153
Mod	3000	1500	3967	1467	0.30	440
Pes	1000	(1000)	83	- 2417	0.50	- 1208.5
					Average NPV =	+ 385

Alternatively, $\frac{2400}{1.10^1} + \frac{850}{1.10^2} - 2500$

Similarly, Project B

	NPV	Prob.	NPV x Prob.
	10702	0.40	4281
	4587	0.20	917
	(10124)	0.40	(4050)
		Average NPV =	+ 1149

(iii) Cal^{n} of Risk i.e. Std Deviation

Project A

Prob (P)	NPV (X)	P x X	dx	dx^2	pdx^2
0.2	5764	.	5379	.	.
0.3	1467	.	1082	.	.
0.5	- 2417	.	- 2802	.	.
		385		$\sum pdx^2$ = i.e. Variance	10063547

$\sigma = \sqrt{10063547}$

= ₹ 3173

Similarly, Project B σ = ₹ 9471

(iv)

	Proj A	Proj B
NPV i.e. Return	385	1149
Std. Dev i.e.Risk	3173	9471
Coefficient of Variation $\left(\frac{\text{Risk}}{\text{Return}}\right)$ or $\left(\frac{\sigma}{\text{NPV}}\right)$	$\frac{3173}{385}$ = 8.2416	$\frac{9471}{1149}$ = 8.2428

Coefficient of Variation defines how much is the Risk per ₹ 1 of Return. Decision: Lower the CV, better is the project

An Aggressive Company will take decision based solely on NPV irrespective of Risks involved. Accordingly, it will Accept Proj B having Highest NPV

A Defensive Company will take decision based solely on Risk irrespective of Returns. Accordingly, it will Accept Proj A having Least Risk.

A rational company should look at both i.e. Return as well as Risk & hence take decision based on coefficient of Variation. Since there is no material difference between CV of both the projects ∴Co should take decision based on other aspects eg qualitative factors.

Eg5. If moderately dependent future cash flows from the project with probability distribution are given

Suppose, Possible cash flows from project for next 2 years are as follows:

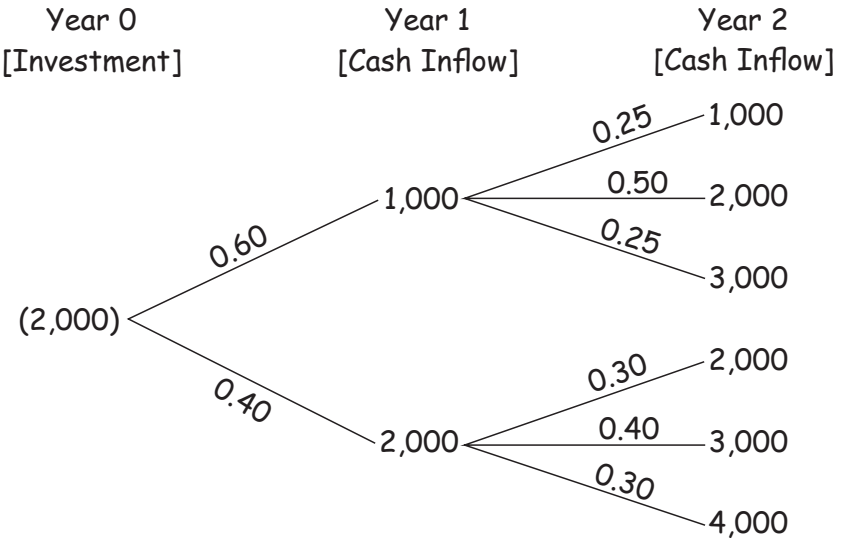
Year 1		Year 2	
Prob.	CF	Prob.	CF
0.60	1,000	0.25	1,000
		0.50	2,000
		0.25	3,000
0.40	2,000	0.30	2,000
		0.40	3,000
		0.30	4,000

Discount rate is 10% . Initial investment in project is ₹ 2,500.

Calculate expected NPV & standard deviation of the project.

Solve:

Step 1: Draw a decision tree showing various paths of cash flows from the project & calculate joint probability of each path (P).



Path	Joint Probabilities
1	0.15
2	0.30
3	0.15
4	0.12
5	0.16
6	0.12
	1.00

Step 2: Calculate NPV of each path (X).

NPV of Path 1 = [1,000 x 0.909 + 1,000 x 0.826] - 2,500 = -₹765
NPV of Path 2 = [1,000 x 0.909 + 2,000 x 0.826] - 2,500 = ₹61
NPV of Path 3 = [1,000 x 0.909 + 3,000 x 0.826] - 2,500 = ₹887
NPV of Path 4 = [2,000 x 0.909 + 2,000 x 0.826] - 2,500 = ₹970
NPV of Path 5 = [2,000 x 0.909 + 3,000 x 0.826] - 2,500 = ₹1,796
NPV of Path 6= [2,000 x 0.909 + 4,000 x 0.826] - 2,500 = ₹2,622

Step 3: Calculate Expected NPV (ENPV) of the project using $ENPV(\overline{X}) = \sum P \times X$

&

Step 4: Calculate risk of the project

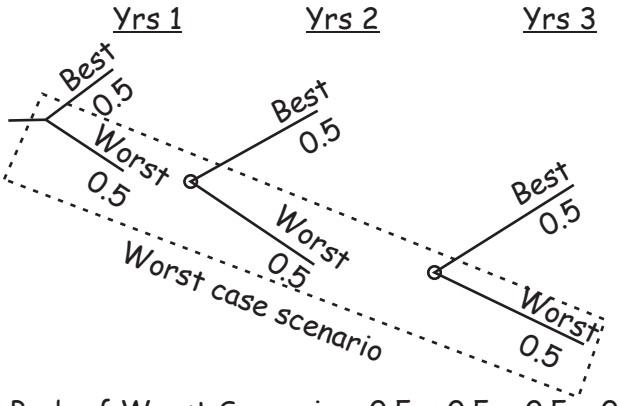
Standard deviation of project (σ) = $\sqrt{\sum p (x - \overline{X})^2}$

Joint prob (P)	NPV (X)	ENPV	$(x - \overline{X})$	$(x - \overline{X})^2$	$(x - \overline{X})^2 \times P$
0.15	-765	-114.75	-1,520	23,10,400	3,46,560
0.30	61	18.3	-694	4,81,636	1,44,491
0.15	887	133.05	132	17,424	2,614
0.12	970	116.4	215	46,225	5,547
0.16	1,796	287.36	1,041	10,83,681	1,73,389
0.12	2,622	314.64	1,867	34,85,689	4,18,283
	ENPV ($\overline{X}$) =	755		Variance (σ^2)	= 10,90,883

Standard Deviation (σ) = $\sqrt{10,90,883}$ = 1,044

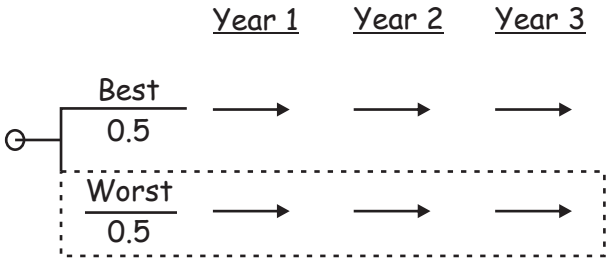
How to calc Prob. of Worst or Prob. of best outcome when CF's are Correlated vs Not Correlated

Cf's are Uncorrelated i.e. '0' Correlation.



Prob of Worst Scenario = 0.5 x 0.5 x 0.5 = 0.125

Cf's are Perfectly Positively Correlated.



Prob of Worst Case Scenario = 0.50 Probability

Conventional Techniques

Risk Adjusted Discount Rate {Refer LDR Q for details}

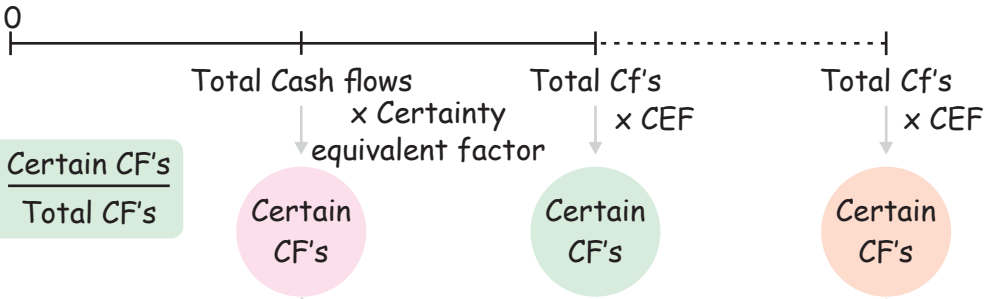
Not all the Projects are equal in terms of Risk. Some Projects involve less risk & some are more risky. Hence it would be wrong to discount every Project by Firm's K_o.

It would be appropriate to discount high risk projects at a higher discount rate and vice-versa.

RADR i.e. Risk Adjusted Discount Rate = Risk free rate + Risk Premium specific to project

Higher the Risk, higher would be the Risk Premium. One way to calculate risk premium is: $(K_o - R_f) \times$ Risk index of project

Certainty Equivalent Approach or Alpha Approach (α) {Refer LDR Q for details}

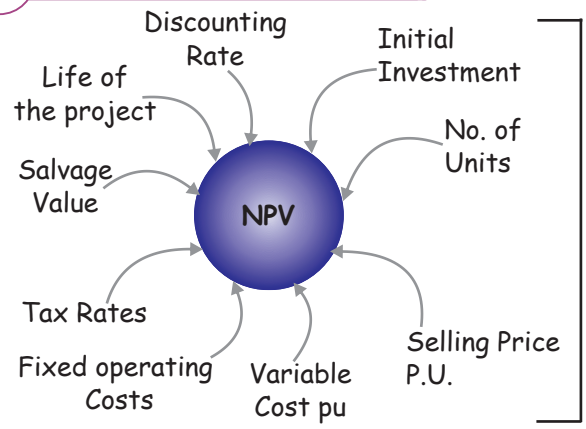


$CEF = \frac{CCF}{TCF}$ i.e. $\frac{\text{Certain CF's}}{\text{Total CF's}}$

If +ve NPV then Accept the Project
If -ve NPV then Reject the Project

Others Techniques

Sensitivity Analysis



An Adverse change beyond a certain level in even a single variable might lead to NPV falling below '0' & make it a loss making project

Eg. Initial Investment = ₹ 100000 Annual CF's = ₹ 40000
Life = 4 Years Disc Rate = 10%

Calculate NPV

Solve:

Year	Cf's	PVF@10%	PV
1	40000	0.909	36363
2	40000	0.826	.....
3	40000	0.751	.....
4	40000	0.683	.....
		PV_I	126795
		Less: Ini Inv	100000
		NPV	+ 26795

Two varieties of Q can be asked in exams

Variety 1 Calculate Sensitivity of a Variable that leads to '0' NPV (aka Break-even approach).

Variety 2 Calculate Impact on NPV due to a given adverse change in a variable

Variety 1

Assume Variable as 'x' & set NPV = 0

Cal Sensitivity % w.r.t

- Initial investment
- Annual Cf's
- Discounting Rate i.e. K_o
- Life of the project

Solve:

$$\text{Sensitivity \%} = \frac{\text{Change}}{\text{Base}} \times 100$$

(i) Sensitivity w.r.t. Initial Investment

Initial Investment may increase by ₹ 26795 at which NPV = 0

$$\therefore \text{ Sensitivity \%} = \frac{26795}{100000} \times 100 = 26.795\%$$

(ii) Sensitivity w.r.t. Annual CF's

Alt 1: Let the Annual Cf's be x at which NPV = 0

NPV = PV of Inflows - Initial Inv.

= Annual Cf's x $PVAF_{(@r\%,\ n\ Yrs)}$ - Initial Inv.

0 = X x $PVAF_{(@10\%,\ 4\ Yrs)}$ - 100000

0 = X x 3.169 - 100000

∴ X = 31547

$$\text{Sensitivity \%} = \frac{40000 - 31547}{40000} \times 100 = 21.13\%$$

Alt 2:

Thought behind this alt

A change in Annual CF's leads to the same proportionate change in PV of such CF's. To be precise, if Annual CF's reduces by 50%, then PV of such Annual CF's also reduces by 50%.

PV of Inflows, at present, is ₹ 126795 and it can fall to ₹ 100000 before NPV turns negative

$$= \frac{126795 - 100000}{126795} \times 100 = 21.13\%$$

(iii) Sensitivity w.r.t. Discounting Rate

Tip Simply calc IRR

Year	Cf's	PV @ 20%	PV @ 25%
1	40000		
2	40000	.....	
3	40000	.....	
4	40000	.....	
	PVI	103550	
	Less: Ini Inv	100000	
	NPV	+3550	(5536)

Using interpolation

IRR = 21.95%

$$\text{Sensitivity \%} = \frac{21.95\ \% - 10\%}{10\%} \times 100 = 119.5\%$$

(iv) Sensitivity % w.r.t life of the Project -

Tip Simply calculate Discounted Pay-back Period (aka Breakeven life of the project)

Year	Cf's	PV of Cf's	Cumulative PV of CF's
1	40000	36363	36363
2	.	.	.
3	.	.	99475
4	.	27320	126795

$$= 3 \text{ Years} + \frac{525}{27320} = 3.0192 \text{ Years}$$

$$\text{Sensitivity \%} = \frac{4 - 3.0192}{4} \times 100 = 24.52\%$$

Conclusion:

It can observed that our Project is Most sensitive to 'Annual CF's [Since just 21.13% change will lead to NPV = 0] & Least sensitive to Disc. Rate

Variety 2: When % adverse change in variable is given in the Q

Q. Calculate % Change in NPV for 10% adverse change in each of the four variables.

Solve: Particulars	Base Case	(i) If initial investment changes	(ii) If Annual Cf's Changes	(iii) If Disc. Rate Changes	(iv) If Life Changes
Initial Investment	100000	110000	100000	100000	100000
Annual CF's	40000	40000	36000	40000	40000
Life	4 Yrs	4 Yrs	4 Yrs	4 Yrs	3.6 Yrs
Disc. Rate	10%	10%	10%	11%	10%
PVAF(@r%, n Yrs)	3.169	3.169	3.169	3.0124	-
PV of CF's	126795	126795	114115	124098	116503 [wn#1]
NPV	26795	16795	14115	24098	16503
% change in NPV	-	37.32% $\left[\frac{26795 - 16795}{26795}\right]$	47.32% Most Sensitive $\left[\frac{26795 - 14115}{26795}\right]$	10.06%	38.41%

WN#1

Year	Cf's	PVF	PV
1	40000	0.909	36363
2	40000	0.826	33058
3	40000	0.751	30053
3.6	$24000 \left[40000 \times \frac{0.6\ Yr}{1\ Yr}\right]$	$1/(1.10)^{3.6}$ = 0.7095	17029
		PV_I	116503
		Pv_0	100000
		NPV	16503

How to convert Variety 2 to Variety 1 answers

Q. Calc Sensitivity % that would lead to NPV = 0 using above calculated Answers in variety 2

Tip Use Cross Multiplication Technique i.e. for 10% Shock (i.e. adverse change) in a particular variable, NPV changes by _._%, therefore, how much shock will be required for NPV to change by 100% [i.e. NPV to become 0]

Note: This method works well only for variables having linear relationship (such as net cashflow, Ini inv) with NPV. In case of other variables (such as discount rates, life) that bears non-linear relationship the answers will only match approximately.

Verification: If Ini Inv. changes

NPV falls by — Increase in Initial investment

$\because$ 37.32% — 10%

$\therefore$ 100% — ? $= \frac{100\% \times 10\%}{37.32\%} = 26.795\%$

Q . Calc sensitivity % to Annual Cf's if Annual CF's are as below (instead of ₹ 40000)

Year	1	2	3	4
Cash Flow	₹30000	₹ 40000	₹ 50000	₹ 60000

Solve: Cal^{-n} of NPV

Year	Cf's	PVF @ 10%	PV
1	30000		.
2	40000		.
3	50000		.
4	60000		.
		PV_I	138877
		(-) Ini Inv	100000
		NPV	38877

Cal^{-n} of Sensitivity %

Tip If Annual CF's are Not same across years then we can't assume 'Let the Annual CF's be x at which NPV = 0'.
Rather simply calc What % fall is required in PV terms of Annual CF's so that NPV = 0 ?'
The % fall as calc above will also be applicable to Actual Annual CF's of the respective years.

$$= \frac{138877 - 100000}{138877} \times 100 \qquad = 27.99\% \sim 28\%$$

Exam Tip

1. Which method to follow in Exams to solve Sensitivity Analysis Q's ?

When Q mentions Adverse change % (say 25% adverse change) in Variables	When Q asks about "how much change in variable can be done such that NPV becomes 'Zero'"	When Q simply asks Sensitivity % but doesn't specify method
Variety 2	Variety 1	Variety 2 [Use standard shock of 10%] plus convert those Answers to Variety 1 type
If Q asks sensitivity % then write +ve% If Q asks impact on NAV then -ve%		

2. If Q asks sensitivity % then write answer in +ve%. If Q asks impact on NPV then write answer in -ve%

Scenario Analysis {Refer LDR Q for details}

Sensitivity Analysis has a shortcoming that it assumes change in only One Variable at a time. However, in practical life what if multiple variables starts changing, simultaneously ? The answer lies in 'Scenario Analysis'.

Under this method, we first develop a 'Base case scenario' & then go for Best Case Scenario as well as worst case Scenario etc.
If it is possible to assign Probabilities for each scenario then 'Expected NPV' may also be calculated as
Expected NPV = $\sum Prob_{Scenario} \times NPV_{Scenario}$

Simulation {Refer LDR Q for details}

is a random number technique that is used when other mathematical models or analytical techniques cannot be used.

Steps in simulation technique

Step 1 Construct Random nos. range with the help of prob distribution (or Cumulative prob distribution)

Step 2 Simulation Run table with the help of random nos. to generate outcomes

Step 3 Take decision by looking at Average of the final result of each trial.

Example: We wish to construct & operate a Mall costing ₹ 750 cr. investment & required return on investment of 15 %.

Solve: Step 1 Random Nos. Range

Footfall

Prob	Random Nos. range	No. of footfalls
0.30	00 - 29	5000
0.50	30 - 79	7000
0.20	80 - 99	10000

% Customers

Prob	RNR	% Shopping
0.50	00 - 49	20%
0.30	50 - 79	40%
0.20	80 - 99	50%

Revenue per Customer

P	RNR	Shopping
0.15	00 - 14	₹ 1000
0.20	15 - 34	₹ 5000
0.50	35 - 84	₹ 10000
0.15	85 - 99	₹ 25000

Profit Margin @ 25 %

Step 2 Simulation Run

Random No.	Footfall	Random No.	% Shopping	Random No.	Avg ₹	Total Profit per day
55	7000 Footfalls	06	20%	79	₹ 10000	₹ 35 Lakhs
.	.	.	.	.	.	.
.	.	.	.	.	.	.
					Total Profit	= ₹ - - - -
					Avg Profit	= ₹ 43 lakhs per day (say)

[7000 x 20% x ₹ 10000 @ 25% profit]

[Total Profit / No. of Trials]

Step 3 Compare Avg profit calc above with your Required profit & take decision

Required Profit = ₹ 750 cr x 15% = ₹ 112.5 cr

Since Avg Profit [₹ 43 lakhs x 365 days i.e. ₹ 156.95 cr] > Required profit [₹ 112.5 cr] , therefore, Co. can accept the project.

Cash flow Utility Approach {Refer LDR Q for details}

Rather than discounting the Cf's we would first translate the Cf's into Utility Score & than evaluate the project.

Formula/ Manner to translate Cf'c into utility score is given in the Q

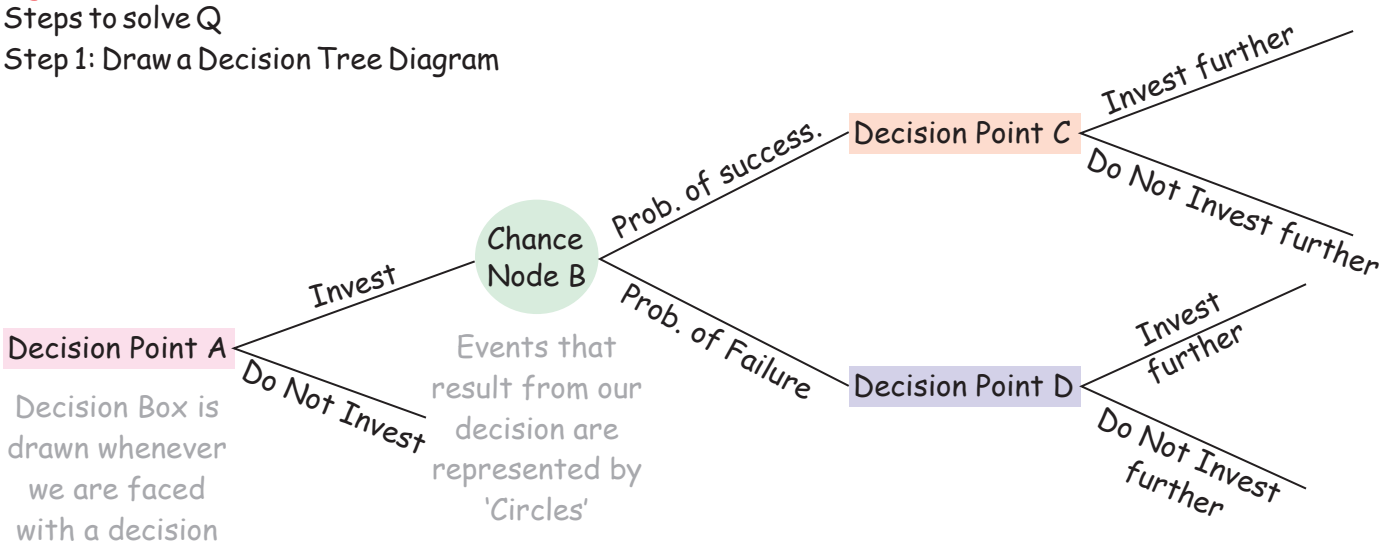
Decision Tree Techniques {Refer LDR Q for details}

is used to solve complex decision making situations which require further Investment decisions in future on the basis of probable future events

Decision Tree's are prepared from 'left to right' but solved from 'right to left'.

Steps to solve Q

Step 1: Draw a Decision Tree Diagram



Step 2: Calc NPV of Investment decision at Decision Point 'C' & 'D', and then decide whether it is beneficial to invest or not at chance Node C & D.

Step 3: Calc Expected Monetary Value (EMV) at Chance Node 'B' as follows :

Outcome	Probability	Benefit Amount at Decision Point [If negative, it is not beneficial to invest, consider it as '0']	Probability x Benefit Amount
Success [Decision Point 'C']	0._ _	xxx	xxx
Failure [Decision Point 'D']	0._ _	xxx	xxx
		Expected Monetary Value (EMV)	xxx

Step 4: Take Decision at Decision Point 'A' by considering Investment Amount & EMV as calculated at Chance Node 'B'.

Real options in capital budgeting

Managers can, & often do, make changes over the life of the project that affect subsequent Cf's. The presence of real options enhances the worth of the project.

NPV with Option = NPV W/o Option + Value of an Option

Three types of Option

Option to Expand/ Grow i.e. Call Option

Expansion is done when

PV of Incremental Cf's > Incremental Inv in expansion

Option to Abandon i.e. Put Option

A project is abandoned when

Abandonment value > PV of Subsequent future Cf's on continuing

Option to Delay/Wait i.e. Timing Option

is used when by waiting you expect to obtain new info that may improve your decision making

Example: Option to Expand

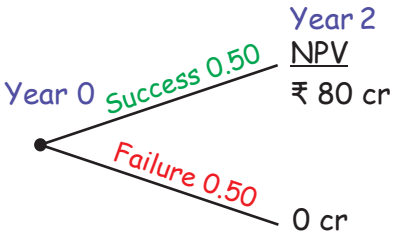
A Co. is thinking about launching a new project. There is a 50:50 chance of success & failure. The NPV of this project is found to be (-) ₹ 25 crores.

However, if successful, Co. has an option to expand the project 2 yrs later by investing ₹ 400 crores & this will generate PV of inflows of ₹ 480 crores at the end of yr 2.

Disc rate is 10% pa.

Calculate (i) Value of call Option (ii) NPV With Option

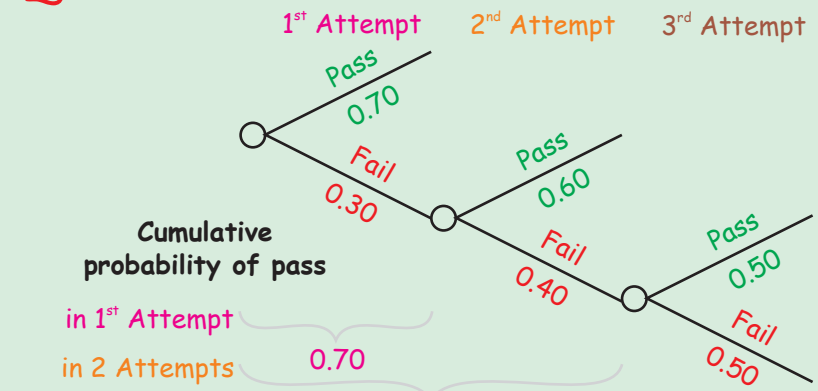
Solve: NPV W/o Option = - 25 cr.



Value of option to expand = $\frac{₹\ 80\ cr \times 0.50}{1.10^2}$ = ₹ 33.06 cr.

∴ NPV with option = (-) 25 cr + ₹ 33.06 cr = ₹ 8.06 cr.

Concept of Probability Vs. Cumulative probability.



Cumulative probability of pass

in 1st Attempt

in 2 Attempts 0.70

in 3 Attempts 0.70 + (0.30 x 0.60) = 0.88

(i.e. Pass in either 1st or 2nd or 3rd attempt) 0.88 + (0.30 x 0.40 x 0.50) = 0.94

Example: Option to Abandon

Tractor manf Co. - Planning to launch a new tractor with project life = 2 yrs; Ini inv = ₹ 300 crores

Projected CF's

Year 1		Year 2	
Prob.	CF (in crores)	Prob.	CF (in crores)
0.25	100	0.25	0
		0.50	100
		0.25	200
0.50	200	0.25	100
		0.50	200
		0.25	300
0.25	300	0.25	200
		0.50	300
		0.25	350

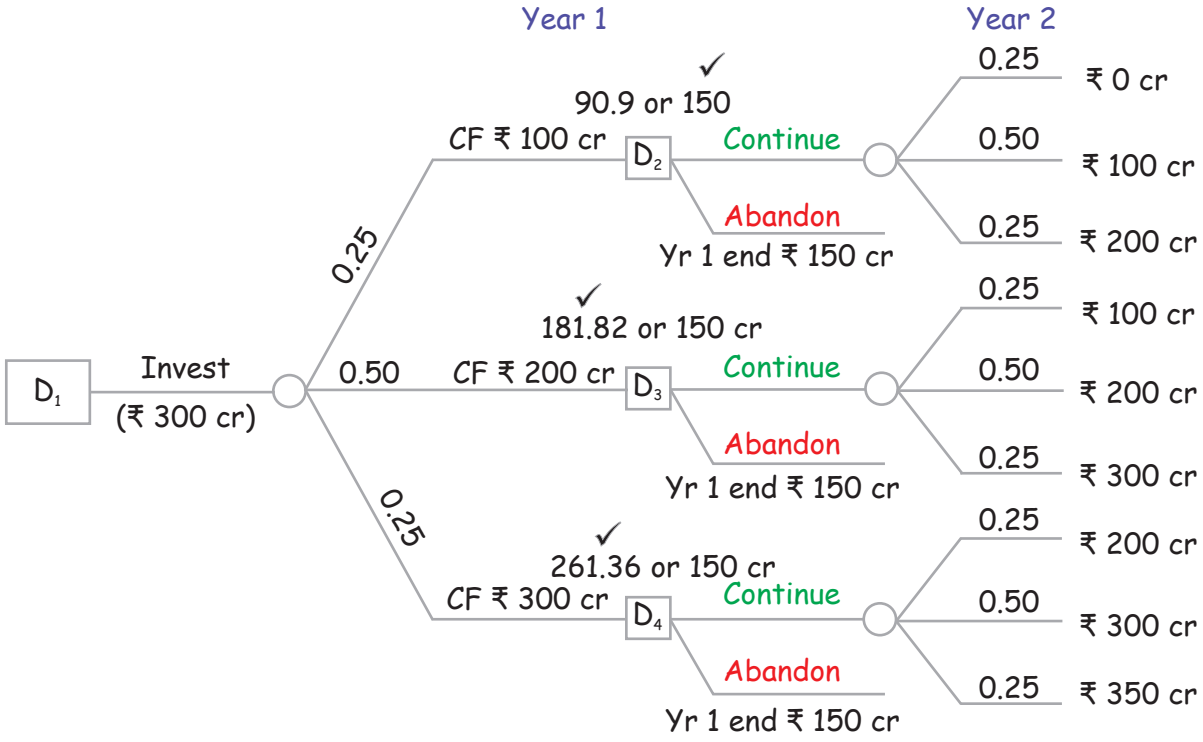
Disc rate = 10 % pa.

There is an option to abandon the project at year 1 end by realizing ₹ 150 cr.

Calculate

(i) NPV of Original Project

(ii) Value of abandonment option & NPV with Option.



(i) NPV w/o Option

$$= (-)\ ₹\ 300\ cr + \frac{(0.25 \times 100) + (0.50 \times 200) + (0.25 \times 300)}{1.10^{1}}$$

$$+ \frac{0.25 \times \begin{pmatrix} 0.25 \times 0 \\ 0.50 \times 100 \\ 0.25 \times 200 \end{pmatrix} + 0.5 \times \begin{pmatrix} 0.25 \times 100 \\ 0.50 \times 200 \\ 0.25 \times 300 \end{pmatrix} + 0.25 \times \begin{pmatrix} 0.25 \times 200 \\ 0.50 \times 300 \\ 0.25 \times 350 \end{pmatrix}}{1.10^{2}}$$

= + ₹ 44.53 cr

(ii) Alternative 1.

Option to abandon is exercisable only when project falters in yr 1 i.e. CF = ₹ 100 cr only path. In rest of the situations it seems better to continue rather than exercise abandon option.

$$\text{Value of Abandonment Option} = 0.25 \times \frac{(150\ cr - 90.9\ cr)}{1.10^{1}}$$

= ₹ 13.43 cr

∴ NPV with option = ₹ 44.53 cr + 13.43 cr

= ₹ 57.96 cr

Alternative 2.

NPV with option

$$= (-)\ ₹\ 300\ cr + \frac{(0.25 \times 100) + (0.50 \times 200) + (0.25 \times 300)}{1.10^{1}} + \left[\frac{0.25 \times 150}{1.10^{1}} + \frac{0.5 \times \begin{pmatrix} 0.25 \times 100 \\ 0.50 \times 200 \\ 0.25 \times 300 \end{pmatrix} + 0.25 \times \begin{pmatrix} 0.25 \times 200 \\ 0.50 \times 300 \\ 0.25 \times 350 \end{pmatrix}}{1.10^{2}}\right]$$

$= +\ ₹\ 57.96\ cr$

$\therefore$ Value of Abandonment Option = ₹ 57.96 cr - ₹ 44.53cr
= ₹ 13.43 cr

Advanced Cap Budg + Derivatives

If probability of success / failure (the two possible outcomes on undertaking the project) are NOT given then use the concept of "Risk Neutral Model/ The Binominal Model" to find probabilities.

You got it right ! It's a mixture of Derivatives + Real options in capital budgeting.

How to set parameters for applying Risk Neutral / The Binomial Modal

Binomial model data input required	Project paramaters to use	
	Abandonment Option [Put Option]	Timing Option/ Growth Option [Call Option]
Current price of underlying [S_0]	PV of future cash inflows from the project	
Strike price [E or X]	Abandonment value of project	Investment amount in project/ Cost of project
Expected price of underlying (Move up) [$_uS_1$]	PV of Cf's from the project on future Investment/ Abandonment date [Higher]	
Expected price of underlying (Move Down) [$_dS_1$]	PV of Cf's from the project on future Investment/ Abandonment date [lower]	
Time Period [t]	Time till future Investment/ Abandonment date	

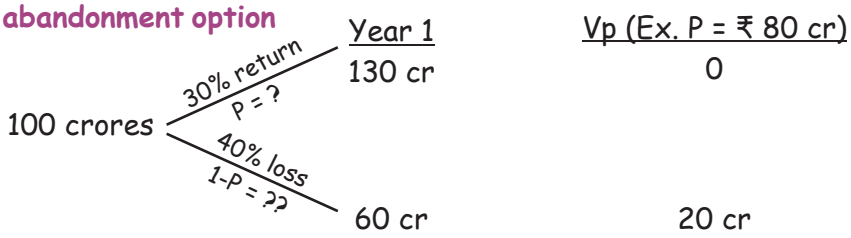
Example: ICAI RTP May 2016, Exam Nov 2024 (Similar), MTP Nov 2024 (Similar)
Ini inv = ₹ 110 crores
PV of proposal = ₹ 100 crores without abandonment option

However, if market conditions turns favourable PV of proposal shall increase by 30%. If remains sluggish then PV of proposal shall reduce by 40%.

In case Co. is not interested in continuation of the project it can be disposed off for ₹ 80 cr at the end of yr1

Rf = 8%, calc value of abandonment option & value of project with abandonment option.

Solve: **Value of abandonment option**



Caln of probabilities using risk neutral model

Do not make the mistake of putting K_o here

Rf	= % upside x P + % downside x (1 - P)
0.08	= 0.30 x P + -0.40 (1 - P)
0.08	= 0.30P - 0.40 + 0.40P
0.48	= 0.70P
∴P	= 0.686

OR

$$P = \frac{i - d}{u - d} = \frac{1.08 - 0.60}{1.30 - 0.60} = 0.686$$

Value of abandonment option

Expected payoff at = ₹ 0 cr x 0.686 + ₹ 20 cr x (1 - 0.686)

Yr 1 end = ₹ 6.28 cr

∴Present value of abandonment option = $\frac{₹\ 6.28\ cr}{1.08}$ = ₹ 5.81 cr

NPV w/o abandonment option = 100 - 110 crores = (-) 10 crores

NPV with abandonment option = (-) 10 + 5.81 crores = (-) 4.19 crores.

How to use Black scholes model for calculating value of an option in case of capital budgeting projects

Example: Project --> Constructing railway coaches for Indian railways. Initial investment = ₹ 98 cr

Year	Cf's
1	+40 cr
2	+31 cr
3	+36 cr

K_o = 18%

This project gives your firm the right to enter into another project of railway coaches maintenance after 3 yrs by investing ₹ 600 crores & generating perpetual CF of ₹ 160 cr p.a.

Rf = 7% Volatility σ = 20%

a) Find NPV of original proposal to construct railway coaches

b) Find V_c using The Black scholes model

c) Find combined NPV including maintenance proposal & decide

Solve:

(a) Calc NPV = PV_I - Ini inv = $\frac{40}{1.18^1} + \frac{31}{1.18^2} + \frac{36}{1.18^3}$ - 98 = - 19.94 crores

(b) r = 0.07

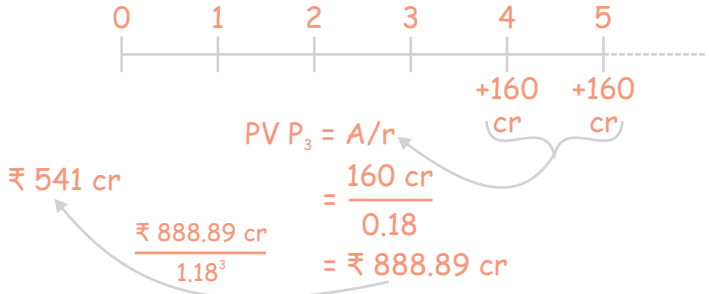
t = 3 years

σ = 0.20

Ex. price = ₹ 600 crores

S_o = ₹ 541 crores

$\left[\frac{160\ cr}{0.18} \times \frac{1}{1.18^3}\right]$



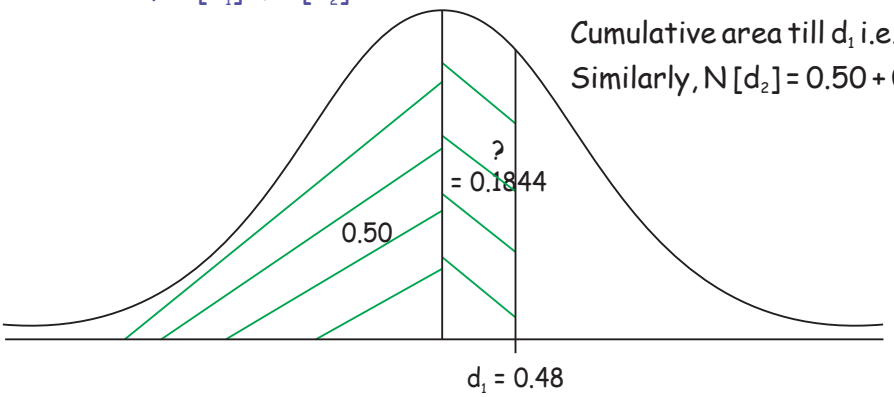
Caln of d_1 & d_2

$$d_1 = \frac{\text{Ln}\,[S_o / E] + [r + 0.5\,\sigma^2]\,t}{\sigma\sqrt{t}}$$

$$= \frac{\text{Ln}\,[541 / 600] + [0.07 + 0.5\,(0.20)^2]\,3}{0.20\sqrt{3}} = \frac{\text{Ln}\ 0.9017 + 0.27}{0.3464} = \frac{-0.10348 + 0.27}{0.3464} = 0.48$$

$d_2 = d_1 - \sigma\sqrt{t} = 0.48 - 0.20\sqrt{3} = 0.13$

Caln of $N[d_1]$ & $N[d_2]$



Cumulative area till d_1 i.e. $N[d_1] = 0.50 + 0.1844 = 0.6844$

Similarly, $N[d_2] = 0.50 + 0.0517 = 0.5517$

$$V_c = S_o \times N[d_1] - \frac{E \times N[d_2]}{e^{rt}}$$

$$= 541 \times 0.6844 - \frac{600 \times 0.5517}{e^{0.07 \times 3}}$$

$$= 541 \times 0.6844 - \frac{331.02}{1.23368}$$

$$= 101.94$$

(c) NPV with option = (-) 19.93 + 101.94 = + 82.01 cr ∴we can accept the project

Replacement Decisions

(1) Replace or Continue Old machine as on today

(2) Calculation of Optimum replacement cycle

(3) When to replace viz - Today vs 1 yr later vs 2 yr later vs ...

Replacement Decisions

Use 'Incremental' Approach i.e (i) Incremental Ini Inv (ii) Increments Annual Cf's (ii) Increments CF's

Eg.

Old Machine

New Machine

	Cost of New Machine	25,00,000
500000	Sale Proceeds on sale of old Machine today	
5 Years	Remaining Life / Life	5 Years
50,000	Salvage value at the end of life	3,00,000
90000 units	Production Capacity	100000 units
₹ 120	Selling Price pu	₹ 120
55	VC pu	₹ 50
600000 p.a.	Repairs & Maint	200000 p.a.
42 lakhs	Other Op Fixed cost	40 lakhs
40%	Tax Rate	40%
15%	Ko	15%

Solve: Evaluation of replacement decision — Used in Exams

Particulars	Old Machine	New Machine	Incremental Approach
A. Initial Investment			
Cost of new Machine		(25,00,000)	(25,00,000)
Proceeds on sale of old machine	(5,00,000) being Opp loss		5,00,000
	Incremental Initial Investment		(20,00,000)
B. Annual CF's			
No. of units	90000	100000	
Sales Revenue	₹ 108 lakhs	₹ 120 lakhs	₹ 12 lakhs
Less : Variable Cost	₹ 49.5 lakhs	₹ 50 lakhs	₹ 0.5 lakhs
Contri	58.5 lakhs	₹ 70 lakhs	11.5
Less : Repairs & Maint	6	2	Savings 4
: Other Op. cost	42	40	Savings 2
CFBT	10.5 lakhs	₹ 28 lakhs	₹ 17.5 lakhs
Less : Depn	0.90 lakhs [500000 - 50000 / 5 yrs]	4.4 [₹ 25 lakhs - 3 lakhs / 5 yrs]	₹ 3.5 lakhs Incremental Depn
PBT	9.60 lakhs	₹ 23.6 lakhs	14 lakhs
Less : Taxes @ 40 %			
PAT			
Add back : Depn			Incremental
CFAT	6.66 lakhs	18.56 lakhs	CFAT 11.90 lakhs
PVAF (@15%,5 yrs)	3. _ _ _	3. _ _ _	3. _ _ _
PV of Annual CF's	22.32 lakhs	62. _ lakhs	39.89 lakhs
C. Terminal CF's			
Salvage Value	0.50 lakhs	3 lakhs	2.5 lakhs
PVAF (@15%,5th yrs)	0. _ _ _	0. _ _ _	0. _ _ _
PV of Terminal CF	0.25 lakhs	1.49 lakhs	1.24 lakhs
NPV	17.57 lakhs	Vs. 38.71 lakhs	Incremental NPV 21.13 lakhs

If +ve then Replace, if -ve then Continue Old

Caution Note regarding Terminal CF's

Old Asset	New Asset	Incremental
Sale value of Old Asset	Sale value of New Asset	~~Incremental Sale value~~ Not Recommended
+/- Tax Treatment on CG/CL	+/- Tax Treatment on CG/CL	~~Incremental Tax Treatment~~
Step ① After tax salv of old	Step ② After tax salv of New	= Incremental After tax salv value
		Step ③ = Step ② - Step ①

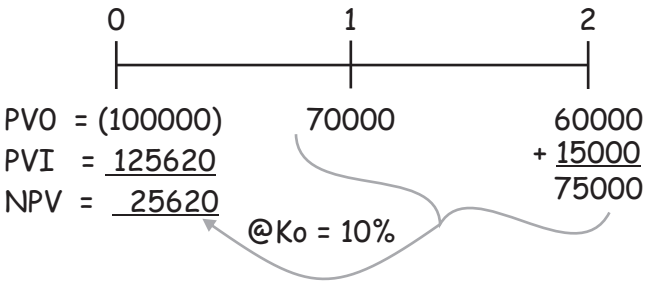
Recommended Approach in Exams Step ①, ② & ③

Projects with Unequal life {CA Inter Concept}

	Made in China machine [Mach - A]	Made in Japan machine [Mach - B]
Cost of machine	1,00,000	1,80,000
Life	2 Years	3 Years
Salvage value	15,000	18,000
Net CFAT Year 1 2 3	 70,000 60,000 -	 90,000 80,000 70,000
Ko	10%	

Solve :

Made in China machine



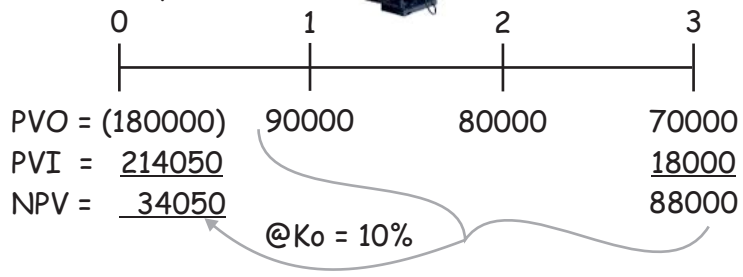
Since life of both the Machines is Unequal, therefore, we cannot Compare NPVs

We have to calc ENPV & then Compare ENPV

$$ENPV = \frac{NPV}{PVAF_{(@\ r\%,\ life\ yrs)}}$$

$$= \frac{25620}{PVAF_{(@\ 10\%,\ 2\ yrs)}} = \frac{25620}{1.735} = 14762$$

Made in Japan machine



$$ENPV = \frac{NPV}{PVAF_{(@\ r\%\ life\ yrs)}}$$

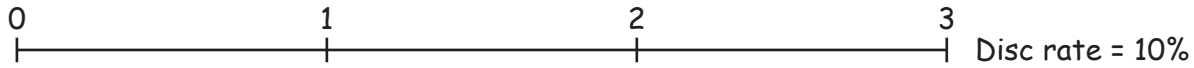
$$= \frac{34050}{PVAF_{(@\ 10\%,\ 3\ yrs)}} = \frac{34050}{2.486} = 13692$$

Decision: We should select 'Made in China' machine since it results in higher ENPV

Optimum replacement cycle

here, we have to decide after every how many years shall we replace the asset

Example



Cost of asset (₹ 15,00,000)

CFAT	₹ 750000	₹ 600000	₹ 350000
Salvage value at the end of respective year	₹ 1100000	₹ 825000	₹ 600000

If replace after every 1 year

NPV = 181818

ENPV or EAC ₹ 200000 ₹ 200000 ₹ 200000 ₹ 200000 . . .for ∞ yrs

$$\left[\frac{\text{NPV}}{\text{PVAF}_{@\ r\%,\ n\ yrs}}\right]$$

If replace after every 2 years

NPV = 359504

ENPV or EAC ₹ 207143 ₹ 207143 ₹ 207143 ₹ 207143 . . .for ∞ yrs

If replace after every 3 years

NPV = 391435

ENPV or EAC ₹ 157402 ₹ 157402 ₹ 157402 ₹ 157402 . . .for ∞ yrs

Decision: Since ENPV is highest when machine is replaced every 2 yrs ∴ optimum replacement cycle = 2 years.

Steps in exam

Step 1 Calculate NPV for each of the possible replacement cycle.

Step2 Convert NPV into ENPV

Decision criteria Select replacement cycle with highest ENPV [In case of only outflows related data being given then select lowest ENPV. $\left(\text{or EAC } \frac{\text{NPV}}{\text{PVAF @r\%, n yrs}}\right)$

When to replace the old machine i.e. Timing of replacement of old machine

[Source ICAI Study Material]

A & Co. is contemplating whether to replace an existing machine or to spend money on overhauling it. A & Co. currently pays no taxes. The replacement machine costs ₹ 90,000 now and requires maintenance of ₹ 10,000 at the end of every year for eight years. At the end of eight years it would have a salvage value of ₹ 20,000 and would be sold. The existing machine requires increasing amounts of maintenance each year and its salvage value falls each year as follows:

Year	Maintenance (₹)	Salvage (₹)
Present	0	40,000
1	10,000	25,000
2	20,000	15,000
3	30,000	10,000
4	40,000	0

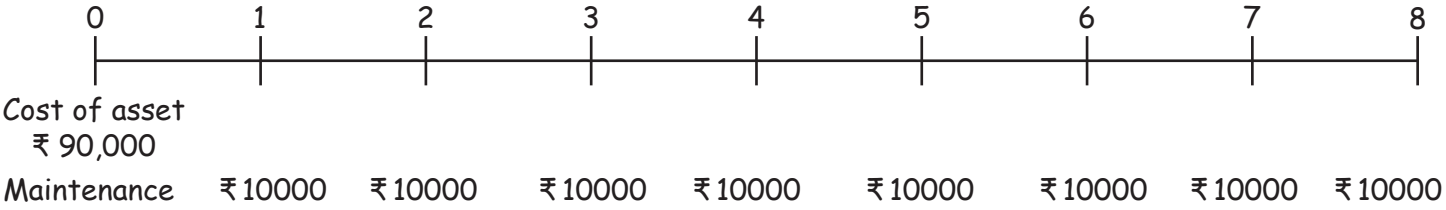
The opportunity cost of capital for A & Co. is 15%.

Required: When should the company replace the machine?

(PVAF for 8 years = 4.4873; PVF for 8th year = 0.3269).

Solve: Step 1: Calculate NPV & ENPV of (Pure) New machine CF's

i.e. don't mix any of the CF related to old machine



NPV = 128335

ENPV or EAC ₹ 28600 ₹ 28600 ₹ 28600 .... ₹ 28600 for ∞ yrs

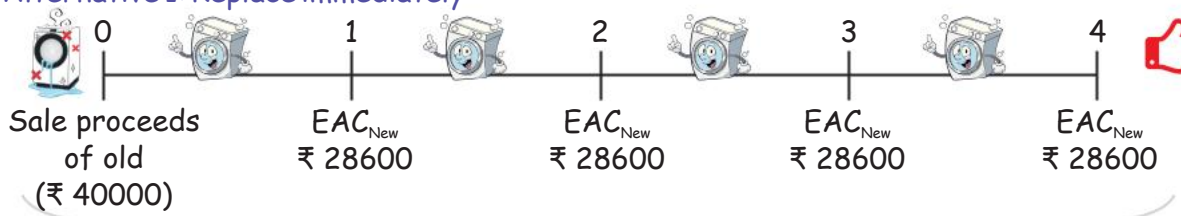
$$\left[\frac{NPV}{PVAF_{@\ r\%,\ n\ yrs}} = \frac{128335}{4.4873}\right]$$

Step 2: Develop various alternatives viz

- ✓ Replace immediately,
- ✓ Replace after 1 year,
- ✓ Replace after 2 year
- ✓ & so on ....

Concept: The life of all these alternatives will be kept the same which will be equal to the max. possible life of old machine. Hence. if max life of old is 3 years (say) then all the alternatives will have equal life of 3 yrs.

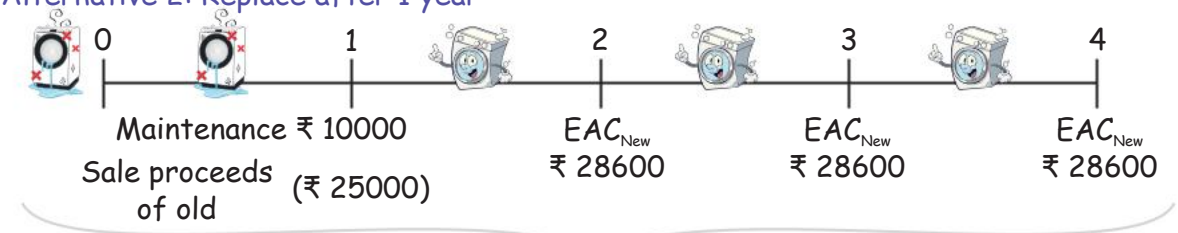
Alternative 1: Replace immediately



NPV, if replaced immediately = ₹ 41652

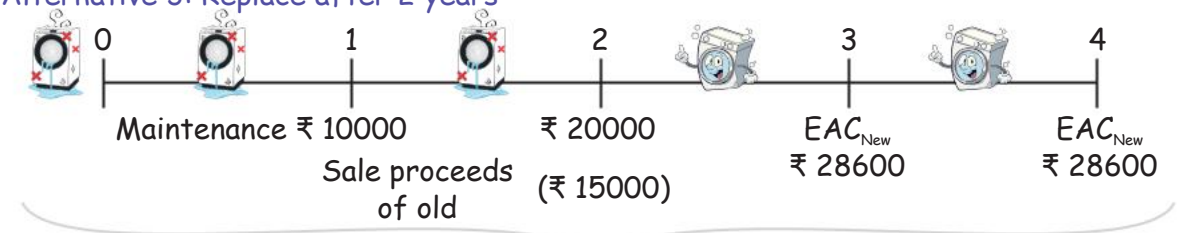
Cf's beyond 4 years will be the same as EAC_{NEW} across all alternatives. Being same, hence irrelevant for decision & hence ignored.

Alternative 2: Replace after 1 year



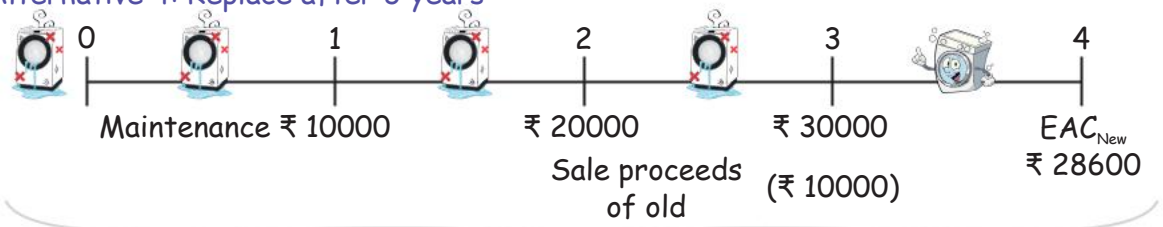
NPV, if Replace after 4 year = ₹ 43739

Alternative 3: Replace after 2 years



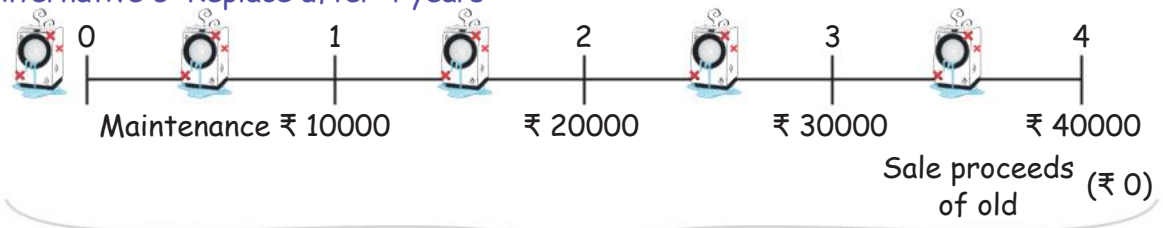
NPV, if Replace after 2 years = ₹ 47633

Alternative 4: Replace after 3 years



NPV, if Replace after 3 years = ₹ 53321

Alternative 5: Replace after 4 years



NPV, if Replace after 4 years = ₹ 66414

Note: NPV's itself of above alternatives will be comparable since life is equal

Step 3: Take a decision

Alternative with highest +ve NPV (or least -ve NPV will be selected, in case of outflows) will be selected

Exam Presentation A & Co. Equivalent cost of (EAC) of new machine

		₹
(i)	Cost of new machine now	90,000
	Add: PV of annual repairs @ ₹ 10,000 per annum for 8 years (₹ 10,000 x 4.4873)	44,873
		1,34,873
	Less: PV of salvage value at the end of 8 years 6,538 (₹20,000 x 0.3269)	6,538
		1,28,335
	Equivalent annual cost (EAC) (₹ 1,28,335/4.4873)	28,600

Alternatively, optimal replacement period can also be computed using the following table:

Scenario	Year	Cash Flow	PV @15%	PV
Replace Immediately	0	(40,000)	1	(40,000)
	1 to 4	28,600	2.855	81,652
				41,652
Replace after 1 year	1	10,000	0.870	8,696
	1	(25,000)	0.870	(21,739)
	2 to 4	28,600	1.985	56,783
				43,739

Replace after 2 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	2	(15,000)	0.756	(11,342)
	3 and 4	28,600	1.229	35,157
				47,633
Replace after 3 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	3	(10,000)	0.658	(6,575)
	4	28,600	0.572	16,352
				53,321
Replace after 4 years	1	10,000	0.870	8,696
	2	20,000	0.756	15,123
	3	30,000	0.658	19,725
	4	40,000	0.572	22,870
				66,414

Advice: The company should replace the old machine immediately because the PV of cost of replacing the old machine with new machine is least.

Adjusted Present Value

APV is a value additive approach to capital budgeting process ie each cash flow is considered individually and discounted at a rate consistent with risk involved.

Step3 : Find APV

$$APV = -I_0 + \underbrace{\sum_{t=1}^{n} \frac{OC_t}{(1+K_u)^t}}_{\text{PV of Operating cash flow}} + \underbrace{\sum_{t=1}^{n} \frac{Intt_t \times T_c}{(1+i_d)^t}}_{\text{PV of Tax shield on Intt}} + \underbrace{\sum_{t=1}^{n} \frac{S_t}{(1+i_d)^t}}_{\text{PV of Intt subsidies}} - F - \text{PV of expected bankruptcy cost}$$

Step1: Base case NPV — Step2: Value of financing effects

here, I_0 means PV of Investment Outlay ie. Initial Investment
OC_t means After - tax Operating CF's eg. NOPAT + Depn or EBIT(1 - t) + Depn
K_U means Required rate of return in the absence of leverage i.e. all - equity financing
i_d means Intt Rate % on Debt ie Before tax Cost of Debt
S_t means Before tax Interest subsidies
F means After tax Floatation Cost

Question 1 Study Material, RTP Sep 2025, MTP Sep 2025

XYZ Ltd. requires ₹ 8,00,000 for a project. Useful life of project - 4 years. Salvage value - Nil. Depreciation Charge ₹ 2,00,000 p.a. Expected revenues & costs (excluding depreciation) ignoring inflation.

Year	1	2	3	4
Revenues	₹ 6,00,000	₹ 7,00,000	₹ 8,00,000	₹ 8,00,000
Costs	₹ 3,00,000	₹ 4,00,000	₹ 4,00,000	₹ 4,00,000

Tax Rate 60% cost of capital 10% (including inflation premium).

Calculate NPV of the project if inflation rates for revenues & costs are as follows:

Year	Revenues	Costs
1	10%	12%
2	9%	10%
3	8%	9%
4	7%	8%

Solution:

Computation of Annual Cash Flow

(i) Inflation adjusted Revenues

Year	Revenues (₹)	Revenues (Inflation Adjusted) (₹)
1	6,00,000	6,00,000 (1.10) = 6,60,000
2	7,00,000	7,00,000 (1.10) (1.09) = 8,39,300
3	8,00,000	8,00,000 (1.10) (1.09) (1.08) = 10,35,936
4	8,00,000	8,00,000 (1.10) (1.09) (1.08) (1.07) = 11,08,452

(ii) Inflation adjusted Costs

Year	Costs (₹)	Costs (Inflation Adjusted) (₹)
1	3,00,000	3,00,000 (1.12) = 3,36,000
2	4,00,000	4,00,000 (1.12) (1.10) = 4,92,800
3	4,00,000	4,00,000 (1.12) (1.10) (1.09) = 5,37,152
4	4,00,000	4,00,000 (1.12) (1.10) (1.09) (1.08) = 5,80,124

(iii) Tax Benefit on Depreciation = ₹ 2,00,000 x 0.60 = ₹ 1,20,000

(iv) Net Profit after Tax

Year	Revenues (Inflation Adjusted) (₹) (1)	Costs (Inflation Adjusted) (₹) (2)	Net Profit (₹) (3) = (1) - (2)	Tax (₹) (4) = 60% of (3)	Net Profit tax (₹) (3) - (4)
1	6,60,000	3,36,000	3,24,000	1,94,400	1,29,600
2	8,39,300	4,92,800	3,46,500	2,07,900	1,38,600
3	10,35,936	5,37,152	4,98,784	2,99,270	1,99,514
4	11,08,452	5,80,124	5,28,328	3,16,997	2,11,331

(v) Present Value of Cash Inflows

Year	Net after Profit (₹)	Tax Benefit on Depreciation (₹)	Cash Inflow (₹)	PVF@ 10%	PV (₹)
1	1,29,600	1,20,000	2,49,600	0.909	2,26,886
2	1,38,600	1,20,000	2,58,600	0.826	2,13,604
3	1,99,514	1,20,000	3,19,514	0.751	2,39,955
4	2,11,331	1,20,000	3,31,331	0.683	2,26,299
					9,06,744

NPV = ₹ 9,06,744 – ₹ 8,00,000 = ₹ 1,06,744

Question 2 Study Material

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹ 50,00,000. The expected cash flow after tax for the next three years is as follows:

(₹)

Year 1		Year 2		Year 3	
CFAT	Probability	CFAT	Probability	CFAT	Probability
14,00,000	0.1	15,00,000	0.1	18,00,000	0.2
18,00,000	0.2	20,00,000	0.3	25,00,000	0.5
25,00,000	0.4	32,00,000	0.4	35,00,000	0.2
40,00,000	0.3	45,00,000	0.2	48,00,000	0.1

The Company wishes to take into consideration all possible risk factors relating to airline operations. The company wants to know:

(i) The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.

(ii) The possible deviation in the expected value.

(iii) How would standard deviation of the present value distribution help in Capital Budgeting decisions?

Solution:

(i) Expected NPV (₹ in lakhs)

Year I			Year 2			Year 3		
CFAT	P	CF × P	CFAT	P	CF × P	CFAT	P	CF × P
14	0.1	1.4	15	0.1	1.5	18	0.2	3.6
18	0.2	3.6	20	0.3	6.0	25	0.5	12.5
25	0.4	10.0	32	0.4	12.8	35	0.2	7.0
40	0.3	12.0	45	0.2	9	48	0.1	4.8
	$\bar{x}$ or $\overline{CF}$	27.0		$\bar{x}$ or $\overline{CF}$	29.3			$\bar{x}$ or $\overline{CF}$ 27.9

NPV	PV factor @ 6%	Total PV
27	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
	PV of cash inflow	74.974
	Less: Cash outflow	50.000
	NPV	24.974

(ii) Possible deviation in the expected value

Year I

$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_1	$(X - \bar{X})^2 P_1$
14 – 27	-13	169	0.1	16.9
18 – 27	-9	81	0.2	16.2
25 – 27	- 2	4	0.4	1.6
40 – 27	13	169	0.3	50.7
				85.4

$\sigma_1 = \sqrt{85.4} = 9.241$

Year II

$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_2	$(X - \bar{X})^2 \times P_2$
15-29.3	-14.3	204.49	0.1	20.449
20-29.3	-9.3	86.49	0.3	25.947
32-29.3	2.7	7.29	0.4	2.916
45-29.3	15.7	246.49	0.2	49.298
				98.61

$\sigma_2 = \sqrt{98.61} = 9.930$

Year III

$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^3$	P_2	$(X - \bar{X})^2 P_3$
18-27.9	-9.9	98.01	0.2	19.602
25-27.9	-2.9	8.41	0.5	4.205
35-27.9	7.1	50.41	0.2	10.082
48-27.9	20.1	404.01	0.1	40.401
				74.29

$\sigma_3 = \sqrt{74.29} = 8.619$

Standard deviation about the expected value :

$$\sigma = \sqrt{\frac{85.4}{(1.06)^2} + \frac{98.61}{(1.06)^4} + \frac{74.29}{(1.06)^6}}$$

$= 14.3696$

(iii) Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

Question 3 Study Material

Project X and Project Y are under the evaluation of XY Co. The estimated cash flows and their probabilities are as below:

Project X : Investment (year 0) ₹ 70 lakhs

Probability weights	0.30	0.40	0.30
Years	₹ lakhs	₹ lakhs	₹ lakhs
1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment (year 0) ₹ 80 lakhs.

Probability weighted	Annual cash flows through life ₹ lakhs
0.20	40
0.50	45
0.30	50

(a) Which project is better based on NPV criterion with a discount rate of 10%?

(b) Compute the standard deviation of the present value distribution and analyse the inherent risk of the projects.

Solution: (a) Calculation of NPV of XY Co.:

Project X		Cash flow	PVF	PV
Year 1	(30 x 0.3) + (50 x 0.4) + (65 x 0.3)	48.5	0.909	44.09
2	(30 x 0.3) + (40 x 0.4) + (55 x 0.3)	41.5	0.826	34.28
3	(30 x 0.3) + (40 x 0.4) + (45 x 0.3)	38.5	0.751	28.91
				107.28
	NPV: (107.28 – 70.00) =			(+) 37.28
Project Y (For 1-3 Years)				
1 - 3	(40 x 0.2) + (45 x 0.5) + (50 x 0.3)	45.5	2.487	113.16
	NPV (113.16 – 80.00)			(+) 33.16

(b) Calculation of Standard deviation σ

As per Hillier's model

$$M = \sum_{i=0}^{n} (1 + r)^{-1} Mi$$

$$\sigma^2 = \sum_{i=0}^{n} (1 + r)^{-2i} \sigma_i^2$$

Project X

Year

1 $\sqrt{(30 - 48.5)^2\ 0.30 + (50 - 48.5)^2\ 0.40 + (65 - 48.5)^2\ 0.30} = \sqrt{185.25} = 13.61$

2 $\sqrt{(30 - 41.5)^2\ 0.30 + (40 - 41.5)^2\ 0.40 + (55 - 41.5)^2\ 0.30} = \sqrt{95.25} = 9.76$

3 $\sqrt{(30 - 38.5)^2\ 0.30 + (40 - 38.5)^2\ 0.40 + (45 - 38.5)^2\ 0.30} = \sqrt{35.25} = 5.94$

Standard Deviation about the expected value

$$= \sqrt{\frac{185.25}{(1 + 0.10)^2} + \frac{95.25}{(1 + 0.10)^4} + \frac{35.25}{(1 + 0.10)^6}} = \sqrt{153.10+65.06+19.90} = \sqrt{238.06} = 15.43$$

Project Y (For 1 - 3 Years)

$$\sqrt{(40 - 45.5)^2\ 0.20 + (45 - 45.5)^2\ 0.50 + (50 - 45.5)^2\ 0.30} = \sqrt{12.25} = 3.50$$

Standard Deviation about the expected value

$$= \sqrt{\frac{12.25}{(1 + 0.10)^2} + \frac{12.25}{(1 + 0.10)^4} + \frac{12.25}{(1 + 0.10)^6}} = \sqrt{10.12+8.37+6.91} = \sqrt{25.4} = 5.03$$

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.

Question 4 — Study Material

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.

	Years	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

(i) The expected NPV of the project.

(ii) The best case and the worst case NPVs.

(iii) The probability of occurrence of the worst case if the cash flows are

(a) perfectly dependent over time and

(b) independent over time.

(iv) Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.

(v) Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to 1.0. If the coefficient of variation of the project is found to be less risky than average, 100 basis points are deducted from the Company's cost of Capital

Should the project be accepted by X Ltd?

Solution: (a) (i) Expected cash flows:-

Year		Net cash flows	P.V.	PV. @ 10%
0	(4,00,000 x 1) =	(-)4,00,000	1.000	(-)4,00,000
1 to 4	(1,00,000 x 0.3 + 1,10,000 x 0.5 + 1,20,000 x 0.2) =	1,09,000	3.170	3,45,530
5	[1,09,000 + (20,000 x 0.3 + 50,000 x 0.5 + 60,000 x 0.2)] =	1,52,000	0.621	94,392
		NPV=		39,922

(ii) ENPV of the worst case

1,00,000 x 3.790 = ₹ 3,79,000 (Students may have 3.791 also the values will change accordingly)

20,000 x 0.621 = ₹ 12,420/-

ENPV = (-) 4,00,000 + 3,79,000 + 12,420 = (-) ₹ 8,580/-

ENPV of the best case

ENPV = (-) 4,00,000 + 1,20,000 x 3.790 + 60,000 x 0.621 = ₹ 92,060/-.

(iii) (a) Required probability = 0.3

(b) Required probability = $(0.3)^5$ = 0.00243

(iv) The moderate case NPV = (-) 4,00,000 + (1,10,000 x 3.79) + (50,000 x 0.621) = ₹ 47,950/-

ENPV = 0.30 x (-) 8580 + 0.5 x 47950 + 92060 x 0.20 = ₹ 39,813/-

Therefore,

$\sigma_{ENPV} = \sqrt{0.3\,(-8580 - 39{,}813)^2 + 0.5\,(47950 - 39813)^2 + 0.2\,(92{,}060 - 39{,}813)^2}$ = ₹ 35,800/-

Therefore, CV = 35,800/39,813 = 0.90

(v) Risk adjusted cost of capital of X Ltd. = 10% - 1% = 9%.

NPV

Year	Expected net cash flow	PV @ 9%	
0	(-) 4,00,000	1.000	(-) 4,00,000
1 to 4	1,09,000	3.240	3,53,160
5	1,52,000	0.650	98,800
		ENPV =	51,960

Therefore, the project should be accepted.

Question 5 Study Material

New Projects Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	₹ 15,00,000	₹ 11,00,000	₹ 19,00,000
Inflows-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000
Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk free interest rate is 10%.

Required:

(i) Find out the risk-adjusted discount rate (RADR) for these projects.

(ii) Which project is the best?

Solution:

(i) The risk free rate of interest and risk factor for each of the projects are given. The risk adjusted discount rate (RADR) for different projects can be found on the basis of CAPM as follows:

Required Rate of Return = $I_{Rf} + (k_o - I_{RF})$ Risk Factor

For P-I : RADR = $0.10 + (0.15 - 0.10)\ 1.80 = 19\%$

For P-II : RADR = $0.10 + (0.15 - 0.10)\ 1.00 = 15\%$

For P-III : RADR = $0.10 + (0.15 - 0.10)\ 0.60 = 13\%$

(ii) The three projects can now be evaluated at 19%, 15% and 13% discount rate as follows:

Project P-I

Annual Inflows	₹6,00,000
PVAF (19%, 4)	2.639
PV of Inflows (₹6,00,000 x 2.639)	₹15,83,400
Less: Cost of Investment	₹15,00,000
Net Present Value	**₹83,400**

Project P-II

Yr	Cash Inflow (₹)	PVF (15%,n)	PV (₹)
1	6,00,000	0.870	5,22,000
2	4,00,000	0.756	3,02,400
3	5,00,000	0.658	3,29,000
4	2,00,000	0.572	1,14,400
Total Present Value			12,67,800
Less: Cost of Investment			11,00,000
Net Present Value			**1,67,800**

Project P-III

Yr	Cash Inflow (₹)	PVF (13%,n)	PV (₹)
1	4,00,000	0.885	3,54,000
2	6,00,000	0.783	4,69,800
3	8,00,000	0.693	5,54,400
4	12,00,000	0.613	7,35,600
Total Present Value			21,13,800
Less: Cost of Investment			19,00,000
Net Present Value			**2,13,800**

Project P-III has highest NPV. So, it should be accepted by the firm

Question 6 Study Material

Red Ltd. is considering a project with the following Cash flows: ₹

Years	Cost of Plant	Recurring Cost	Savings
0	10,000		
1		4,000	12,000
2		5,000	14,000

The cost of capital is 9%. Measure the sensitivity of the project to changes in the levels of plant value, running cost and savings (considering each factor at a time) such that the NPV becomes zero. The P.V. factor at 9% are as under:

Year	Factor
0	1
1	0.917
2	0.842

Which factor is the most sensitive to affect the acceptability of the project?

Solution: P.V. of Cash Flows

Year 1	Running Cost	₹ 4,000 x 0.917	= (₹ 3,668)
	Savings	₹ 12,000 x 0.917	= ₹ 11,004
Year 2	Running Cost	₹ 5,000 x 0.842	= (₹ 4,210)
	Savings	₹ 14,000 x 0.842	= ₹ 11,788
			₹ 14,914
Year 0	*Less*: P.V. of Cash Outflow	₹ 10,000 x 1	₹ 10,000
		NPV	₹ 4,914

Sensitivity Analysis

(i) Increase of Plant Value by ₹ 4,914

$$\therefore \frac{4,914}{10,000} \times 100 = 49.14\%$$

(ii) Increase of Running Cost by ₹ 4,914

$$\frac{4,914}{3,668 + 4,210} = \frac{4,914}{7,878} \times 100 = 62.38\%$$

(iii) Fall in Saving by ₹ 4,914

$$\frac{4,914}{11,004 + 11,788} = \frac{4,914}{22,792} \times 100 = 21.56\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Alternative Solution

Sensitivity Analysis

(i) If the initial project cost is varied adversely by say 10%*.

NPV (Revised) (₹ 4,914 – ₹ 1,000) = ₹ 3,914

$$\text{Change in NPV } \frac{₹\ 4,914 - ₹\ 3,914}{₹\ 4,914} = 20.35\%$$

(ii) If Annual Running Cost is varied by say 10%*.

NPV (Revised) (₹ 4,914 – ₹ 400 X 0.917 – ₹ 500 x 0.842)

= ₹ 4,914 – ₹ 367 – ₹ 421 = ₹ 4,126

$$\text{Change in NPV } \frac{₹\ 4,914 - ₹\ 4,126}{₹\ 4,914} = 16.04\%$$

(iii) If Saving is varied by say 10%*.

NPV (Revised) (₹ 4,914 – ₹ 1,200 X 0.917 – ₹ 1,400 X 0.842)

= ₹ 4,914 – ₹ 1,100 – ₹ 1,179 = ₹ 2,635

$$\text{Change in NPV } \frac{₹\ 4,914 - ₹\ 2,635}{₹\ 4,914} = 46.38\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project.

* Any percentage of variation other than 10% can also be assumed.

Question 7 Study Material

The Easygoing Company Limited is considering a new project with initial investment, for a product "Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.
Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:
Profit Volume Ratio (P/V) is 70%,
Variable cost ₹ 60/- per unit
Annual Cash Flow ₹ 57,500/-
Ignore Depreciation on initial investment and impact of taxation.

Calculate
(i) Initial Investment of the Project
(ii) Net Present Value of the Project
(iii) Annual Fixed Cost
(iv) Estimated annual unit of sales
(v) Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

Solution:

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%,5) x Cash Flow (Annual)

= 3.274 x ₹ 57,500

= ₹ 1,88,255

(ii) Net Present Value (NPV)

Let Cost of Capital be X, then $\frac{16 - X}{X} \times 60\%$ X = 10%

Thus NPV of the project
= Annual Cash Flow x PVAF (10%, 5)
– Initial Investment
= ₹ 57,500 x 3.791 – ₹ 1,88,255
= ₹ 2,17,982.50 – ₹ 1,88,255 = ₹ 29,727.50

(iii) Annual Fixed Cost

Let change in the Fixed Cost which makes NPV zero is X. Then,
₹ 29,727.50 – 3.791X = 0
Thus X = ₹ 7,841.60
Let original Fixed Cost be Y then,
Y × 7.8416% = ₹ 7,841.60
Y = ₹ 1,00,000
Thus Fixed Cost is equal to ₹ 1,00,000

(iv) Estimated Annual Units of Sales

$$\text{Selling Price per unit} = \frac{₹\ 60}{100\% - 70\%} = ₹\ 200$$

$$\frac{\text{Annual Cash Flow + Fixed Cost}}{\text{P/V Ratio}} = \text{Sales Value}$$

$$\frac{₹\ 57,500 + ₹\ 1,00,000}{0.70} = ₹\ 2,25,000$$

$$\text{Sales in Units} = \frac{₹\ 2,25,000}{₹\ 200} = 1,125 \text{ units}$$

(v) Break Even Units

$$\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}} = \frac{1,00,000}{140} = 714.285 \text{ units}$$

Question 8 Study Material

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be₹ 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

(a) sale price;
(b) sales volume;
(c) variable cost;
(d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Prob.
Poor	1,75000	0·30
Normal	2,00,000	0·60
Good	2,25,000	0·10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

Solution: Calculation of NPV

= - ₹ 50,00,000 + [2,00,000 (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%, 5)
= - ₹ 50,00,000 + [2,00,000 (₹ 13.50) – ₹ 10,00,000] 3.605
= - ₹ 50,00,000 + [₹ 27,00,000 – ₹ 10,00,000] 3.605
= - ₹ 50,00,000 + ₹ 61,28,500 = ₹ 11,28,500

Measurement of Sensitivity Analysis

(a) Sales Price:-

Let the sale price/Unit be S so that the project would break even with 0 NPV.
∴ ₹ 50,00,000 = [2,00,000 (S – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)
₹ 50,00,000 = [2,00,000S – ₹ 33,00,000 – ₹ 10,00,000] 3.605
₹ 50,00,000 = [2,00,000S – ₹ 43,00,000] 3.605
₹ 13,86,963 = 2,00,000S – ₹ 43,00,000
₹ 56,86,963 = 2,00,000S
S = ₹ 28.43 which represents a fall of (30 - 28.43)/30 or 0.0523 or 5.23%

(b) Sales volume:-

Let V be the sale volume so that the project would break even with 0 NPV.
∴ ₹ 50,00,000 = [V (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)
₹ 50,00,000 = [V (₹ 13.50) – ₹ 10,00,000] PVIAF (12%,5)
₹ 50,00,000 = [₹ 13.50V – ₹ 10,00,000] 3.605
₹ 13,86,963 = ₹ 13.50V – ₹ 10,00,000
₹ 23,86,963 = ₹ 13.50V
V = 1,76,812 which represents a fall of (2,00,000 - 1,76,812)/2,00,000 or 0.1159 or 11.59%

(c) Variable Cost:

Let the variable cost be V so that the project would break even with 0 NPV.

∴ ₹50,00,000 = [2,00,000(₹30 – V) – ₹10,00,000] PVIAF (12%, 5)

₹50,00,000 = [₹60,00,000 – 2,00,000 V – ₹10,00,000] 3.605

₹50,00,000 = [₹50,00,000 – 2,00,000 V] 3.605

₹13,86,963 = ₹50,00,000 – 2,00,000 V

₹36,13,037 = 2,00,000V

V = ₹18.07 which represents a fall of (18.07 – 16.50)/16.50 or 0.0951 or 9.51%

(d) Expected Net Present Value

(1,75,000 X 0.30) + (2,00,000 X 0.60) + (2,25,000 X 0.10) =1,95,000

NPV = [1,95,000 X ₹13.50 – ₹10,00,000] 3.605 – ₹50,00,000 = ₹8,85,163

Further NPV in worst and best cases will be as follows:

Worst Case:

[1,75,000 X ₹13.50 – ₹10,00,000] 3.605 – ₹50,00,000 = - ₹88,188

Best Case:

[2,25,000 X ₹13.50 – ₹10,00,000] 3.605 – ₹50,00,000 = ₹23,45,188

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

Question 9

Study Material, (5 Marks) Exam Nov 2008

Uncertainty is associated with two aspects of the project: Annual Net Cash Flow & Life of the project. NPV model for the project is

$$\sum_{t=1}^{n} [CF_t / (1 + i)^t] - I$$

Where i→ Risk free interest rate, I→ initial investment are parameters, CF = Annual Cash Flow With i = 10%, I = ₹1,30,000, CF_t & n stochastic exogenous variables with the following distribution will be as under:

Annual Cash Flow		Project Life	
Value (₹)	Probability	Value (Year)	Probability
10,000	0.02	3	0.05
15,000	0.03	4	0.10
20,000	0.15	5	0.30
25,000	0.15	6	0.25
30,000	0.30	7	0.15
35,000	0.20	8	0.10
40,000	0.15	9	0.03
		10	0.02

Perform ten manual simulation runs for the project and calculate expected NPV?

Random Number

53479	81115	98036	12217	59526
97344	70328	58116	91964	26240
66023	38277	74523	71118	84892
99776	75723	03172	43112	83086
30176	48979	92153	38416	42436
81874	83339	14988	99937	13213
19839	90630	71863	95053	55532
09337	33435	53869	95053	18801
31151	58295	40823	41330	21093
67619	52515	03037	81699	17106

Solution:

To perform this operation, values are generated at random for the two exogenous variables viz., Annual Cash Flow and Project Life. For this purpose, we take following steps

(1) set up correspondence between values of exogenous variables and random numbers

(2) choose some random number generating device.

Correspondence between Values of Exogenous Variables and two Digit Random Numbers:

Annual Cash Flow				Project Life			
Value (₹)	Probability	Cumulative Probability	Two Digit Random No.	Value (Year)	Probability	Cumulative Probability	Two Digit Random No.
10,000	0.02	0.02	00 - 01	3	0.05	0.05	00 - 04
15,000	0.03	0.05	02 - 04	4	0.10	0.15	05 -14
20,000	0.15	0.20	05 - 19	5	0.30	0.45	15 - 44
25,000	0.15	0.35	20 - 34	6	0.25	0.70	45 - 69
30,000	0.30	0.65	35 - 64	7	0.15	0.85	70 - 84
35,000	0.20	0.85	65 - 84	8	0.10	0.95	85 - 94
40,000	0.15	1.00	85 - 99	9	0.03	0.98	95 - 97
				10	0.02	1.00	98 - 99

For random numbers, we can begin from any-where taking at random from the table and read any pair of adjacent columns, column/row wise. For the first simulation run we need two digit random numbers (1) For Annual Cash Flow (2) For Project Life. The numbers are 53 & 97 and corresponding value of Annual Cash Flow and Project Life are ₹ 3,000 and 9 years respectively.

Simulation Results

Run	Annual Cash Flow		Project Life		PVAF @ 10% (2)	NPV (1) x (2) – 1,30,000
	Random No.	Corres. Value of Annual Cash Flow (1)	Random No.	Corres. Value of Project Life		
1	53	30,000	97	9	5.759	42,770
2	66	35,000	99	10	6.145	85,075
3	30	25,000	81	7	4.868	(8,300)
4	19	20,000	09	4	3.170	(66,600)
5	31	25,000	67	6	4.355	(21,125)
6	81	35,000	70	7	4.868	40,380
7	38	30,000	75	7	4.868	16,040
8	48	30,000	83	7	4.868	16,040
9	90	40,000	33	5	3.791	21,640
10	58	30,000	52	6	4.355	650

Question 10 Study Material, RTP Nov 2024

Jumble Consultancy Group has determined relative utilities of cash flows of two forthcoming projects of its client company as follows:

Cash Flow in ₹	-150000	-100000	-40000	0	150000	100000	50000	10000
Utilities	-100	-60	-3	0	40	30	20	10

The distribution of cash flows of project A and Project B are as follows:

Project A

Cash Flow (₹)	-150000	- 100000	150000	100000	50000
Probability	0.10	0.20	0.40	0.20	0.10

Project B

Cash Flow (₹)	-100000	-40000	150000	50000	100000
Probability	0.10	0.15	0.40	0.25	0.10

Which project should be selected and why ?

Solution: Evaluation of project utilities of Project A and Project B

	Project A		
Cash flow (in ₹)	Probability	Utility	Utility value
-1,50,000	0.10	-100	-10
-1,00,000	0.20	-60	-12
1,50,000	0.40	40	16
1,00,000	0.20	30	6
50,000	0.10	20	2
			2

	Project B		
Cash flow (in ₹)	Probability	Utility	Utility value
-1,00,000	0.10	-60	-6
-40,000	0.15	-3	-0.45
1,50,000	0.40	40	16
50,000	0.25	20	5
1,00,000	0.10	30	3
			17.55

Decision: Project B should be selected as its expected utility is more.

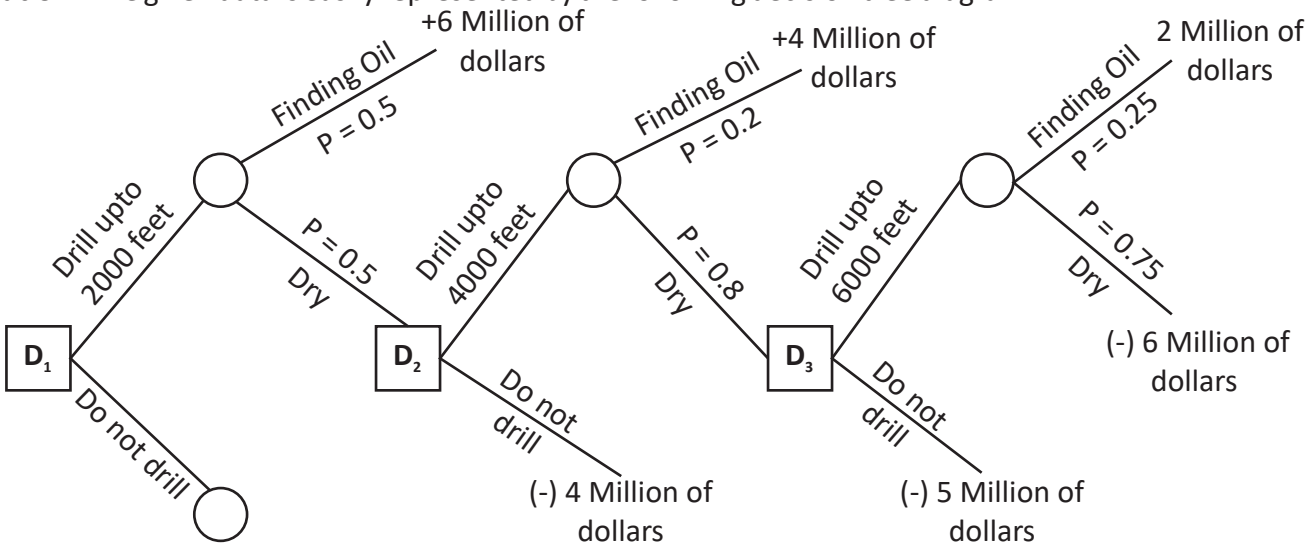
Question 11

Big oil is wondering whether to drill for oil in Westchester country. The prospects are as follows.

Depth of Well Feets	Total Cost $ in millions	Cumulative probability of finding oil	PV of Oil(if found) $ in millions
2000	4	0.5	10
4000	5	0.6	9
6000	6	0.7	8

Draw a decision tree showing successive drilling decisions to be made by big oil. How deep should it be prepared to drill?

Solution: The given data is easily represented by the following decision tree diagram



There are three decision points in the tree indicated by D_1, D_2 and D_3.

Using rolling back technique, we shall take the decision at decision point D_3 first and then use it to arrive decision at a decisions point D_2 and then use it to arrive decision at a decision point D_1.

Statement showing the evaluation of decision at Decision point D_3

Decision	Event	Probability	P.V. of Oil (if found) (Millions of dollars)	Expected P.V. of Oil (if found) (Millions of dollars)
1. Drill upto 6,000 feet	Finding Oil Dry (Refer to working note)	0.25 0.75	+2 -6	0.50 -4.50 -4.00
2. Do not drill				-5.00

Since the Expected P.V. of Oil (if found) on drilling upto 6,000 feet – 4 millions of dollar is greater than the cost of not drilling –5 millions of dollars. Therefore, Big Oil should drill upto 6,000 feet.

Statement showing evaluation of decision at decision Point D_2

Decision	Event	Probability	P.V. of Oil (if found) (Millions of dollars)	Expected P.V. of Oil (if found) (Millions of dollars)
1. Drill upto 4,000 feet	Finding Oil Dry (Refer to working note)	0.2 0.8	4 -4	0.6 -3.2 -2.4
2. Do not drill				-4

Since the Expected P.V. of Oil (if found) on drilling upto 4,000 feet – 2.4 millions of dollar is greater than the cost of not drilling –4 millions of dollars. Therefore, Big Oil should drill upto 4,000 feet.

Statement showing evaluation of decision at decision Point D_1

Decision	Event	Probability	P.V. of Oil (if found) (Millions of dollars)	Expected P.V. of Oil (if found) (Millions of dollars)
1. Drill upto 2,000 feet	Finding Oil Dry (Refer to working note)	0.5 0.5	6 -2.4	3.0 -1.2 +1.8
2. Do not drill				NIL

Since the Expected P.V. of Oil (if found) on drilling upto 2,000 feet is 1.8 million of dollars (positive), Big Oil should drill upto 2,000 feet.

Working Notes

Let x be the event of not finding oil at 2,000 feets and y be the event of not finding oil at 4,000 feet and z be the event of not finding oil at 6,000 feets.

We know that, $P(x \cap y) = P(x) \times P(y/x)$

Where, $P(X \cap y)$ is the joint probability of not finding oil at 2,000 feets and 4,000 feets, P(x) is the probability of not finding oil at 2,000 feets and P (y/x) is the probability of not finding oil at 4,000 feets, if the event x has already occurred.

$P(x \cap y)$ = 1 - Cumulative probability of finding oil at 4,000 feet

= 1 - 0.6 = 0.4

P(x) = 1 - Probability of finding oil at 2,000 feets

= 1 - 0.5 = 0.5

Hence, $P(y/x) = \frac{P(x \cap y)}{P(x)} = \frac{0.4}{0.5} = 0.8$

Therefore, probability of finding oil between 2,000 feets to 4,000 feets = 1 - 0.8 = 0.2 we know that,
$P(x \cap y \cap z) = P(x) \times P(y/x) \times P(z/x \cap y)$

where, $P(x \cap y \cap z)$ is the joint probability of not finding oil at 2,000 feets, 4,000 feets and 6,000 feets, P(x) and P(y/x) are as explained earlier and $P(z/x \cap y)$ is the probability of not finding oil at 6,000 feets if the event x and y has already occurred.

$P(x \cap y \cap z)$ = 1 - cumulative probability of finding oil at 6,000 feets

= 1 - 0.7 = 0.3

$P(z/x \cap y) = \frac{P(x \cap y \cap z)}{P(x) \times P(y/x)} = \frac{0.3}{0.5 \times 0.8} = \frac{0.3}{0.4} = 0.75$

Therefore, probability of finding oil between 4,000 feets to 6,000 feets = 1 – 0.75 = 0.25

Question 12 (5 Marks) Exam May 2013

Ramesh owns a plot of land on which he intends to construct apartment units for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be ₹ 600 lakhs or ₹ 1025 lakhs respectively. Current market price for each apartment unit is ₹ 80 lakhs. The market price after a year for apartment units will depend upon the conditions of market. If the market is buoyant, each apartment unit will be sold for ₹ 91 lakhs, if it is sluggish, the sale price for the same will be ₹ 75 lakhs. Determine the current value of vacant plot of land. Should Ramesh start construction now or keep the land vacant? The yearly rental per apartment unit is ₹ 7 lakhs and the risk free interest rate is 10% p.a.

Assume that the construction cost will remain unchanged.

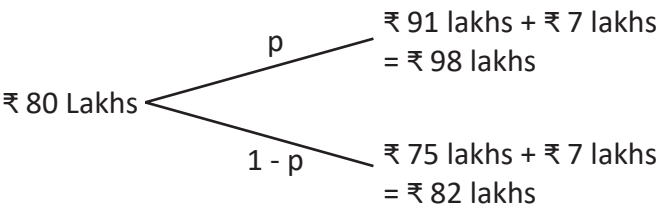
Solution: Presently 10 units apartments shall yield a profit of ₹ 200 lakh (₹ 800 lakhs - ₹ 600 lakhs) and 15 unit apartment will yield a profit of ₹ 175 lakh (₹ 1200 lakhs -₹ 1025 lakhs). Thus 10 units apartment is the best alternative if Ramesh has to construct now.

However, Ramesh waits for 1 year his pay-off will be as follows:

	Market Conditions	
	Buoyant Market	**Sluggish Market**
10 units apartments	₹ 91 lakhs x 10 - ₹ 600 lakhs = **₹ 310 lakhs**	₹ 75 lakhs x 10 - ₹ 600 lakhs = **₹ 150 lakhs**
15 units apartments	₹ 91 lakhs x 15 - ₹ 1025 lakhs = **340 lakhs**	₹ 75 lakhs x 15 - ₹ 1025 lakhs = **₹ 100 lakhs**

Thus if market conditions turnout to be buoyant the best alternative is 15 units apartments and net pay-off will be ₹ 340 lakhs and if market turnout to be sluggish the best alternative is the 10 units apartments and net pay-off shall be ₹ 150 lakhs.

To determine the value of vacant plot we shall use Binomial Model (Risk Neutral Method) of option valuation as follows:



Alternatively student can calculate these values as follows (Sale Value + Rent):

If market is buoyant then possible outcome
= ₹ 91 lakh + ₹ 7 lakh = ₹ 98 lakhs

It market is sluggish then possible outcome
= ₹ 75 lakh + ₹ 7 lakh = ₹ 82 lakhs

Let p be the probability of buoyant condition then with the given risk-free rate of interest of 10% the following condition should be satisfied:

$$₹\ 80\ \text{lakhs} = \frac{[(p \times ₹\ 98\ \text{lakhs}) + (1 - p) \times ₹\ 82\ \text{lakhs}]}{1.10}$$

$$\therefore p = \frac{3}{8} \text{ i.e. } 0.375 \qquad \text{Thus } 1 - p = 0.625$$

Expected cash flow next year

0.375 x ₹ 340 lakhs + 0.625 x ₹ 150 lakhs = ₹ 221.25 lakhs

Present Value of expected cash flow:

₹ 221.25 lakhs (0.909) = ₹ 201.12 lakhs

Thus the value of vacant plot is ₹ 201.12 lakhs

Since the current value of vacant land is more than profit from 10 units apartments now the land should be kept vacant.

Question 13 Study Material

ABC Ltd. is a pharmaceutical company possessing a patent of a drug called 'Aidrex', a medicine for aids patient. Being an approach drug ABC Ltd. holds the right of production of drugs and its marketing. The period of patent is 15 years after which any other pharmaceutical company produce the drug with same formula. It is estimated that company shall require to incur $ 12.5 million for development and market of the drug. As per a survey conducted the expected present value of cashflows from the sale of drug during the period of 15 years shall be $ 16.7 million. Cash flow from the previous similar type of drug have exhibited a variance of 26.8% of the present value of cashflows. The current yield on Treasury Bonds of similar duration (15 years) is 7.8%.

Determine the value of the patent.

Given

ln(1.336) = 0.2897

$e^{-1.0005} = 0.3677$ and $e^{-1.17} = 0.3104$

Solution:

The given solution is like valuation of stock option wherein delay in introduction of drug 'Aidrex' shall cause the loss of cashflow which is like payment of dividend.

To value the patent, we shall use Black Scholes Model for option pricing as follows:

Inputs

S (Spot Price) = The Present Value of Cashflows = $16.7 million

E (Exercise Price) = Cost of Development Formula = $ 12.5 million

σ^2 (Variance of Cash flow) = 26.8% i.e. 0.268

R (Risk Free Rate of Return) = 7.8%

D (Expected cost of Delays) = $\frac{1}{15}$ = 0.0667 i.e. 6.67%

Value call option

$$C = S\, N(d_1)e^{-df} - Ee^{-rt}\, N(d_2)$$

$$d_1 = \frac{\ln (S/E) + [R - D + \left(\frac{1}{2}\right)\sigma^2]\, t}{\sigma\sqrt{t}}$$

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

Accordingly,

$$d_1 = \frac{\ln (16.7 / 12.5) + [0.078 - 0.0667 + \left(\frac{1}{2}\right)(0.268)]\, 15}{\sqrt{0.268}\,\sqrt{15}}$$

$$d_1 = \frac{0.2897 + (0.1453)\, 15}{0.5177 \times 3.8730}$$

$$d_1 = \frac{0.2897 + 2.1795}{2.005}$$

$$d_1 = \frac{2.4692}{2.005} = 1.2315$$

$d_2 = 1.2315 - 2.005$

$d_2 = -0.7735$

$N(d_1) = 0.8910$

$N(d_2) = 0.2196$

Value of Patent

$= 16.7 \times e^{-0.0667 \times 15} \times 0.8910 - 12.5 \times e^{-0.078 \times 15} \times 0.2196$

$= 16.7 \times 0.3677 \times 0.8910 - 12.5 \times 0.3104 \times 0.2196$

$= 5.471 - 0.852 = 4.619$

Thus, the value of patents is $ 4.619 million

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Question 14 Study Material

A company has an old machine having book value zero – which can be sold for ₹ 50,000. The company is thinking to choose one from following two alternatives:

(i) To incur additional cost of ₹ 10,00,000 to upgrade the old existing machine.

(ii) To replace old machine with a new machine costing ₹ 20,00,000 plus installation cost ₹ 50,000.

Both above proposals envisage useful life to be five years with salvage value to be nil.

The expected after tax profits for the above three alternatives are as under :

Year	Old existing Machine (₹)	Upgraded Machine (₹)	New Machine (₹)
1	5,00,000	5,50,000	6,00,000
2	5,40,000	5,90,000	6,40,000
3	5,80,000	6,10,000	6,90,000
4	6,20,000	6,50,000	7,40,000
5	6,60,000	7,00,000	8,00,000

The tax rate is 40 per cent.

The company follows straight line method of depreciation. Assume cost of capital to be 15 per cent.

P.V.F. of 15%, 5 = 0.870, 0.756, 0.658, 0.572 and 0.497. You are required to advise the company as to which alternative is to be adopted.

Solution:

(A)	Cash Outflow		₹
	(i)	In case machine is upgraded:	
		Upgradation Cost	10,00,000
	(i)	In case new machine installed:	
		Cost	20,00,000
		Add: Installation cost	50,000
		Total Cost	20,50,000
		Less: Disposal of old machine	
		₹ 50,000 – 40% tax	30,000
		Total Cash Outflow	20,20,000

Working Note:

(i) Depreciation - in case machine is upgraded
₹ 10,00,000 ÷ 5 = ₹ 2,00,000

(ii) Depreciation - in case new machine is installed
₹ 20,50,000 ÷ 5 = ₹ 4,10,000

(iii) Old existing machine - Book Value is zero. So, no depreciation.

(B) Cash Inflows after Taxes (CFAT)

Year	Old existing Machine	Upgraded Machine			
	(i) EAT/CFAT ₹	(ii) EAT ₹	(iii) DEP ₹	(iv) CFAT ₹	= (iv) - (i) Incremental CFAT ₹
1	5,00,000	5,50,000	2,00,000	7,50,000	2,50,000
2	5,40,000	5,90,000	2,00,000	7,90,000	2,50,000
3	5,80,000	6,10,000	2,00,000	8,10,000	2,30,000
4	6,20,000	6,50,000	2,00,000	8,50,000	2,30,000
5	6,60,000	7,00,000	2,00,000	9,00,000	2,40,000

Cash Inflow after Taxes (CFAT)

Year	New Machine			
	(ii) EAT ₹	(iii) DEP ₹	(iv) CFAT ₹	(ix) = (viii) – (i) Incremental CFAT (₹)
1	6,00,000	4,10,000	10,10,000	5,10,000
2	6,40,000	4,10,000	10,50,000	5,10,000
3	6,90,000	4,10,000	11,00,000	5,20,000
4	7,40,000	4,10,000	11,50,000	5,30,000
5	8,00,000	4,10,000	12,10,000	5,50,000

P.V. AT 15% - 5 Years – on Incremental CFAT

Year	Upgraded Machine			New Machine		
	Incremental CFAT ₹	PVF	Total P.V. ₹	Incremental CFAT	PVF	Total PV ₹
1	2,50,000	0.870	2,17,500	5,10,000	0.870	4,43,700
2	2,50,000	0.756	1,89,000	5,10,000	0.756	3,85,560
3	2,30,000	0.658	1,51,340	5,20,000	0.658	3,42,160
4	2,30,000	0.572	1,31,560	5,30,000	0.572	3,03,160
5	2,40,000	0.497	1,19,280	5,50,000	0.497	2,73,350
Total P.V. of CFAT			8,08,680			17,47,930
Less: Cash Outflows			10,00,000			20,20,000*
N.P.V. =			-1,91,320			- 2,72,070

*Acquisition Cost (including installation cost)	₹20,50,000
Less: Salvage Value of existing machine net of Tax	₹30,000
	₹20,20,000

As the NPV in both the new (alternative) proposals is negative, the company should continue with the existing old Machine.

Question 15 Study Material, (8 Marks) Exam May 2024

A machine used on a production line must be replaced at least every four years. Costs incurred to run the machine according to its age are:

	Age of the Machine (years)				
	0	1	2	3	4
Purchase price (in ₹)	60,000				
Maintenance (in ₹)		16,000	18,000	20,000	20,000
Repair (in ₹)		0	4,000	8,000	16,000
Scrap Value (in ₹)		32,000	24,000	16,000	8,000

Future replacement will be with identical machine with same cost. Revenue is unaffected by the age of the machine. Ignoring inflation and tax, determine the optimum replacement cycle. PV factors of the cost of capital of 15% for the respective four years are 0.8696, 0.7561, 0.6575 and 0.5718.

Solution: Working Notes : First of all, we shall calculate cash flows for each replacement cycle as follows:

One Year Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	32,000	16,000

Two Years Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	24,000	2,000

Three Years Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	16,000	(12,000)

Four Years Replacement Cycle ₹

Year	Replacement Cost	Maintenance & Repair	Residual Value	Net cash Flow
0	(60,000)	-	-	(60,000)
1	-	(16,000)	-	(16,000)
2	-	(22,000)	-	(22,000)
3	-	(28,000)	-	(28,000)
4	-	(36,000)	8,000	(28,000)

Now we shall calculate NPV for each replacement cycles

		1 Year		2 Year		3 Year		4 Year	
Year	PVF@ 15%	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV	Cash Flows	PV
0	1	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000	-60,000
1	0.8696	16,000	13,914	-16,000	-13,914	-16,000	-13,914	-16,000	-13,914
2	0.7561	-	-	2,000	1,512	-22,000	-16,634	-22,000	-16,634
3	0.6575	-	-	-	0	-12,000	-7,890	-28,000	-18,410
4	0.5718	-	-	-	0		0	-28,000	-16,010
			-46,086		-72,402		-98,438		-1,24,968

Replacement Cycles	1 Year	2 Year	3 Year	4 Year
EAC (₹)	$\frac{46,086}{0.8696} = 52,997$	$\frac{72,402}{1.6257} = 44,536$	$\frac{98,438}{2.2832} = \mathbf{43,114}$	$\frac{1,24,968}{2.855} = 43,772$

Since EAC is least in case of replacement cycle of 3 years hence machine should be replaced after every three years.

Question 16 2 Q Merged | Exam Nov 2020

The Management of a multinational company TL Ltd. is engaged in construction of Infrastructure Project. A proposal to construct a Toll Road in Nepal is under consideration of the Management.

The following information is available:

The initial investment will be in purchase of equipment costing USD 250 lakhs. The economic life of the equipment is 10 years. The depreciation on the equipment will be charged on straight line method.

EBIDTA to be collected from the Toll Road is projected to be USD 33 lakhs per annum for a period of 20 years.

To encourage investment Nepalese government is offering a 15 year term loan of USD 150 lakhs at an interest rate of 6 per cent per annum. The interest is to be paid annually. The loan will be repaid at the end of 15 year in one tranche. The after tax costs of issue are expected to be USD 10 lakhs.

The required rate of return for the project under all equity financing is 12 per cent per annum.

Post tax cost of debt is 5.6 per cent per annum.

Corporate Tax Rate is 30 per cent.

All cash Flows will be in USD.

Ignore inflation.

You are required to advise the management on the viability of the proposal by using Adjusted Net Present Value method.

Given

PVIFA (12%, 10) = 5.650, PVIFA (12%, 20) = 7.469, PVIFA (8% 15) = 8.559, PVIF (8%, 15) = 0.315.

Solution:

(i) Net Present Value (All Equity Financed) - Base NPV

Particulars	Period	USD Lakhs	PVF @ 12%	PV (USD Lakhs)
Initial Investment	0	(250.00)	1.000	(250.000)
EBIDTA	1 to 20	33.00	7.469	246.477
Tax	1 to 20	(9.90)	7.469	(73.943)
Depreciation	1 to 10	(25.00)		
Tax Savin on Dep	1 to 10	7.50	5.650	42.375
			NPV	(35.091)

(ii) Present Value of Impact of Tax Shield on Interest

Particulars	Period	USD Lakhs	PVF @ 8%	PV (USD Lakhs)
Tax Saving on Interest	1 to 15	2.70 [150 x 6% x 30%]	8.559	23.109

Adjusted Present Value of the Project

= Base NPV + PV of Tax Shield on Interest - After tax cost of issuing debt

= -US$ 35.091 + US $ 23.109 lakh - US$ 10 lakh

= -US$ 1.982 lakh

Advise: Since APV is negative, TL Ltd. should not accept the project.

Tutorial Note: ICAI has issued two alternative solutions for above Q, we have presented only one alternative that is more logical.

Interest Rates Risk Management

Types of Interest rates

(1) Fixed Interest rates
Interest rates remains same over the life of loan .
Example : 8 % , 9 % , 10 % etc.

(2) Floating interest rates
Interest rates varies according to benchmark rate (i.e. BPLR, MIBOR, SOFR etc) on each reset date.
'Reset date' means the date on which interest rate is revised for the upcoming period according to the benchmark rate.
Example: A 2 year loan benchmarked at 6 month MIBOR

	0	6 months	12 months	18 months	24 months
6 months MIBOR at each reset date	7%	7.25%	7.75%	7.40%	
Payment on due dates @		7%	7.25%	7.75%	7.40%

How to Manage Interest Rate Risk

Traditional methods
1. Matching - Asset & liabilities management
2. Forward Rate Agreement [FRA]

Modern methods
1. Swaps
2. Interest Rate Futures
3. Interest Rate Options

Swaps

Swap means " to give in exchange "

Types of Swaps

Interest rate swaps
Helps in managing interest rate risk

Currency swaps
Helps in managing Currency exch. rate risk

Interest Rate Swaps

Involves exchange of interest payment between 2 parties on notional principal amount.

- One party will pay interest at fixed interest rate known as fixed rate payer & Other party will pay interest at floating interest rate known as floating rate payer.

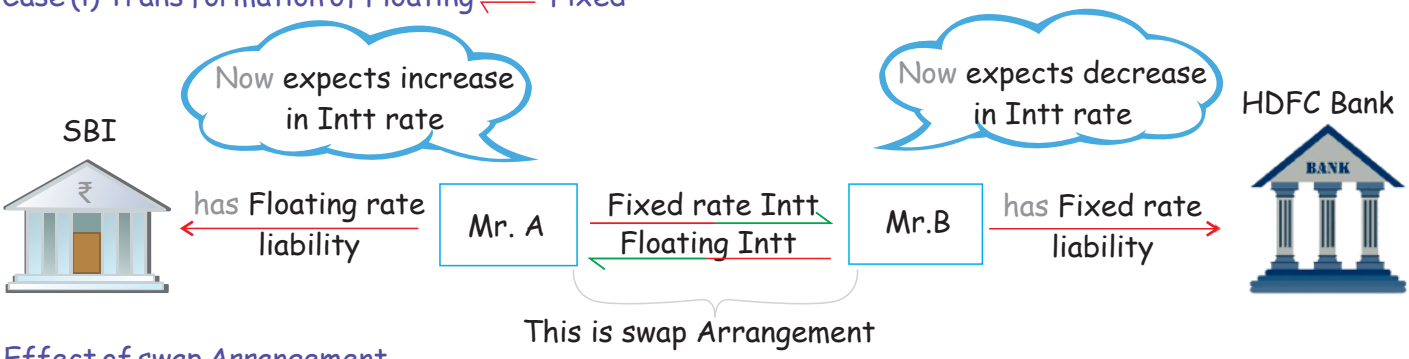
Uses of interest rate swaps

Case (i)
Transformation of fixed / floating rate asset / liability to floating / fixed rate asset/ liability

Case (ii)
Absolute advantage argument

Case (iii)
Comparative advantage argument

Case (i) Trans formation of Floating ⇄ Fixed



Effect of swap Arrangement

Mr. A's Floating rate liability has transformed into a fixed rate liability
Mr. B's Fixed rate liability has transformed into a floating rate liability

In the similar manner floating / fixed rate asset can also be transformed into a fixed / floating rate asset

Features of swap

1. In case of Interest rate swaps agreement, principal amounts are NOT exchanged & hence principal is termed as " Notional principal "
2. Primary obligations remain unaffected even after entering into swap arrangement.
3. Cash flows are exchanged on net basis.

Case (ii) Absolute advantage argument

Mr. Optimistic & Mr. Pessimistic both are willing to take loan. Mr. Optimistic expects a fall Intt Rates & Mr. Pessimistic expects a rise in Intt rate .

	Mr. Optimistic	Mr. Pessimistic
Floating rate	Wishes Bank rate +3%	Borrow Bank rate +2%
Fixed rate	Borrow 12%	Wishes 15%

Design a swap strategy that results into sharing of gain b/w both the parties in the ratio of 4:3 after commission to intermediary @ 0.50%

Solve :

WN #1: Calc of net advantage & its sharing

Advantage under Floating rate [BR + 3% - (BR + 2%)]	1%
Advantage under Fixed rate [15% - 12%]	3%
Gross Advantage	4%
Less : Comm. to FI	0.5%
Net Advantage	3.5%
To be shared between :-	
Mr. Optimistic [3.5% x 4/7]	2%
Mr. Pessimistic [3.5% x 3/7]	1.5%

WN#2: Calc of floating rate to be paid by Mr. Optimistic under swap

Interest cost without swap arrangement	BR + 3%
Less: Advantage promised to Mr. Optimistic under swap	- 2
Overall interest rate under swap	BR + 1%

Case (iii) Comparative advantage argument

	Mr. Rich	Mr. Poor
Floating rate	Wishes Bank rate +1%	Borrow Bank rate +3%
Fixed rate	Borrow 10%	Wishes 15%

Design a swap strategy with comm to FI @ 0.50% & gain sharing in the ratio of 3:2

Solve :

WN #1: Caln of net advantage & its sharing

Advantage under fixed rate	5%
Disadvantage under floating rate	(2%)
Gross Advantage	3%
Less: Comm. to FI	0.5%
Net Advantage	2.5%
To be share b/w :-	
Mr. Rich [2.5% x 3/5]	1.5%
Mr. Poor [2.5% x 2/5]	1%

WN # 2: Caln of fixed rate to be paid be Mr. rich

Interest rate without swap	BR + 1%
Less: advantage under swap	(1.5%)
Overall interest rate under swap	BR - 0.5%

(-) Overall Intt Outflow under Swap = (-) Outflow of Intt to Bank + Inflow/Outflow with Other Party in the Swap

Trick is to denote outflow of intt with -ve sign & inflow as +ve sign

(-) (BR - 0.5%) = (-) 10% (-) BR + Fixed Rate

∴ Fixed Rate = 10.5%

Quality Spread Differential

when parties of different level of credit worthiness experience different levels of intt. rates on debt then generally, diff in fixed rates > diff in floating rates.

QSD = Default risk premium differential on fixed rate debt
less: Default risk prem. diff on floating rate debt

Eg.	Mr. Rich	Mr. Poor
Fixed rate	10%	5% → 15%
Floating rate	PLR + 2%	2% → PLR + 4%

Quality spread differential = 3%

Interpretation of Swap quotation when Bid Ask rates are given

Eg. A swap Quotation reads as PLR is floating rate Vs. 7.5% - 8% are fixed rates

Now which one 7.5% or 8% is applicable rate on you ?

If we agree to pay floating rate i.e PLR then in exchange we will receive lesser fixed rate i.e 7.5% {aka Seller of Swap}

If we agree to receive floating rate i.e PLR then in exchange we have to pay higher fixed rate i.e 8% {aka Buyer of Swap}

Tutorial Note : Remember the rule, customer बेचारा is always at a loss in Bid - Ask spread game !

Varieties of Swaps

MTP Nov 2024

1. Generic swap/ Plain vanilla Swap / Coupon Swap
   (a) Fixed payment is based on 30/360 days Convention i.e. assuming 30 days in a month & 360 days in a year
   (b) Floating rate Payment is based on actual /360 days Convention i.e. actual no. of days during that period & 360 days in a year

   How to calculate 'Net settlement amount'

   Step 1: Calc interest payment by fixed rate payer

   $$N \times AIC \times \frac{\text{No. of days till settlement date}}{360}$$

   here,

   N = Notional principal amount
   AIC = All in cost i.e. fixed interest rate
   No. of days are taken by assuming 30 days in a month

   Step 2: Calc interest payment by floating rate payer

   $$= N \times \text{floating interest rate} \times \frac{\text{Actual No. of days till settlement date}}{360}$$

   here,

   N = Notional principal amount
   Actual No. of actual days are taken

   Step 3: Calc Net Settlement amount

   = Difference between interest payment by fixed rate payer vs. floating rate payer [i.e. step 1 - step 2]

2. All-in-Cost swap means a swap in which rates are quoted in such a way that it includes all types of Costs eg. Brokerage, service charges etc.

3. Overnight index swap involves some kind of overnight rates, (money market rates for short term lending / borrowing) being exchanged for fixed rates.
   The floating rate is compounded over everyday of the payment period, however, fixed rate is not compounded daily. Use Actual / 365 day count rule.
   Saturday's Floating rate will be applicable for Sunday without compounding.

4. Basis Swaps Floating rates are exchanged with another floating rates. Normally, Bank use basis swap to fix difference b/w their liability basis & Asset basis.

5. Equity Swap the exchange of fixed rate investments (such as Bonds which pay a guaranteed coupon rate) with floating rate investments (such as an Index.)

6. Amortising Swap An interest rate swap in which notional principal amount declines during the life of the swap.

Swaptions

An option to enter into a swap contract on some future date. It gives the holder the right but not the obligation to enter into an interest rate swap at a specific date in the future, at a particular fixed rate and for a specified term. Types of Swaption:

Payer Swaption (Call Swaption) - Used by Bullish on Interest Rate / A Prospective Borrower

Gives the Owner of the Swaption the right but not the obligation to enter into a swap where they pay the fixed leg and receive the floating leg.

Receiver Swaption (Put Swaption) - Used by Bearish on Interest Rate / A Prospective Investor

Gives the Owner of the Swaption the right but not the obligation to enter into a Swap in which they will receive the fixed leg and pay the floating leg.

Areas of application of Swaptions

(a) It can be applied for speculation purposes or to hedge a portion of their swap books.
(b) It can be applied in a variety of ways for both active traders as well as for corporate treasurers.
(c) It have become useful tool for hedging embedded optionality which is common to the natural course of many businesses.
(d) It is useful to borrowers targeting an acceptable borrowing rate.
(e) It is also useful to those businesses tendering for contracts.
(f) It also provides protection on callable/puttable bond issues.

Currency Swaps

Why do we need currency swaps

Infosys

Liab		Assets	
	Today $ 1 = ₹ 80		
Bank Loan	₹ 8000 cr.	Inv in America	$ 1 billion
	After 1yr Spot $ 1 = ₹ 60		
Bank Loan	₹ 6000 cr.	Inv in America Sold	$ 1 billion

Convert $1 = ₹ 60

Loss = ₹ 2000 crore due to ex. rate fluctuations

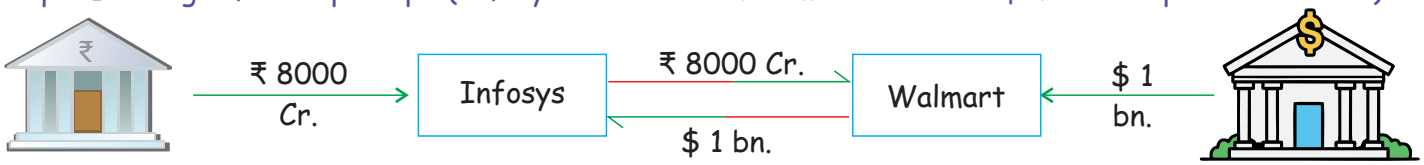
Above loss is due to asset liability currency mismatch .

- Ideally borrowing should be done in the same currency in which we have to invest. However, cost of raising funds on foreign land would be relatively higher for an outsider.
- Hence cos. can borrow in their home countries & enter into currency swap as explained below :

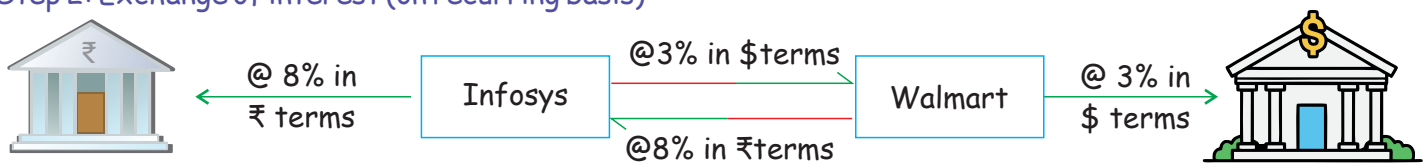
Example : Infosys wants to setup a software development unit in America & Walmart wants to setup Retail Stores in India.

	Infosys	Walmart
₹	Borrow 8%	Wishes 9%
$	Wishes 4%	Borrow 3%

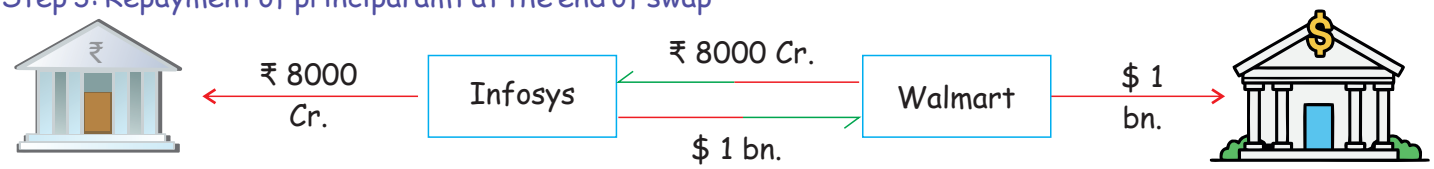
Step 1: Exchange of initial principal (Infosys borrows in ₹ & walmart borrows in $ & then swap the currencies)



Step 2: Exchange of interest (on recurring basis)



Step 3: Repayment of principal amt at the end of swap



Advantages / Benefits of Currency swap

1. It helps in achieving asset & liab Currency matching concept & hence acts as a natural hedge against foreign exchange rate risk
2. Avoidance of Currency conversion cost i.e. savings of bid - ask spread.
3. Overall reduction in the cost of borrowing .

Step to solve the currency swap Q

Step 1: Calc amount received at the beginning due to loan taken & Exchange of Principal

	Party 1 [Say, USA Co.]	Party 2 [Say, Indian Co.]
Principal amount borrowed from lender	Inflow $	Inflow ₹
(-) Principal amount transferred to other party	Outflow $	Outflow ₹
(+) Principal amount received from other party	Inflow ₹	Inflow $
Amount received at beginning	Net Inflow ₹	Net Inflow $

Step 2: Calc effective interest cost on loan

	Party 1 [USA Co.]	Party 2 [Indian Co.]
Interest amount received from other party	$	₹
(-) Interest amount paid to lender	($)	(₹)
Gain/(loss)	$/($)	₹/(₹)
Gain/(loss) Converted in party's required currency	₹/(₹)	$/($)
Interest amount paid to other party	(₹)	($)
Interest cost (in amount)	₹	$
Interest cost (in %) $\left[\frac{\text{Interest cost (in amount)}}{\text{Amount received at beginning}} \times 100\right]$	%	%

Step 3: Calc Opportunity Gain/ Savings in Interest cost due to use of Swap

	Party 1	Party 2
Interest cost (in %) if required loan taken directly	%	%
(-) Interest cost (in %) due to use of swap	(%)	(%)
Opportunity Gain / saving	%	%

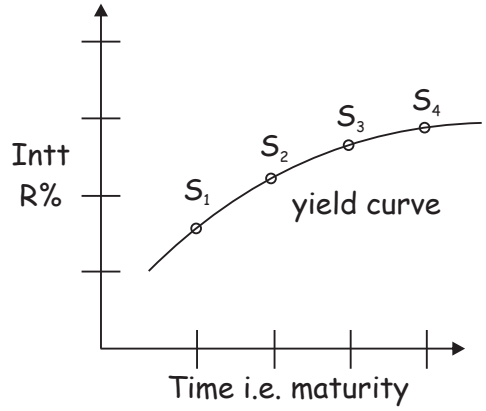
Interest Rate Derivatives

Interest Rate Derivatives is a financial product under which one party agrees to borrow & another party agrees to lend a specific amount on some specified future date @ Interest Rates agreed upon today .

- Interest Rate Forward or Forward Rate agreement [FRA]
- Interest Rate Guarantee → is an Option on Interest Rate
- Interest Rate Futures
- Interest Rate Options

Let's talk about an Interest Rate related concept of Bootstrapping first

Bootstrapping



Bootstrapping is used to derive Yield curve (aka Term structure of interest rates). It is a method of constructing fixed income yield curve from the Price of a set of a coupon - bearing products eg . Bonds .

A bootstrap curve correspondingly is one where the Price of an instrument is used as an input to the curve will be an exact output when this same instruments are valued using this curve.

Here the term structure of spot rate is recovered from the Bond Yield by solving for them recursively , by forward substitution , this iterative method is called as Bootstrap method .

Forward Rate Agreement is a contract to borrow/invest at a later date

is a contract with bank for betting on interest rate for a loan of certain maturity after a specified period. [Cash Settlement]

Just like other derivative contracts, FRA can be used for speculation, hedging and arbitrage.

(i) Speculation [Since we are going to speculate so I"ll use the word 'betting' for explaining the concept]

If we expect that

- Interest rate will rise in future → enter into Upside betting on Interest rate [i.e. Buy FRA]
- Interest rate will fall in future → enter into Downside betting on Interest rate [i.e. Sell FRA]

Example: A bank is offering a FRA for a loan of 3 month after 6 month from now at 10% p.a. [6x9 FRA]
If we expect interest rate will rise after 6 month from now, then we should buy FRA at 10% p.a. (i.e. Upside betting on this rate.)
But, if as per our expectations interest rate will Fall after 6 month from now, then we should Sell FRA at 10% p.a. (i.e. Downside betting on this rate.)

eg: Interpretation of FRA quotation when Bid Ask are given:

3 x 9 FRA	7%	-	7.5%
	A customer sells FRA at Bid rate [i.e. Downside betting]		A customer buys FRA at Ask Rate [i.e. Upside betting]

Tutorial Note : Remember the rule, customer बेचारा is always at a loss in Bid - Ask spread game!

Profit or loss is settled in cash as follows

If Initially bought FRA [Upside betting]
- Profit, if RR > FR
- Loss, if RR < FR

If Initially sold FRA [Downside betting]
- Loss, if RR > FR
- Profit, if RR < FR

Final Settlement [Profit or Loss] on FRA

$$\text{Final Settlement amount} = \frac{N \times (RR - FR) \times t}{1 + (RR \times t)}$$

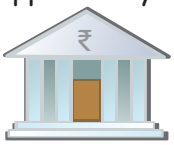
here, N = Notional principal amount of loan
RR = Reference rate i.e. actual interest rate after the specified period
FR = Contracted FRA rate
$t = \frac{\text{No. of Days or months of FRA loan}}{365 \text{ or } 12}$

(ii) Hedging
A prospective borrower can Buy FRA
A prospective lender can Sell FRA
in order to prevent from an adverse change in interest rates

(iii) Arbitrage
Step 1: Calc Theoretical/ Fair FRA rate
Step 2: Compare Fair FRA rate vs Actual FRA rate to identify arbitrage opportunity

Example

Calc Fair Forward Intt Rates or Theoretical/ Fair FRA based on Expectations Theory ?



SBI

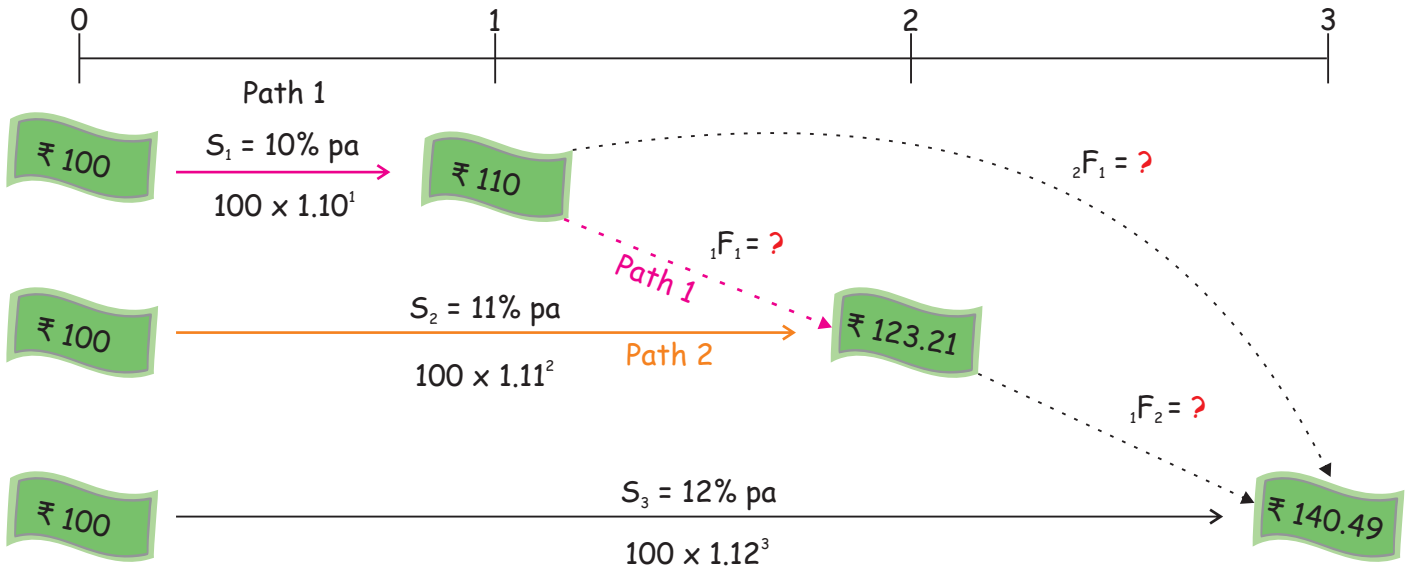
Below is the Interest rates info

Year	Spot Interest rates
1	10% pa
2	11% pa
3	12% pa

Solve:

Theoretical/ Fair FRA rate is the rate at which company is indifferent between 2 short period borrowings & 1 full long period borrowing.

Let's assume we can borrow / invest ₹ 100 today



Tutorial Note: To avoid confusion, Students may read F as "After". Hence, $_2F_1$ may be read as 2 Years Rate After 1 Year

here
$_2F_1$ would means 2 Years Forward Rate after 1 Year
$_1F_2$ would means 1 Year Forward Rate after 2 Years

Calc of $_1F_1$

$(1 + S_2)^2 = (1 + S_1)^1 (1 + {}_1F_1)^1$
$(1.11)^2 = (1.10)^1 (1 + {}_1F_1)^1$
$1.2321 = 1.10 \times (1 + {}_1F_1)^1$
$_1F_1$ = 12.009% ~ 12.01% pa

or

$FV = PV (i + r)^n$
$123.21 = 110 (i + r)^1$
r = 12.009% ~ 12.01%

Calc of $_1F_2$

$(1 + S_3)^3 = (1 + S_2)^2 (1 + {}_1F_2)^1$
$(1.12)^3 = (1.11)^2 (1 + {}_1F_2)^1$
$_1F_2$ = 14.03 % pa

Cal^{-n} of $_2F_1$

$(1 + S_3)^3 = (1 + S_1)^1 (1 + {}_2F_1)^2$
$(1.12)^3 = (1.10)^1 (1 + {}_2F_1)^2$
$_2F_1$ = 13.01 % pa

Tutorial Note: $_2F_1$ is read as 2 year loan Rate After 1 Year

Q What if in above case $_1F_1$, quoted by Bank is 10.5%

Solve: Since Actual $_1F_1$ (10.5%) < Fair $_1F_1$, (12.01%), therefore, arbitrage opportunities exist.

(i) We'll borrow at 1 Year Spot Rate today & enter into $_1F_1$ to refinance the O/s amount for another 1 Year. {Borrow on Path 1}

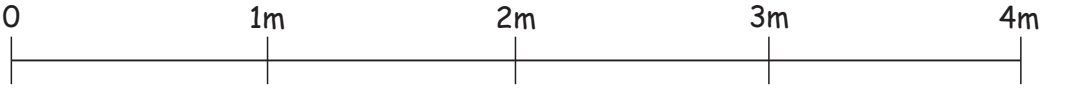
(ii) Invest the borrowed amount at 2 Yr Spot Rates today {Invest on Path 2} to earn risk-free arbitrage gain of ₹ 1.66 at the end of Yr 2 per ₹ 100 borrowed today.

Proof of Arbitrage		
Amount borrowed (say)		₹ 100000
Add: Interest @ S_1 for 1 Year	100000 x 10% pa	₹ 10000
		₹ 110000
Add: Interest @ $_1F_1$ for 2nd Year	110000 x 10.5% pa	₹ 11550
	Total amount payable	₹ 121550

Amount Invested		₹ 100000
Add: Interest @ S_2 ie 11% pa for 2 years	100000 x 1.11^2 - 100000	₹ 23210
	Total Amount Realized	₹ 123210

Net Arbitrage Gain ₹ 1,660 per ₹ 1,00,000 borrowed

Alternative ways to denote FRA ie . Forward Rate Agreement



this is 1 month Intt Rate after 3 month i.e. $_1F_3$

may also be denoted as

3	/	4	FRA
3	x	4	FRA
3	v	4	FRA

Interest Rate Guarantee is an option to borrow/invest

It is a contract with the bank where we get the right to take loan of certain maturity after a specified period at strike rate agreed upon today.

Eg. A prospective Borrower buys an IRG (ie. buys call option on interest rate) & pays premium.

Interest rate guarantee premium is paid to the bank at beginning for getting the right to take loan at a strike rate.

If after the specified period

Actual Interest rate > Strike rate
↓
Exercise IRG & take loan at strike rate

Actual Interest rate < Strike rate
↓
Do not Exercise IRG & take loan at actual interest rate

Calculation of total interest amount payable on loan:

Interest amount on loan as per above selected rate (ie. Actual Intt Rate or Strike rate whichever is more beneficial)	xxx
+ Interest rate guarantee premium amount	xxx
	xxx

Interest Rate Futures

are the Futures contract wherein interest rate is agreed upon today for delivery on some future date .

Price of Interest Rate Futures contract is generally quoted as

= 100 - Interest Rate
or Mkt Intt / Yield

i.e. In nutshell it reflects Bond Price .If Intt Rates ↑ then Intt Rate Futures Price ↓ & Vice Versa

Hence, a borrow will enter into Short Position & a lender will enter into long Position in Interest Rate Futures contract.

Interest rate future can be either cash settled or settled through physical delivery of bonds

(i) Cash Settled

IRF can be used for speculation & hedging. Let's take example of hedging

Step 1: Decide whether IRF to be bought or sold

If company is a Borrower	If company is a Lender
↓	↓
it means company fears rise in interest rates	it means company fears a fall in interest rates
↓	↓
Sell IRF since ↑ in intt rate will ↓ IRF price	Buy IRF since ↓ in intt rate will ↑ IRF price

Step 2: Calc No. of IRF contracts to be bought or sold

$$= \frac{\text{Loan Amount}}{\text{Future contract size}} \times \frac{\text{Loan duration in months}}{\text{Future contract period in months}}$$

Step 3: Calc of Gain / Loss on IRF Contracts

Gain / (Loss) on IRF contracts

If initially Sold IRF	If initially bought IRF
↓	↓
It price of IRF on Maturity	It price of IRF on Maturity
Rises ↓ Loss / Falls ↓ Gain	Rises ↓ Gain / Falls ↓ Loss

$$\text{Total gain/(loss) on IRF} = \text{Number of IRF contracts} \times \text{Future contract Size} \times \left[\text{Difference between price of IRF on maturity (Settlement price) \& Initially contracted price}\right] \% \times \frac{\text{Future contract Period}}{12}$$

Step 4: Calc Net interest (paid) / received on maturity after hedging

Actual Interest (paid)/ received on loan Borrowed / Lent $\left[\text{Loan amount} \times \text{Actual interest rate} \times \frac{\text{Loan duration in months}}{12}\right]$	xxx/(xxx)
Gain / (Loss) on IRF contracts	xxx/(xxx)
Net Interest (Paid) / Received	xxx/(xxx)

Step 5: Calc effective/ Net Interest rate achieved due to hedging

$$= \frac{\text{Net Interest amount as calc in step 4}}{\text{Loan amount}} \times \frac{12}{\text{Loan duration in months}} \times 100$$

(ii) Physically Settled

It is a contract on stock exchange to buy or sell coupon bearing bond on a specified future date at a pre-fixed price.

This contract is done for a notional bond. So, Seller of a IRF contract can deliver any available bond from the basket of deliverable bonds at NSE on maturity

Since Seller of IRF contract can deliver any bond on maturity, he will choose cheapest to deliver (CTD) bond because it is the least expensive bond in the basket of deliverable bonds. A CTD bond minimizes the difference between the quoted spot price of bond & futures settlement price (adjusted by conversion factor). A CTD bond is selected as follows:

Step 1: Calculate profit/ (Loss) on each available bond that can be delivered

$$= \underbrace{\left[\begin{array}{l}\text{Future price agreed or}\\ \text{Original settlement price or}\\ \text{Future settlement price}\end{array} \times \text{Conversion factor}\right]}_{\text{Actual delivery price i.e. Effective or Final settlement price}} - \begin{array}{l}\text{Quoted spot price of}\\ \text{Bond on maturity}\end{array}$$

Note: Conversion factor for each bond is determined by the stock exchange (hence will be given in Q)

Step 2: Select that bond for delivery which provides maximum profit. (as calc in above step) among all available bonds.

Format of presentation

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) x (3)	Quoted Price of Bonds (5)	Profit (6)
:	:	:	:	:	:

Interest Rate Options

- Interest Rate Cap is bought by a Floating Rate Borrower
- Interest Rate Floor is bought by a Floating Rate Investor
- Interest Rate Collar

Interest Rate Cap | Cap Option | Call Option

On each Reset Date, if Benchmark Rate of Floating Interest Rate Loan > Strike Rate of cap Option, then Option Buyer will receive Payoff from Option Seller on next Interest Payment Date.

$$\text{Pay off under Cap Option} = \text{Loan Amount} \times \left[\text{Benchmark Rate on Reset Date} - \text{Strike Rate}\right] \times \frac{\text{No. of days or months from Reset Date to Interest Payment Date}}{365 \text{ or } 12}$$

If Benchmark Rate on a Reset Date is at or below the Strike Rate, then Pay off under Cap Option will be 'Zero' (0) for next Interest Payment Date.

Suppose you are a Company who issued Floating Rate Bonds to raise funds but wishes to Cap the Intt Rates @ 10%

Financial Intermediary

3%
2%
1%

Floating Intt Rates

13%
12%
11%
10%
9%
8%

13%
12%
11%
10%
9%
8%

Bondholders

Company buys an Interest Rate Cap @ 10%. Now, any Intt Rate above 10% will be reimbursed by Financial Intermediary who sold Intt Rate Cap

Effective Cost of Borrowing

Intt paid to bond holders	Reimbursement from Intt Rate Cap	Effective cost
13%	3%	10%
12%	2%	10%
11%	1%	10%
10%	-	10%
9%	-	9%
8%	-	8%

Interest Rate Floor

On each Reset Date, If Benchmark Rate of Floating Interest Rate Loan < Strike Rate of Floor Option, then Option Buyer will receive Payoff from Option seller on next Interest Payment Date.

$$\text{Pay off under Floor Option} = \text{Loan Amount} \times \left[\text{Strike Rate} - \text{Benchmark Rate on Reset Date}\right] \times \frac{\text{No. of days or months from Reset Date to Interest Payment Date}}{365 \text{ or } 12}$$

If Benchmark Rate on Reset Date is at or above the Strike Rate, then Pay off will be 'Zero' (0) for next Interest Payment Date.

Suppose you are an Investor who has made Floating Rate investment in Bonds issued by a Co. but fears a fall in Intt rates and wishes to protect from Intt Rates fall below 7%

Floating Rate Investor

Floating Intt Rates

9% → 9%

8% → 8%

7% → 7%

6% → 6% ← 1%

5% → 5% ← 2%

4% → 4% ← 3%

Financial Intermediary

Investor bought a 7% Floor from FI. Hence, any fall below 7% will be reimbursed by FI.

Effective Rate of Return

Intt from Floating rate Inv.	Reimbursement from Intt Rate floor	Effective Return
9%	-	9%
8%	-	8%
7%	-	7%
6%	1%	7%
5%	2%	7%
4%	3%	7%

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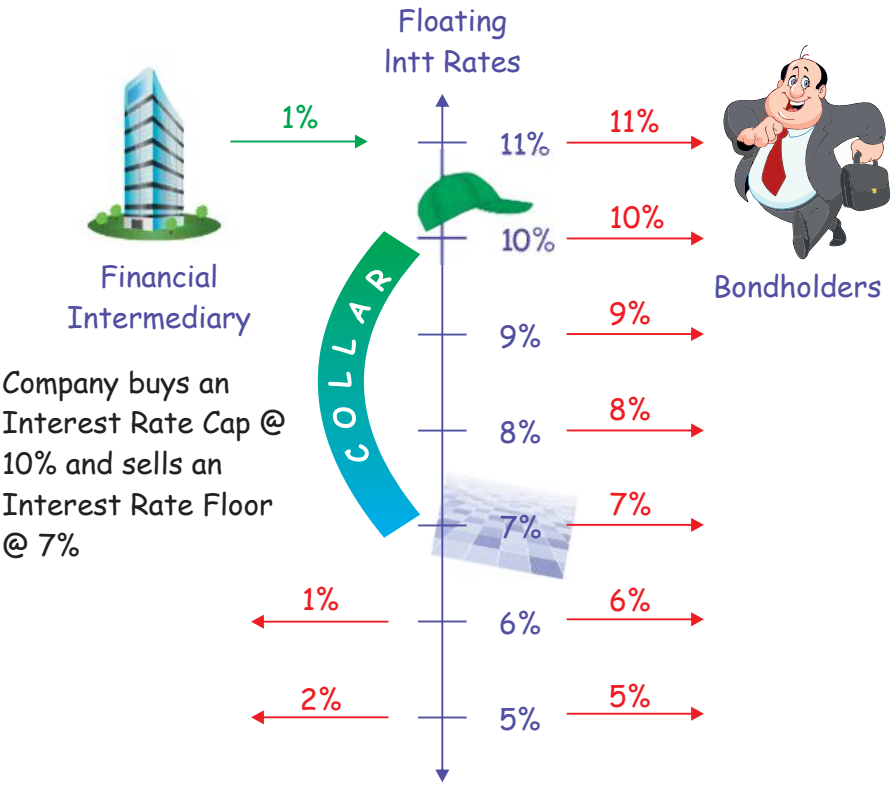
Interest Rate Collar

A floating rate borrower wishes to cap increase in interest rates but at the same time wish to reduce his net premium payment & hence he sells the floor.

Suppose you are a Company who issued Floating Rate Bonds but wishes to Cap the Intt Rates @ 10% and at the same time wish to reduce Premium Cost of Buying Cap, so you sell Intt Rate Floor @ 7%



Company buys an Interest Rate Cap @ 10% and sells an Interest Rate Floor @ 7%

Effective Cost of Borrowing

Intt paid to bond holders	Inflow from Cap	Outflow under floor	Effective cost
11%	1%	-	10%
10%	-	-	10%
9%	-	-	9%
8%	-	-	8%
7%	-	-	7%
6%	-	1%	7%
5%	-	2%	7%

Things to Remember

If Question asks 'how much interest rate risk is hedged through Option,' then calculate Net pay off from option on each interest payment date as follows :

= Pay off from option on a payment date (-) Option premium allocated to that payment date

*Option premium allocated to each payment date = $\frac{\text{Option premium paid at the beginning}}{\text{PVAF @ Fixed interest rate for all payment dates}}$ [Just Like ENPV = $\frac{\text{NPV}}{\text{PVAF}}$]

Question 1 Study Material (Similar), Exam Nov 2008 (Similar), (8 Marks) Exam Nov 2023

Suppose a dealer bank quotes for a generic swap "AIC 8%/8.20% vs. 6M LIBOR Flat". Notional principal amount of swap is ₹ 1 Million, and the same is for a period of three years, reset after every six months. In this context, answer the following questions :

(1) Interpret the dealer bank quote.

(2) If a firm is buying a swap, what is the nature of cash flows ?

(3) If a firm is selling a swap, what is the nature of cash flows ?

(4) Calculate semi-annual fixed payment for the buyer of swap at the end of every six months.

(5) If the six month period from the effective date of swap to the settlement date comprises of 181 days and that the corresponding LIBOR was 5% on the effective date of swap, then what will be the first floating rate payment for the buyer ?

(6) If the settlement is on "Net Basis", how much the buyer of swap has to pay or receive at the end of first six months ?

[Assume 30/360 days basis]

Solution: (1) Interpretation of dealer bank quote:

- AIC in the dealer bank quote refers to 'All in cost' i.e. cost of swap all inclusive.
- First part of the quote i.e. '8%/8.20% refers to the fixed leg part and the second part of the quote i. e. '6m LIBOR Flat' refers to the floating leg part.
- The difference in the fixed rates i.e. 20 bps refers to the margin charged by the Bank on the fixed leg of transactions.
- The term 'flat' on the floating leg quote, indicates that the Bank does not charge any commission on the floating leg. Therefore, bank charges 20 bps for transacting swap as a whole.

(2) A buyer of swap pays 'Fixed' cash flows and receives 'Floating'. As per the quote, the buyer would pay 8.2% (higher of 8%, 8.2%) to the Bank and would receive '6M LIBOR' against it.

(3) A seller of swap pays 'floating' cash flows and receives 'fixed'. As per the quote, the seller would pay '6M LIBOR' to the bank and would receive 8% (lower of 8%, 8.2%) against it.

(4) Semi-annual Payment every six-month for buyer of Swap:

$$₹\ 10,00,000 \times 8.20\% \times \frac{1}{2} = ₹\ 41,000$$

(5) Floating Rate Payment

$$= N\ (LIBOR)\left(\frac{dt}{360}\right) \qquad = 10,00,000 \times 0.05 \times \frac{181}{360}$$

= 10,00,000 × 0.05 (0.503) or 5,00,000 × 0.05 (0.502777)
= 10,00,000 × 0.02515 or 10,00,000 × 0.02514 = ₹ 25,150 or ₹ 25,140

(6) Net Settlement
₹ 41,000 - ₹ 25,150 = ₹ 15,850 Or ₹ 41,000 - ₹ 25,140 = ₹ 15,860
or ₹ 41,000 - ₹ 25,138.89 = ₹ 15,861.11

Question 2 Study Material, Exam N10, N24, RTP N21, N24, MTP S22, N23, A24, M25

Derivative Bank entered into a plain vanilla swap through an OIS (Overnight Index Swap) on a principal of ₹ 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 2nd August, 2010 and was to commence on 3rd August, 2010 and run for a period of 7 days.

Respective MIBOR rates for Tuesday to Monday were:
7.75%, 8.15%, 8.12%, 7.95%, 7.98%, 8.15%

If Derivative Bank received ₹ 317 net on settlement, calculate Fixed rate and interest under both legs.

Notes: (i) Sunday is Holiday. (ii) Work in rounded rupees and avoid decimal working.

Solution:

Day	Principal (₹)	MIBOR (%)	Interest (₹)
Tuesday	10,00,00,000	7.75	21,233
Wednesday	10,00,21,233	8.15	22,334
Thursday	10,00,43,567	8.12	22,256
Friday	10,00,65,823	7.95	21,795
Saturday & Sunday (*)	10,00,87,618	7.98	43,764
Monday	10,01 ,31,382	8.15	22,358
Total Interest @ Floating			1,53,740
Less: Net Received			317
Expected Interest @ fixed			153,423
Thus Fixed Rate of Interest			0.07999914
Approx.			8%

(*) ie. interest for two days..

ICAI Note: Alternatively, answer can also be calculated on the basis of 360 days in a year.

Question 3 (10 Marks) Exam May 2010

ABC Bank is seeking fixed rate funding. It is able to finance at a cost of six months LIBOR + ¼ % for ₹ 200 million for 5 years. The bank is able to swap into a fixed rate at 7.5% versus six month LIBOR treating six months as exactly half a year.

(a) What will be the "all in cost" funds to ABC Bank?

(b) Another possibility being considered is the issue of a hybrid instrument which pays 7.5% for first three years and LIBOR – ¼% for remaining two years.

Given a three year swap rate of 8%, suggest the method by which the bank should achieve fixed rate funding.

Solution:

a) ABC Bank pays LIBOR + 0.25% p.a. for 5 years. The swap involves payment of 7.5% p.a. and receipt of LIBOR.

Inflow	Outflow
LIBOR	LIBOR + 0.25% + 7.5%

Net interest payment 7.75%

Cash flows per six month period

Inflow	Outflow
(LIBOR/2) x ₹ 200 million	(LIBOR/2) x ₹ 200 million + ₹ 2,50,000 + ₹ 75,00,000

Therefore, All in cost of funds = ₹ 77,50,000.

Alternatively it can also be calculated as follows:
₹ 200 million x 7.75% x 6/12
= ₹ 7.75 millions or ₹ 77,50,000

b) ABC Bank issues hybrid and enters both the five year and three year swaps.

First three years:	
Bank pays on hybrid	7.5% p.a.
Bank pays on five year swap	7.5% p.a.
Bank receives on three year swap	8% p.a.
Bank receives on five year swap	LIBOR
Bank pays on three year swap	LIBOR
Net interest payment	7% p.a.

Final two years:	
Bank pays on hybrid	LIBOR – 0.25%
Bank received on five year swap	LIBOR
Bank pays on five year swap	7.5% p.a.
Net interest payment	7.25% p.a.

Therefore the arrangement in (b) compared to (a) saves 0.75% p.a. over the first three years and 0.5% p.a. over final two years.

Question 4 RTP Nov 2010

TMC Corporation entered into € 3.5 million notional principal interest rate swap agreement. As per the agreement TMC is to pay a fixed rate and to receive a floating rate of LIBOR.

The Payment will be made at the interval of 90 days for one year and it will be based on the adjustment factor 90/360. The term structure of LIBOR on the date of agreement is as follows:

Days	Rate (%)
90	7.00
180	7.25
270	7.45
360	7.55

You are required to calculate fixed rate on the swap and first net payment on the swap.

Solution: (i) The discount bond prices are as follows:

Term	Rate	Discount Bond Price
90 days	7.00	$B_0(90) = 1/(1 + 0.07(90/360)) = 0.9828$
180 days	7.25	$B_0(180) = 1/(1 + 0.0725(180/360)) = 0.9650$
270 days	7.45	$B_0(270) = 1/(1 + 0.0745(270/360)) = 0.9471$
360 days	7.55	$B_0(360) = 1/(1 + 0.0755(360/360)) = 0.9298$

The fixed rate is

$$= \frac{1 - 0.9298}{0.9828 + 0.9650 + 0.9471 + 0.9298} \times \frac{360}{90}$$

$$= 0.0734$$

(ii) The first net payment is based on a fixed rate of 7.34 percent and a floating rate of 7 percent:

Fixed payment: € 35,00,000(0.0734)(90/360) = € 64,225

Floating payment: € 35,00,000(0.07)(90/360) = € 61,250

The net is that the party paying fixed makes a payment of € 2,975

Question 5 Study Material, RTP Nov 2012, (6 Marks) Exam Nov 2024

Drilldip Inc. a US based company has won a contract in India for drilling oil field. The project will require an initial investment of ₹ 500 crore. The oil field along with equipments will be sold to Indian Government for ₹ 740 crore in one year time. Since the Indian Government will pay for the amount in Indian Rupee (₹) the company is worried about exposure due to exchange rate volatility.

You are required to:

(a) Construct a swap that will help the Drilldip to reduce the exchange rate risk.

(b) Assuming that Indian Government offers a swap at spot rate which is 1US$ = ₹ 50 in one year, then should the company opt for this option or should it just do nothing. The spot rate after one year is expected to be 1US$ = ₹ 54. Further you may also assume that the Drilldip can also take a US$ loan at 8% p.a.

Solution: (a) The following swap arrangements can be entered by Drilldip.

i. Swap a US$ loan today at an agreed rate with any party to obtain Indian Rupees (₹) to make initial investment.

ii. After one year swap back the Indian Rupees with US$ at the agreed rate. In such case the company is exposed only on the profit earned from the project.

(b) **With the swap**

	Year 0 (Million US$)	Year 1 (Million US$)
Buy ₹ 500 crore at spot rate of 1US$ = ₹ 50	(100.00)	---
Swap ₹ 500 crore back at agreed rate of ₹ 50	---	100.00
Sell ₹ 240 crore at 1US$ = ₹ 54	---	44.44
Interest on US$ loan @8% for one year	---	(8.00)
	(100.00)	136.44

Net result is a net receipt of US$ 36.44 million

Without the swap

	Year 0(Million US$)	Year 1 (Million US$)
Buy ₹ 500 crore at spot rate of 1US$ = ₹ 50	(100.00)	---
Sell ₹ 740 crore at 1US$ = ₹ 54	---	137.04
Interest on US$ loan @8% for one year	---	(8.00)
	(100.00)	129.04

Net result is a net receipt of US$ 29.04 million

Decision: Since the net receipt is higher in swap option the company should opt for the same.

Question 6 (8 Marks) Exam May 2010

Consider the following data for Government securities:

Face Value (₹)	Interest rate	Maturity (Year)	Current Price (₹)
1,00,000	0%	1	91,000
1,00,000	10.5%	2	99,000
1,00,000	11.0%	3	99,500
1,00,000	11.5%	4	99,900

Calculate the forward interest rates.

Solution: To get forward Interest rates, begin with the One-year Government Security

$$₹\ 91,000 = \frac{₹\ 1,00,000}{(1 + r)} \qquad \therefore\ r = 0.099$$

Next consider the two year Government Security

$$₹\ 99,000 = \left(\frac{₹\ 10,500}{1.099}\right) + \left\{\frac{₹\ 1,10,500}{(1.099)\ (1 + r)}\right\} \qquad \therefore\ r = 0.124$$

Then consider the three year Government Security

$$₹\ 99,500 = \left(\frac{₹\ 11,000}{1.099}\right) + \left\{\frac{₹\ 11,000}{(1.099)\ (1.124)}\right\} + \left\{\frac{₹\ 1,11,000}{(1.099)\ (1.124)\ (1 + r)}\right\} \qquad \therefore\ r = 0.115$$

Finally consider the four year Government Security

$$₹\ 99,900 = \left(\frac{₹\ 11,500}{1.099}\right) + \left\{\frac{₹\ 11,500}{(1.099)\ (1.124)}\right\} + \left\{\frac{₹\ 11,500}{(1.099)\ (1.124)\ (1.115)}\right\} + \left\{\frac{₹\ 1,11,500}{(1.099)\ (1.124)\ (1.115)\ (1 + r)}\right\}$$

$\therefore\ r = 0.128$

Question 7

Exam May 2010, RTP Nov 2023

The following market data is available:

Spot USD/ JPY 116.00

Deposit Rates p.a.	USD	JPY
3 months	4.50%	0.25%
6 months	5.00%	0.25%

a. Whether 3 months FRA rate at 3 months forward for YEN should be NIL or not.

b. What should be 3 months FRA rate at 3 months Forward?

c. Analyse is any arbitrage opportunity available if the 6 & 12 months LIBORS for USD are 5% & 6.5% respectively and Bank XYZ is quoting 6/12 USD FRA at 6.50 – 6.75% ?

Solution:

(a) The FRA on Yen shall be nil as interest rate for both the periods i.e. 3 months and 6 months are same.

(b) **3 Months Interest rate is 4.50% & 6 Months Interest rate is 5% p.a.**

Future Value 6 Months from now is a product of Future Value 3 Months now & 3 Months Future Value from after 3 Months.

$(1 + 0.05*6/12) = (1 + 0.045*3/12) \times (1 + i_{3,6} *3/12)$

$i_{3,6} = [(1 + 0.05* 6/12) / (1 + 0.045 *3/12) - 1] *12/3$

i.e. 5.44% p.a.

(c) **6 Months Interest rate is 5% p.a & 12 Month interest rate is 6.5% p.a.**

Future value 12 month from now is a product of Future value 6 Months from now and 6 Months Future value from after 6 Months.

$(1 + 0.065) = (1 + 0.05*6/12) \times (1 + i_{6,6} *6/12)$

$i_{6,6} = [(1 + 0.065/1.025) - 1] *12/6$

6 Months forward 6 month rate is 7.80% p.a.

The Bank is quoting 6/12 USD FRA at 6.50 – 6.75%

Therefore, there is an arbitrage Opportunity of earning interest @ 7.80% p.a. & Paying @ 6.75%

Borrow for 6 months, buy an FRA & invest for 12 months

To get $ 1.065 at the end of 12 months for $ 1 invested today

To pay $ 1.060# at the end of 12 months for every $ 1 Borrowed today

Net gain $ 0.005 i.e. risk less profit for every $ borrowed

$(1 + 0.05/2)(1 + .0675/2) = (1.05959)$ say 1.060

Question 8

RTP Nov 2014, RTP Nov 2019, RTP Nov 2020, MTP Sep 2025

Two companies ABC Ltd. and XYZ Ltd. approach the DEF Bank for FRA (Forward Rate Agreement). They want to borrow a sum of ₹ 100 crores after 2 years for a period of 1 year. Bank has calculated Yield Curve of both companies as follows:

Year	XYZ Ltd.	ABC Ltd.*
1	3.86	4.12
2	4.20	5.48
3	4.48	5.78

(i) Identify at least one reason for difference in the yield curve for the companies

(ii) Calculate the rate of interest DEF Bank would quote under 2V3 FRA, using the company's yield information as quoted above.

(iii) Suppose bank offers Interest Rate Guarantee for a premium of 0.1% of the amount of loan, you are required to calculate the interest payable by XYZ Ltd. if interest in 2 years turns out to be

a. 4.50%

b. 5.50%

Solution:

(i) The difference in yield curve maybe due to the lower credit rating of ABC Ltd. compared to XYZ Ltd.

(ii) **DEF Bank will fix interest rate for 2V3 FRA after 2 years as follows:**

XYZ Ltd.

$(1+r)(1+0.0420)^2 = (1+0.0448)^3$

$(1+r)\ (1.0420)^2 = (1.0448)^3$

$r = 5.04\%$

Bank will quote 5.04% for a 2V3 FRA.

ABC Ltd.

$(1+r)\ (1+0.0548)^2 = (1+0.0578)^3$

$(1+r)\ (1.0548)^2 = (1.0578)^3$

$r = 6.38\%$

Bank will quote 6.38% for a 2V3 FRA.

(ii)

Year		4.50%- Allow to Lapse	5.50% - Exercise
Interest	₹ 100 crores x 4.50%	₹ 4.50 crores	---
	₹ 100 crores x 5.04%*	---	₹ 5.04 crores
Premium (Cost of Option)	₹ 100 crores x 0.1%	₹ 0.10 crores	₹ 0.10 crores
		4.60 crores	5.14 crores

*Since after 2 years 1-year interest rate turned out to be 5.50%, it will be beneficial for XYZ Ltd. to exercise its option.

Question 9

2Q Merged | SM, (8 Marks) Exam M13, N19 (Similar), N24, S25, MTP O22, RTP M25

M/s Parker & Co. is contemplating to borrow an amount of ₹ 60 crores for a period of 3 months in the coming 6 months time from now. The current rate of interest is 9% p.a. but it may go up in 6 months time. The company wants to hedge itself against the likely increase in interest rate.

The Company's Bankers quoted an FRA (Forward Rate Agreement) at 9.30% p.a.

(a) What will be the effect of FRA and actual rate of interest cost to the company, if the actual rate of interest after 6 months happens to be (i) 9.60% p.a. and (ii) 8.80% p.a.?

(b) Also calculate the actual interest rate

(i) If due to FRA banker pays to Parker & Co. an amount of ₹ 658938

(ii) If due to FRA parker will pay to the banker an amount of ₹ 513510

Solution: (a) Final settlement amount shall be computed by using formula:

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

here, N = the notional principal amount of the agreement;

RR = Reference Rate for the maturity specified by the contract prevailing on the contract settlement date;

FR = Agreed-upon Forward Rate; and

DTM = maturity of the forward rate, specified in days (FRA Days)

DY = Day count basis applicable to money market transactions which could be 360 or 365 days.

Accordingly,

If actual rate of intt after 6 m happens to be 9.60%

$$= \frac{(₹\ 60\ crore)\ (0.096 - 0.093)\ (3 / 12)}{[1 + 0.096\ (3 / 12)]}$$

$$= \frac{(₹\ 60\ crore)\ (0.00075)}{1.024} = ₹\ 4,39,453$$

Thus banker will pay Parker & Co. a sum of ₹ 4,39,453

If actual rate of intt after 6 m happens to be 8.80%

$$= \frac{(₹\ 60\ crore)\ (0.088 - 0.093)\ (3 / 12)}{[1 + 0.088\ (3 / 12)]}$$

$$= \frac{(₹\ 60\ crore)\ (-0.00125)}{1.022} = ₹\ 7,33,855$$

Thus Parker & Co. will pay banker a sum of ₹ 7,33,855

ICAI Note: It might be possible that students may solve the question on basis of days instead of months (as considered in above calculations). Further there may be also possibility that the FRA days and Day Count convention may be taken in various plausible combinations such as 90 days/360 days, 90 days/ 365 days, 91 days/360 days or 91 days/365days.

(b) (i) It's a case of reverse calculation. Let's assume actual intt rate to be X

$$+ 658938 = \frac{(₹\ 60\ crore)\ (X - 0.093)\ (3/12)}{[1 + X\ (3/12)]}$$

$$6,58,938\ [1 + 0.25x] = ₹\ 15\ crore\ X - ₹\ 1.395\ crore$$

$$6,58,938 + 1,64,735\ X = 15,00,00,000\ X - 1,39,50,000$$

$$\therefore X = \frac{1,46,08,938}{14,98,35,265} = 0.0975 \text{ or } 9.75\% \text{ p.a.}$$

(ii) It's a case of reverse calculation. Let's assume actual intt rate to be X

$$- 5,13,510 = \frac{(₹\ 60\ crore)\ (X - 0.093)\ (3/12)}{[1 + X\ (3/12)]}$$

$$- 5,13,510\ [1 + 0.25x] = ₹\ 15\ crore\ X - ₹\ 1.395\ crore$$

$$- 5,13,510 - 1,28,378\ X = 15,00,00,000\ X - 1,39,50,000$$

$$\therefore X = \frac{1,34,36,490}{15,01,28,378} = 0.0895 \text{ or } 8.95\% \text{ p.a.}$$

Question 10

Study Material, MTP May 2025

TM Fincorp has bought a 6 x 9 ₹ 100 crore Forward Rate Agreement (FRA) at 5.25%. On fixing date reference rate i.e. MIBOR turns out be as follows:

Period	Rate (%)
3 months	5.50
6 months	5.70
9 months	5.85

You are required to determine:

(a) Profit/Loss to TM Fincorp in terms of basis points.

(b) The settlement amount.

(Assume 360 days in a year)

Solution:

(a) TM will make a profit of 25 basis points since a 6 X 9 FRA is a contract on 3-month interest rate in 6 months, which turns out to be 5.50% (higher than FRA price).

(b) The settlement amount shall be calculated by using the following formula:

$$= \frac{(N)\ (RR - FR)\ (dtm / 360)}{[1 + RR\ (dtm / 360)]}$$

Where,

N = Notional Principal Amount

RR = Reference Rate

FR = Agreed upon Forward Rate

Dtm = FRA period specified in days.

Accordingly:

$$\frac{100\ crore\ (5.50\% - 5.25\%)\ (90 / 360)}{1 + 0.055\ (90 / 360)} = ₹\ 6,16,523$$

Hence there is profit of 6,16,523 to TM Fincorp.

Question 11 (8 Marks) MTP May 2021, (6 Marks) Exam Nov 2023

In March 2020, XYZ Bank sold some 7% Interest Rate Futures underlying Notional 7.50% Coupon Bonds. The exchange provides following details of eligible securities that can be delivered.

Security	Quoted Price of Bonds	Conversion Factor
7.96 GOI 2023	1037.40	1.0370
6.55 GOI 2025	926.40	0.9060
6.80 GOI 2029	877.50	0.9195
6.85 GOI 2026	972.30	0.9643
8.44 GOI 2027	1146.30	1.1734
8.85 GOI 2028	1201.70	1.2428

Recommend the Security that should be delivered by the XYZ Bank if Future Settlement Price is 1000.

Solution: The XYZ Bank shall choose those CTD (Cheapest-to-Deliver) Bonds from the basket of deliverable Bonds which gives maximum profit computed as follows:

Profit = Future Settlement Price x Conversion Factor - Quoted Spot Price of Deliverable Bond

Accordingly, the profit of each bond shall be computed as follows:

Security (1)	Future Settlement Price (2)	Conversion Factor (3)	(4) = (2) x (3)	Quoted Price of Bonds (5)	Profit (6)
7.96 GOI 2023	1000	1.0370	1037.00	1037.40	- 0.40
6.55 GOI 2025	1000	0.9060	906.00	926.40	-20.40
6.80 GOI 2029	1000	0.9195	919.50	877.50	42.00
6.85 GOI 2026	1000	0.9643	964.30	972.30	- 8.00
8.44 GOI 2027	1000	1.1734	1173.40	1146.30	27.10
8.85 GOI 2028	1000	1.2428	1242.80	1201.70	41.10

Since maximum profit to the Bank is in case of 6.80 GOI 2029, same should be opted for.

Question 12 RTP May 2014, RTP May 2021, MTP Sep 2025, RTP Sep 2025, MTP Sep 2025

Electraspace is consumer electronics wholesaler. The business of the firm is highly seasonal in nature. In 6 months of a year, firm has a huge cash deposits and especially near Christmas time and other 6 months firm faces cash crunch, leading to borrowing of money to cover up its exposures for running the business.

It is expected that firm shall borrow a sum of €50 million for the entire period of slack season in about 3 months.

A Bank has given the following quotations:

Spot	5.50% - 5.75%
3 × 6 FRA	5.59% - 5.82%
3 × 9 FRA	5.64% - 5.94%

3 month €50,000 future contract maturing in a period of 3 months is quoted at 94.15 (5.85%).

You are required to determine:

(a) How a FRA, shall be useful if the actual interest rate after 6 months turnout to be:
(i) 4.5% (ii) 6.5%

(b) How 3 months Future contract shall be useful for company if interest rate turns out as mentioned in part (a) above.

Note: Ignore the time value of money in settlement amount for future contract

Solution:

(a) By entering into an FRA, firm shall effectively lock in interest rate for a specified future in the given it is 6 months. Since, the period of 6 months is starting in 3 months, the firm shall opt for 3 x 9 FRA locking borrowing rate at 5.94%.

In the given scenarios, the net outcome shall be as follows:

	If the rate turns out to be 4.50%	If the rate turns out to be 6.50%
FRA Rate	5.94%	5.94%
Actual Interest Rate	4.50%	6.50%
Loss/ (Gain)	1.44%	(0.56)%
FRA Payment / (Receipts)	€ 50m x 1.44% pa x ½ = € 360,000	€ 50 m x 5.6% pa x ½ = (€ 140,000)
Interest after 6 months on €50 Million at actual rates	€ 50m x 4.5% x ½ = € 1,125,500	€ 50m x 6.5% x ½ = € 1,625,500
Net Out Flow	€ 1,485,000	€ 1,485,000

Thus, by entering into FRA, the firm has committed itself to a rate of 5.94 as follows:

$$\frac{€\ 1,485,000}{€\ 50,00,000} \times 100 \times \frac{12}{6} = 5.94\%$$

(b) Since firm is a borrower it will like to off-set interest cost by profit on Future Contract. Accordingly, if interest rate rises it will gain hence it should sell interest rate futures.

$$\text{No. of Contracts} = \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{\text{3 months}}$$

$$= \frac{€\ 50,000,000}{€\ 50,000} \times \frac{6}{3} = 2000 \text{ Contracts}$$

The final outcome in the given two scenarios shall be as follows:

	If the rate turns out to be 4.5%	If the rate turns out to be 6.5%
Future Course Action:		
Sell to open	94.15	94.15
Buy to close	95.50 (100-4.5)	93.50 (100-6.5)
Loss/ (Gain)	1.35%	(0.65%)
Future Cash Payment / (Receipt)	€ 50,000 x 2000 x 1.35% x 3/12 = € 337,500	€ 50,000 x 2000 x 0.65% x 3/12 = (€ 162,500)
Interest for 6 months on € 50 million at actual rates	€50 million x 4.5% x ½ = € 11,25,000	€50 million x 6.5% x ½ = € 16,25,000
	€ 1,462,500	€ 1,462,500

Thus, the firm locked itself in interest rate = $\frac{€\ 1,462,500}{€\ 50,000,000} \times 100 \times \frac{12}{6} = 5.85\%$

Note: Time Value of Money is ignored while calculating Interest.

Question 13 Study Material, (5 Marks) Exam May 2013, MTP Oct 2019, RTP Nov 2022

XYZ Limited borrows £ 15 Million of six months SONIA (Sterling Overnight Index Average) + 10.00% for a period of 24 months. The company anticipates a rise in SONIA, hence it proposes to buy a Cap Option from its Bankers at the strike rate of 8.00%. The lump sum premium is 1.00% for the entire reset periods and the fixed rate of interest is7.00% per annum. The actual position of SONIA during the forthcoming reset period is as under:-

Reset Period	SONIA
1	9.00%
2	9.50%
3	10.00%

You are required to show how far interest rate risk is hedged through Cap Option.

For calculation, work out figures at each stage up to four decimal points and amount nearest to £. It should be part of working notes.

Solution: First of all we shall calculate premium payable to bank as follows

$$P = \frac{rp}{PVAF\ (3.5\%, 4)} \times A$$

$$= \frac{0.01}{(0.966 + 0.933 + 0.901 + 0.871)} \times £\ 15,000,000$$

$$= \frac{£\ 1,50,000}{3.671} = £\ 40,861$$

Where

P = Premium
A = Principal Amount
rp = Rate of Premium
i = Fixed Rate of Interest
t = Time

Now we see the net payment received from bank

Reset period	Additional interest due to rise in interest rate	Amount received from bank	Premium paid to bank*	Net amt. received from bank
1	£ 75,000	£ 75,000	£ 40,861	£ 34,139
2	£ 1,12,500	£ 1,12,500	£ 40,861	£ 71,639
3	£ 1,50,000	£ 1,50,000	£ 40,861	£ 1,09,139
Total	£ 3,37,500	£ 3,37,500	£ 1,22,583	£ 2,14,917

Thus, from above it can be seen that interest rate risk amount of £337,500 reduced by £214,917 by using Cap option.
*Alternatively, if premium paid is considered as £40,595, then above figure of £2,14,917 shall be changed to £2,15,715

Question 14 (8 Marks) Exam May 2022

MPD Ltd. issues a ₹ 50 million Floating Rate loan on July 1, 2018 with resetting of coupon rate every 6 months equal to LIBOR + 50 bps. MPD is interested in a Interest Rate collar strategy by selling a Floor and buying a Cap. MPD buys the 3 years Cap and sell 3 years Floor as per the following details on July 1, 2018:

Notional Principal Amount	₹ 50 million
Reference Rate	6 months LIBOR
Strike Rate	5% for Floor and 8% for Cap
Premium	Nil, *Since Premium paid for Cap = Premium received for Floor

Using the following data you are required to determine:

(i) Effective interest paid out at each six reset date, (Round off to the nearest rupee)

(ii) Average overall effective rate of interest p.a. (round off to 2 decimals)

Reset Date	31-12-2018	30-06-2019	31-12-2019	30-06-2020	31-12-2020	30-06-2021
LIBOR (%)	7.00	8.00	6.00	4.75	4.25	5.25

Solution:

(i) The pay-off of each leg shall be computed as follows:

Cap Receipt

$$\text{Max}\left\{0, \text{Notional principal} \times \left(\begin{matrix}\text{LIBOR on Reset date} \\ \text{- Cap Strike Rate}\end{matrix}\right) \times \frac{\text{No. of days in the settlement period}}{365}\right\}$$

Floor Pay-off

$$\text{Max}\left\{0, \text{Notional principal} \times \left(\begin{matrix}\text{Floor Strike Rate} \\ \text{- LIBOR on Reset date}\end{matrix}\right) \times \frac{\text{No. of days in the settlement period}}{365}\right\}$$

Statement showing effective interest on each payment date

Reset Date	LIBOR (%)	Date of Payment	Days	Interest Payment (₹) LIBOR + 0.50%	Cap Receipts (₹)	Floor Pay-off (₹)	Effective Interest
31-12-2018	7.00	30-06-2019	181	18,59,589	0	0	18,59,589
30-06-2019	8.00	31-12-2019	184	21,42,466	0	0	21,42,466
31-12-2019	6.00	30-06-2020	182	16,16,120	0	0	16,16,120
30-06-2020	4.75	31-12-2020	184	13,19,672	0	62,842	13,82,514
31-12-2020	4.25	30-06-2021	181	11,77,740	0	1,85,959	13,63,699
30-06-2021	5.25	31-12-2021	184	14,49,315	0	0	14,49,315
Total			1096				98,13,703

(ii) Average Annual Effective Interest Rate shall be computed as follows:

$$\frac{98,13,703}{5,00,00,000} \times \frac{365}{1096} \times 100 = 6.54\%$$

Question 15

Study Material, (8 Marks) Exam Nov 2017, May 2024, RTP May 2022, MTP Nov 2023

A textile manufacturer has taken floating interest rate loan of ₹ 40,00,000 on 1st April, 2022. The rate of interest at the inception of loan is 8.5% p.a. interest is to be paid every year on 31st March.

(i) Suppose in the month of October 2022, the Central bank of the country releases following projections about the interest rates likely to prevail in future.

Date	Rate of Interest
31st March, 2023	8.75%
31st March 2024	10%
31st March 2025	10.5%
31st March 2026	7.75%

Show how borrower can hedge the risk using Option Cap arising out of expected rise in the rate of interest when he wants to peg his interest cost at 8.50% p.a.

(ii) Assume that the premium negotiated by both the parties is 0.75% to be paid on 1st October, 2022 and the actual rate of interest on the respective due dates happens to be as follows:

Date	Rate of Interest
31st March, 2023	10.2%
31st March 2024	11.5%
31st March 2025	9.25%
31st March 2026	8.25%

Show how the settlement will be executed on the respective interest due dates.

(iii) State whether this option is advantageous when compared to Interest rate collar option. Explain.

Solution:

(i) As borrower does not want to pay more than 8.5% p.a., on this loan where the rate of interest is likely to rise beyond this, hence, he has hedge the risk by entering into an agreement to buy interest rate caps with the following parameters:

- Notional Principal: ₹ 40,00,000
- Strike rate: 8.5% p.a.
- Reference rate: the rate of interest applicable to this loan
- Calculation and settlement date: 31st March every year
- Duration of the caps: till 31st March 2026
- Premium for caps: negotiable between both the parties

To purchase the caps this borrower is required to pay the premium upfront at the time of buying caps. The payment of such premium will entitle him with right to receive the compensation from the seller of the caps as soon as the rate of interest on this loan rises above 8.5%. The compensation will be at the rate of the difference between the rate of none of the cases the cost of this loan will rise above 8.5% calculated on ₹ 40,00,000. This implies that in none of the cases the cost of this loan will rise above 8.5%. This hedging benefit is received at the respective interest due dates at the cost of premium to be paid only once.

(ii) The premium to be paid on 1st October 2022 is **30,000** (₹ 40,00,000 x 0.75/100). The payment of this premium will entitle the buyer of the caps to receive the compensation from the seller of the caps whereas the buyer will not have obligation. The compensation received by the buyer of caps will be as follows:

Date	Interest Rate	Option	Payment of Interest ₹	Settlement / Compensation Amount	Net Interest ₹
31.03.2023	10.2%	Exercise	4,08,000	68,000	3,40,000
31.03.2024	11.5%	Exercise	4,60,000	1,20,00	3,40,000
31.03.2025	9.25%	Exercise	3,70,000	30,000	3,40,000
31.03.2026	8.25%	Lapse*	3,30,000	-	3,30,000

* Since actual rate of interest ≤ Strike Rate.

Thus, by paying the premium upfront buyer of the caps gets the compensation on the respective interest due dates without any obligations.

(iii) Comparing to Interest Rate Collar, Cap Option appears to be better because even though Collar may not involve initial outflow of cash on account of Premium but selling Put Option at 8.5% can lead to cash outflow if interest rate goes below 8.5%.

Securitization

Concept and Definition

Securitization involves the creation of pool of assets from the illiquid financial assets, such as receivables or loans which are marketable. In other words, it is the process of repackaging or rebundling of illiquid assets into marketable securities. These assets can be automobile loans, credit card receivables, residential mortgages or any other form of future receivables.

The reserve Bank of India defines Securitization as "transactions where credit risks in assets are redistributed by repackaging them into tradable securities".

Features of Securitization

MTP Nov 2023

Q. "Securitization is the process of repackaging of illiquid assets into marketable securities". Explain.

or

Creation of Financial Instruments Process of creation of additional financial product of securities in market backed by collaterals.

Bundling and Unbundling When all the assets are combined in one pool it is bundling and when these are broken into instruments of fixed denomination it is unbundling.

Tool of Risk Management If assets are securitized on non-recourse basis, then the risk of default is shifted.

Structured Finance Financial instruments are tailor structured to meet the risk return trade of profile of investor.

Tranching Portfolio of different receivable or loan or asset are split into several parts based on risk and return they carry called 'Tranche'.

Homogeneity Under each tranche the securities are issued of homogenous nature and even meant for small investors.

Benefits of Securitization

From the angle of Originator (entity which sells assets collectively to Special Purpose Vehicle)

(i) Off – Balance Sheet Financing When loan/receivables are securitized it release a portion of capital tied up in these assets resulting in off Balance Sheet financing leading to improved liquidity position which helps expanding the business of the company.

(ii) More specialization in main business By transferring the assets the entity could concentrate more on core business as servicing of loan is transferred to SPV.

(iii) Helps to improve financial ratios Helps to manage Capital –To-Weighted Asset Ratio effectively.

(iv) Reduced borrowing Cost Since securitized papers are rated due to credit enhancement even they can also be issued at reduced rate resulting in reduced cost of borrowings.

From the angle of Investor

1. Diversification of Risk Purchase of securities backed by different types of assets provides the diversification of portfolio resulting in reduction of risk.
2. Regulatory requirement Acquisition of asset backed belonging to a particular industry say micro industry helps banks to meet regulatory requirement of investment of fund in industry specific.
3. Protection against default In case of recourse arrangement if there is any default by any third party then originator shall make good the loss amount. Moreover, there can be insurance arrangement for compensation for any such default.

Participants in Securitization

Primary Participants

(a) Originator / Securitizer It is an entity which sells the assets lying in its books and receives the funds generated through the sale of such assets, transferring legal as well as beneficial interest to SPV.

(b) Special Purpose Vehicle is created for the purpose of executing the deal. It holds the legal title of the assets. It could be in form of a company, a firm, a society or a trust.

The main objective of SPV is to remove the asset from the Balance Sheet of Originator. SPV makes an upfront payment to the originator. Further, it also issues the securities (called Asset Based Securities or Mortgage Based Securities) to the investors.

(c) The Investors Investors are the buyers of securitized papers which may be an individual, an institutional investor such as mutual funds, provident funds, insurance companies, mutual funds, Financial Institutions etc.

Since, they acquire a participating in the total pool of assets/receivable, they receive their money back in the form of interest and principal as per the terms agreed.

Secondary Participants

RTP Sep 2025, MTP Nov 2023

(a) Obligors owe money to the firm and are assets in the Balance Sheet of Originator.

(b) Rating Agency Securitization is based on the pools of assets rather than the originators, the assets have to be assessed in terms of its credit quality and credit support available. Rating agency assesses the following:

- Strength of the Cash Flow.
- Mechanism to ensure timely payment of interest and principle repayment.
- Credit quality of securities.
- Liquidity support.
- Strength of legal framework.

(c) Receiving and Paying agent (RPA) Also, called Servicer or Administrator, it collects the payment due from obligor(s) and passes it to SPV. It also follow up with defaulting borrower and if required initiate appropriate legal action against them.

(d) Agent or Trustee Trustees are appointed to oversee that all parties to the deal perform in the true spirit of terms of agreement. Normally, it takes care of interest of investors who acquires the securities.

(e) Credit Enhancer Since investors in securitized instruments are directly exposed to performance of the underlying they require credit rating of issued securities which also empowers marketability of the securities.

Originator itself or a third party say a bank may provide this additional context called

Credit Enhancer. While originator provides his comfort in the form of over collateralization or cash collateral, the third party provides it in form of letter of credit or surety bonds.

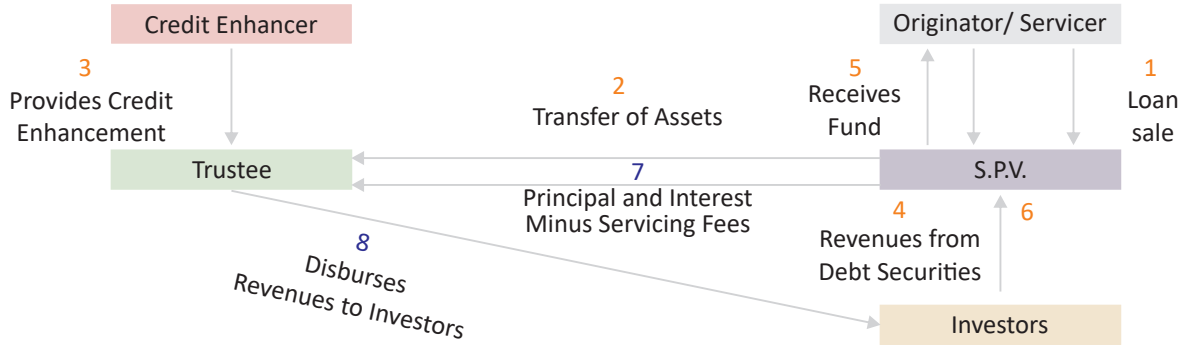
(f) Structurer It brings together the originator, investors, credit enhancers and other parties to the deal of securitization. Normally, these are investment bankers who ensures that deal meets all legal, regulatory, accounting and tax laws requirements.

Mechanism of Securitization | Steps involved in securitization mechanism

1. Creation of Pool of Assets The process of securitization begins with creation of pool of assets by segregation of assets backed by similar type of mortgages in terms of interest rate, risk, maturity and concentration units.
2. Transfer to SPV Once assets have been pooled, they are transferred to Special Purpose Vehicle (SPV) especially created for this purpose.
3. Sale of Securitized Papers SPV designs the instruments based on nature of interest, risk, tenure etc. based on pool of assets. These instruments can be Pass Through Security or Pay Through Certificates.

4. Administration of assets The administration of assets is subcontracted back to originator which collects principal and interest from underlying assets and transfer it to SPV, which works as a conduct.
5. Recourse to Originator Performance of securitized papers depends on the performance of underlying assets and unless specified in case of default they go back to originator from SPV.
6. Repayment of funds SPV will repay the funds in form of interest and principal that arises from the assets pooled.
7. Credit Rating to Instruments Sometime before the sale of securitized instruments credit rating can be done to assess the risk of the issuer.

The mechanism of Securities is shown below in diagrammatic form.



Problems in Securitization | Problem in growth of Securitisation market in India (4 Marks) Exam Nov 2023

1. Stamp Duty Stamp Duty is one of the obstacle in India. A mortgage debt stamp duty goes upto 12% in some states and this impeded the growth of securitization in India. It should be noted that since pass through certificate does not evidence any debt only able to receivable, they are exempted from stamp duty.
2. Taxation In the absence of any specific provision relating to securitized instruments in Income Tax Act experts' opinion differ a lot. Some opine that SPV as a trustee is liable to be taxed, others opine investors will be taxed on their share of income. Clarity is also required on the issues of capital gain implications on passing payments to the investors.
3. Accounting Accounting and reporting of securitized assets in the books of originator is another area of concern. Although securitization is slated to an off-balance sheet instrument but in true sense receivables are removed from originator's balance sheet especially when assets are transferred without recourse.
4. Lack of standardization Every originator follows own format for documentation and administration.
5. Inadequate Debt Market Lack of existence of a well-developed debt market in India hinders the growth of secondary market of securitized or asset backed securities.
6. Ineffective Foreclosure laws Foreclosure laws are not supportive to lending institutions and this makes securitized instruments especially mortgaged backed securities less attractive as lenders face difficulty in transfer of property in event of default by the borrower.

Securitization Instruments

On the basis of different maturity characteristics, the securitized instruments can be divided into foll 3 categories:

1. Pass Through Certificates (PTCs) In PTC, Originator (seller of the assets) transfers the entire receipt of cash in form of interest or principal repayment from the assets sold. Thus, PTC represent direct claim of the investors on all the securitized assets.

   Since all cash flows are transferred the investors carry proportional beneficial interest in the asset held in the trust by SPV.

It should be noted that since it is a direct route any prepayment of principal is also proportionately distributed among the securities holders. Further, due to these characteristics on completion of securitization by the final payment of assets, all the securities are terminated simultaneously.
Skewness of cash flows occurs in early stage if principals are repaid before the scheduled time.

2. Pay Through Security (PTS) In PTS, SPV debt securities backed by the assets and hence it can restructure different tranches from varying maturities of receivables.
This structure permits desynchronization of servicing of securities issued' from cash flow generating from the asset. Further, this structure also permits the SPV to reinvest surplus funds
(In case of early retirement of receivables) for short term yield.

3. Stripped Securities Stripped Securities are created by dividing the cash flows associated with underlying securities into two or more new securities. Those two securities are as follows:
   (i) Interest Only (IO) Securities
   (ii) Principle Only (PO) Securities
   Accordingly, the holder of IO securities receives only interest while PO security holder receives only principal.
   In case yield to maturity in market rises, PO price tends to fall as borrower prefers to postpone the payment on cheaper loans. Whereas if interest rate in market falls, the borrower tends to repay the loans as they prefer to borrow fresh at lower rate of interest.
   In contrast, value of IO's securities increases when interest rate goes up in the market as more interest is calculated on borrowings.

Pricing of The Securitized Instruments

RTP Nov 2023

Q. "While pricing the securitized instruments, it is important that it should be acceptable to both originators as wall as the inventors." Explain.

From Originator's Angle From originator's point of view, the instruments can be priced at a rate at which originator has to incur an outflow and if that outflow can be amortized over a period of time by investing the amount raised through securitization.

From Investor's Angle From an investor's angle security price can be determined by discounting best estimate of expected future cash flows using rate of yield to maturity of a security of comparable security with respect to credit quality and average life of the securities. This yield can also be estimated by referring the yield curve available for marketable securities, though some adjustments is needed on account of spread points, because of credit quality of the securitized instruments.

Risks in Securitization

In a securitization transaction, investors are exposed to several risks at each stage of the transaction. The various types of risks in any securitization transaction are as follows:

Credit risk or Counterparty risk
It is the prime risk wherein investors are prone to the risk of bankruptcy and non-performance of the servicer.

Legal risks
Since in the Indian context it is a recently developed concept there is an absence of conclusive judicial precedent or explicit statutory provisions on securitization transactions. As a result, any dispute over the legal ownership of the assets is likely to result in uncertainty regarding investor pay-outs from the pool cash flow.

Market risks

Market risks represent risks external to the transaction and include market-related factors that impact the performance of the transaction. Some of these risks are as follows:

(a) Macroeconomic risks The performance of the underlying loan contracts depends on macroeconomic factors, such as industry downturns or adverse price movements of the underlying assets. For example, in the transportation industry a continuous decline in industrial production may lead to a downtrend in the use of services of the Commercial Vehicles (CVs) adversely impacting the cash flow of CVs operators. This in turn, may impact repayments on CV loans. Similarly, a fall in the prices of the CVs may increase chances of default as the borrower may wilfully default the loan and let the finance company repossess and sell the underlying vehicle instead of retaining it and continuing to pay instalments on time.

(b) Prepayment risks A change in the market interest rate represents a difficult situation for investors because it is a combination of prepayment risk and volatile interest rates. With a reduction in interest rates generally prepayment of retail loans increases, resulting in reinvestment risk for investors because investors may receive their monies ahead of schedule and may not be able to reinvest the amount at the same yield.

(c) Interest rate risks This risk is prominent where the loans in the pool are based on a floating rate and investor pay-outs are based on a fixed rate or vice versa. It results in an interest rate mismatch and can lead to a situation where the pool cash inflow, even at 100% collection efficiency, is not sufficient to meet investor pay-outs. Interest rate swaps can be used to hedge this type of risk to some extent.

Blockchain

Blockchain, sometimes referred to as Distributed Ledger Technology (DLT) is a shared, peer-to- peer, and decentralized open ledger of transactions system with no trusted third parties in between. This ledger database has every entry as permanent as it is an append-only database which cannot be changed or altered. All transactions are fully irreversible with any change in the transaction being recorded as a new transaction. The decentralised network refers to the network which is not controlled by any bank, corporation, or government. A block chain generally uses a chain of blocks, with each block representing the digital information stored in public database ("the chain").

A simple analogy for understanding blockchain technology is a Google Doc. When we create a document and share it with a group of people, the document is distributed instead of copied or transferred. This creates a decentralized distribution chain that gives everyone access to the document at the same time. No one is locked out awaiting changes from another party, while all modifications to the document are being recorded in real-time, making changes completely transparent. Following figure represents the working of any Blockchain transaction.

- A transaction like sending money to someone is initated.
- Transaction is broadcasted via the network.
- The network validates the transaction using cryptography.
- The transaction is represented online as a block.
- Block is added to the existing block chain.
- Transaction is complete.

Applications of Blockchain

MTP Nov 2024

Some initiatives that are already existing in various fields like financial services, healthcare, government, travel industry, economic forecasts etc. are discussed below:

(a) Financial Services Blockchain can be used to provide an automated trade lifecycle in terms of the transaction log of any transaction of asset or property - whether physical or digital such as laptops, smartphones, automobiles, real estate, etc. from one person to another.

(b) Healthcare Blockchain provides secure sharing of data in healthcare industry by increasing the privacy, security, and interoperability of the data by eliminating the interference of third party and avoiding the overhead costs.

(c) Government At the government front, there are instances where the technical decentralization is necessary but politically should be governed by governments like land registration, vehicle registration and management, e-voting etc. Blockchain improves the transparency and provides a better way to monitor and audit the transactions in these systems.

(d) Travel Industry Blockchain can be applied in money transactions and in storing important documents like passports/other identification cards, reservations and managing travel insurance, loyalty, and rewards thus, changing the working of travel and hospitality industry.

(e) Economic Forecasts Blockchain makes possible the financial and economic forecasts based on decentralized prediction markets, decentralized voting, and stock trading, thus enabling the organizations to plan and shape their businesses.

Risks associated with Blockchain

(4 Marks) Exam Sep 2025, MTP April 2024

(i) With the use of blockchain, organizations need to consider risks with a wider perspective as different members of a particular blockchain may have different risk appetite/risk tolerances that may further lead to conflict when monitoring controls are designed for a blockchain. There may be questions about who is responsible for managing risks if no one party is in-charge, and how proper accountability is to be achieved in a blockchain.

(ii) The reliability of financial transactions is dependent on the underlying technology and if this underlying consensus mechanism has been tampered with, it could render the financial information stored in the ledger to be inaccurate and unreliable.

(iii) In the absence of any central authority to administer and enforce protocol amendments, there could be a challenge in the development and maintenance of process control activities and in such case, users of public blockchains find difficult to obtain an understanding of the general IT controls implemented and the effectiveness of these controls.

(iv) As blockchain involves humongous data getting updated frequently, risk related to information overload could potentially challenge the level of monitoring required. Furthermore, to find competent people to design and perform effective monitoring controls may again prove to be difficult.

Meaning of Tokenization

Tokenization is a process of converting tangible and intangible assets into blockchain tokens. Digitally representing anything has recently acquired a lot of traction. It can be effective in conventional industries like real estate, artwork etc.

Tokenization and Securitization

Exam May 2024, MTP March 2024

Since tokenization of illiquid assets attempts to convert illiquid assets into a product that is liquid and tradable and hence to some extent it resembles the process of Securitization. Some similarities between Tokenization and Securitization:

(i) Liquidity First and foremost both Securitization and Tokenization inject liquidity in the market for the assets which are otherwise illiquid assets.

(ii) Diversification Both help investors to diversify their portfolio thus managing risk and optimizing returns.

(iii) Trading Both are tradable hence helps to generate wealth.

(iv) New Opportunities Both provide opportunities for financial institutions and related agencies to earn income through collection of fees.

Strategic Financial Decision Making Frame Work

Since capital is the limiting factor, strategic allocation of limited funds by Management to increase investor returns is essential. Therefore, all businesses need to have the following three fundamental essential elements:

- ✓ A clear and realistic **strategy,**
- ✓ The **financial** resources, controls and systems to see it through and
- ✓ The right **management** team and processes to make it happen.

Fundamentals of Business = Strategy + Finance + Management

Meaning of Strategic Financial Management

Strategic financial management is the application to strategic decisions of financial techniques in order to help achieve the decision-maker's objectives. *Strategic financial management combines the backward-looking, report-focused discipline of (financial) accounting with the more dynamic, forward-looking subject of financial management.*

Functions of Strategic Financial Management:

The investment and financial decisions functions involve the following functions:

- ✓ Continual search for best investment opportunities;
- ✓ Selection of the best profitable opportunities;
- ✓ Determination of optimal mix of funds for the opportunities;
- ✓ Establishment of systems for internal controls; and
- ✓ Analysis of results for future decision-making.

Four major components of Strategic financial management. The key decisions falling within the scope of financial strategy include the following: (4 Marks) Exam Nov 2024

1. Financing decisions deal with the mode of financing or mix of equity and debt capital.
2. Investment decisions involve profitable utilization of firm's funds especially in long-term projects (capital projects). Since projects necessarily involve risk, therefore evaluated in relation to their expected return and risk.
3. Dividend decisions determine the division of earnings between payments to shareholders and reinvestment in the company.
4. Portfolio decisions evaluation of investments based on their contribution to the aggregate performance of the entire corporation.

Strategy at Different Hierarchy Levels

(4 Marks) Exam Nov 2023, MTP May 2024

1. Corporate Level Strategy is concerned with selection of businesses in which a company should compete and also with the development and coordination of that portfolio of businesses.

Corporate level strategy should be able to answer three basic questions:	
Suitability	Whether the strategy would work for the accomplishment of common objective of the company
Feasibility	Determines the kind & number of resources required to formulate & implement the strategy.
Acceptability	It is concerned with the stake holder's satisfaction and can be financial and non-financial.

2. Business Unit Level Strategy Strategic business unit (SBO) may be any profit centre that can be planned independently. The strategic issues are about
   (i) practical coordination of operating units and
   (ii) developing and sustaining a competitive advantage for the products and services that are produced.
3. Functional Level Strategy The functional level is the level of the operating divisions and departments. The strategic issues at this level are related to functional business processes and value chain. Functional level strategies in R&D, operations, manufacturing, marketing, finance, and human resources involve the development and coordination of resources through which business unit level strategies can be executed effectively and efficiently. The functional units translate higher level strategies into discrete action plans they must accomplish for the strategy to succeed.

Financial Planning

Is a systematic approach whereby the financial planner helps the customer to maximize his existing financial resources by utilizing financial tools to achieve his financial goals.

There are 3 major components of Financial planning:

✓ Financial Resources (FR) ✓ Financial Tools (FT) ✓ Financial Goals (FG)

Outcomes of the financial planning for the evaluation of the corporate performance are :

Financial objectives are decided at the very outset. The objectives need to be consistent with the corporate mission and corporate objectives.

Financial decision-making helps in analyzing the financial problems and accordingly deciding the course of action.

Financial measures eg. ratio analysis, analysis of cash flow statement are used to evaluate the performance. The selection of these measures again depends upon the Corporate objectives.

Interface of Financial Policy and Strategic Management

(4 Marks) Exam May 2024

The fact is that the starting point of an organization is money and the end point of that organization is also money.

(i) Sources of finance and capital structure are the most important dimensions of a strategic plan. The need for fund mobilization to support the expansion activity of firm is very vital for any organization. The generation of funds may arise out of ownership capital and or borrowed capital depending. on the capital structure which indicates the desired mix of equity capital and debt capital.

(ii) Another important dimension of strategic management and financial policy interface is the investment and fund allocation decisions. Investment proposals may be
   (a) for addition of a new product
   (b) to increase the level of operation of an existing product eg. increase in capacity
   (c) for cost reduction and efficient utilization of resources through a new approach

(iii) Dividend policy is yet another area for making financial policy decisions. Stability of the dividend payment is a desirable consideration that can have a positive impact on share prices. The alternative policies could be (i) paying a constant percentage of the net earnings or (ii) pay a minimum dividend per share and additional dividend when earnings are higher. Alternatives like cash dividend and stock dividend are also to be examined while working out an ideal dividend policy.

Thus the financial policy of a company cannot be worked out in isolation of other functional policies.

Balancing Financial Goals vis-a-vis Sustainable Growth

MTP March 2024

Sustainable growth rate (SGR)

- is the maximum rate of growth in sales that can be achieved, given the firm's profitability, asset utilization, and desired dividend payout and debt (financial leverage) ratios.
- is a measure of how much a firm can grow without borrowing more money. After the firm has passed this rate, it must borrow funds from another source to facilitate growth.

SGR = ROE x (1- Dividend payment ratio) OR ROE x RR

Sustainable growth models assume that the business wants to:

(1) maintain a target capital structure without issuing new equity;
(2) maintain a target dividend payment ratio; and
(3) increase sales as rapidly as market conditions allow.

If the firm is willing to issue additional equity, there is in principle no financial constraint on its growth rate.

Achieving sustainable growth is not possible without paying heed to twin cornerstones:

(i) growth strategy and
(ii) growth capability (i.e. put the necessary infrastructure in place to execute that strategy)

What makes an organisation financially sustainable? [(4 Marks) Exam Sep 2025]

To be financially sustainable, an organisation must:

- ✓ have more than one source of income;
- ✓ have more than one way of generating income;
- ✓ do strategic, action and financial planning regularly;
- ✓ have adequate financial systems;
- ✓ have a good public image;
- ✓ be clear about its values (value clarity); and
- ✓ have financial autonomy.

What makes an organisation sustainable?

In order to be sustainable, an organisation must:

- ✓ have a clear strategic direction; .
- ✓ be able to scan its environment or context to identify opportunities for its work;
- ✓ be able to attract, manage and retain competent staff;
- ✓ have an adequate administrative and financial infrastructure;
- ✓ be able to demonstrate its effectiveness and impact in order to leverage further resources; and
- ✓ get community support for, and involvement in its work.

Advanced Role of CFO in Various Matters Including Value Creation

RTP May 2024

Traditionally, the main role of CFO was concentrated to wealth maximisation for shareholders by taking care of financial health of an organization and overseeing and implementing adequate financial controls.

However, in recent time because of globalization, growth in information and communications, pandemic situation etc. their range of responsibilities has been drastically expanded, driven by complexity and changing expectations.

Now a days in addition to fulfilling traditional role relating to governance, compliances and controls, and business ethics as a part of the leadership of role CFOs are also expected to contribute their support in strategic and operational decision making.

In post-pandemic time their role has been advanced in the following areas in addition to traditional role:

a. Risk Management Now a days the CFOs are expected to look after the overall functioning of the framework of Risk Management system of an organisation.
b. Supply Chain Post pandemic supply chain management system has been posing the challenge for the company to maintain the sustainable growth. Since CFOs are care takers of finance of the company, considering the financial viability of the Supply Chain Management their role has now become more critical.
c. Mergers, acquisitions, and Corporate Restructuring Since in recent period to maintain the growth and capture the market share there has been a spate of Mergers and Acquisitions and hence the role of CFOs has become more crucial because these are strategic decision and any error in them can lead to collapse of the whole business.
d. Environmental, Social and Governance (ESG) Financing With the evolving of the concept of ESG their role has been shifted from traditional financing to sustainability financing.

Thus, in today's time CFOs are taking a leadership role in Value Creation for the organisation

External Funding Requirement {Prefer in Exams}

As business sales grow, it is essential to increase both current and non- current assets. It becomes necessary to determine the amount of external funding requirement (EFR) while maintaing certain ratios such as Debt- to - Equity Ratio or Current Ratio. Two approaches

1. Analytical approaches
   Ascertain each item on the B/s in relation to changes in sales while maintaining prescribed ratios
2. Formula based approaches

$$EFR = \underbrace{\frac{TA}{Sales} \times \Delta S}_{\text{Desired increase in total assets}} - \underbrace{\frac{\text{Payable and Liabilities}}{Sales} \times \Delta S}_{\text{Amount by which current liabilities will increase}} - \underbrace{mS_1 (1 - d)}_{\text{Amount avlbl from retained earnings during the next year}}$$

Gross funding requirement from equity + debt

Where:
ΔS = Change in Sales ;
S_1 = Revised Sales;
TA = Total Assets

Payable and Liabilities = Payables and liabilities that change spontaneously in accordance with level of sales.

m = Profit Multiplier or percentage of Net Profit after Tax ;

d = Dividend Pay-out Ratio

After that we use equations to compute amount to be raised from different sources under the given conditions.

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Question 1 Study Material (Similar), Exam Jan 2021

The Balance Sheet of M/s. Sundry Ltd. as on 31-03-2024 is follows: (₹ in lakhs)

Liabilities	₹	Assets	₹
Share Capital	3000	Fixed Assets	6000
Reserves	2000	Inventory	5000
Long Term Loan	4000	Receivables	2400
Short Term Loan	3000	Cash	600
Payables & Provisions	2000		
Total	**14000**	**Total**	**14000**

Sales for the year was ₹ 6000 lakhs. The sales are expected to grow by 20% during the year. The profit margin and dividend pay-out ratio are expected to be 4% and 50% respectively.

The company further desires that during the current year Sales to Short Term Loan and Payables and Provision should be in the ratio of 4 : 3. Ratio of fixed assets to Long Term Loans should be 1.5. Debt Equity Ratio should not exceed 1.5.

You are required to determine:

(i) The amount of External Fund Requirement (EFR)

(ii) The amount to be raised from Short Term, Long Term and issue of New Equity.

Note: ICAI has provided two alternative presentations. We have printed only one which you should ideally follow in exams.

Solution: (i) External Funds Requirement (EFR):

	(₹ in lakhs)
Expected sales (₹ 6000 + 20% of ₹ 6000)	7200.00
Profit margin @ 4%	288.00
Dividend payout ratio @ 50%	144.00
Balance to be ploughed back (A)	144.00
Additional funds required (₹ 14000 - ₹ 2000*) x 0.20 (B)	2400.00
Balance to be met from external source (B - A)	2256.00

* As current liabilities shall also be increased proportionately with increase in sales.

(ii) Amount to be raised from different sources with following conditions:

Sales to short term loans and payables & provisions	4:3
Ratio of fixed assets to long term loans	1.5
Debt equity ratio should not exceed	1.5

(1) Amount to be raised from short term funds:

	(₹ in lakhs)
New amount of short-term loans and payables & provision $\frac{3}{4}$ x 7200	5400
Less: Existing Amount of short-term loans and payables & provision (2000 x 1.20 + 3000)	5400
Amount to be raised from short term funds	Nil

(2) Amount to be raised from Long term funds:

	(₹ in lakhs)
New fixed assets (₹ 6000 + 20% of ₹ 6000)	7200
New long-term loans as per given condition (₹ 7200/1.5)	4800
Less: Existing long-term loans	4000
Amount to be raised from Long term funds	800

(3) Amount to be raised from equity funds:

	(₹ in lakhs)
Amount to be raised from external sources	2256.00
Less: Amount to be raised from short term funds	- - -
Less: Amount to be raised from Long term funds	800.00
Balance amount to be raised from new equity	1456.00

Question 2 Exam Nov 22

Mr. X has submitted the following data:

Particulars	(₹) in Lakhs
Total Assets	250
Total Liabilities	220
Net Income	12
Dividend Paid	4.5
Sales	100

Mr. X wants to know to what extent sales can be increased without going for additional borrowings by using Sustainable Growth Rate (SGR) concept?

Solution:

Sl. No	Particulars	Amount in ₹ Lakhs
(a)	Total Assets	250.00
(b)	Total Liabilities	220.00
(c)	Net Income	12.00
(d)	Dividend Paid	4.50
(e)	Sales	10.000
(f)	Equity (a) – (b)	30.00
(g)	Return on Equity (ROE) (c) /(f)	40.00%
(h)	Dividend pay-out Ratio (d) /(c)	37.50%
(i)	SGR [g x (1 - h)]	25.00%*
(j)	Additional Sales can be achieved without further borrowings (e) × (i)	25.00
(k)	Maximum sales can be achieved without further borrowings (e) + (j)	125.00

* Alternatively, it can also be computed as follows:

$$SGR = \frac{g\,(1 - h)}{1 - [g\,(1 - h)]} = 33.33\%$$ and then Additional Sales shall be ₹ 33.33 Lakhs and Maximum Sales can be achieved without further borrowings shall be ₹ 133.33 Lakhs

Mergers, Acquisition & Restructuring

Benefits of Merger / Rationale for Mergers and Acquisitions

- ✔ Synergistic Operating Economics
- ✔ Diversification
- ✔ Tax savings
- ✔ Growth
- ✔ Consolidation of Production Capacities and increasing market power
- ✔ Deployment of surplus funds
- ✔ Superior Management
- ✔ Avoiding unhealthy competition
- ✔ Cross Selling of Products
- ✔ Acquisition of Patent rights, Brand names etc

Reasons for M&A Failures

- Acquirers generally overpay
- The value of synergy is over-estimated
- Poor post-merger integration
- Psychological barriers

How Mergers & Acquisitions and Business Restructuring Unlocks the Value | Reasons

- Horizontal growth helps to achieve optimum size, enlarge the market share, curb competition and use of unutilised capacity;
- Vertical combination helps to economise costs and eliminate avoidable taxes /duties;
- Diversification of business;
- Mobilising financial resources by utilising the idle funds lying with another company for the expansion of business.
- Taking over a 'shell' company which may have the necessary industrial licences etc., but whose promoters do not wish to proceed with the project.
- An amalgamation may also be resorted to for the purpose of nourishing a sick unit in the group and this is normally a merger for keeping up the image of the group.
- The business restructuring helps the company in:
  - ❖ Positioning the company to be more competitive,
  - ❖ Surviving an adverse economic climate,
  - ❖ positioning the company into in an entirely new direction.

Take Over Strategies

- Street Sweep This refers to the technique where the acquiring company accumulates larger number of shares in a target before making an open offer.
- Bear Hug When the acquirer threatens the target to make an open offer, the board of target company agrees to a settlement with the acquirer for change of control.
- Strategic Alliance This involves disarming the acquirer by offering a partnership rather than a buyout.
- Brand Power This refers to entering into an alliance with powerful brands to displace the target's brands and as a result, buyout the weakened company.

In AFM, theory questions asked are usually straight froward hence there is no need on our part to provide theory in Question - Answer format. An understanding of theory concept plus a little-bit of cramming is all that you need!

Defensive Tactics

- Divestiture target company divests or spins off some of its businesses in the form of an independent, subsidiary company. Thus, reducing the attractiveness of the existing business to the acquirer.
- Crown Jewels When a target company uses the tactic of divestiture it is said to sell the crown jewels.
- Poison Pill: The tactics used by the target company to make itself unattractive to a potential bidder is called poison pills. For instance, the acquiring company may issue substantial amount of convertible debentures to its existing shareholders to be converted at a future date when it faces a takeover threat.
- Poison Put In this case the target company issue bonds that encourage holder to cash - in at higher prices. The resultant cash drainage would make the target unattractive.
- Greenmail Greenmail refers to an incentive offered by management of the target company to the potential bidder for not pursuing the takeover. The management of the target company may offer the acquirer for its shares a price higher than the market price.
- White Knight In this a target company offers to be acquired by a friendly company to escape from a hostile takeover.
- White Squire This strategy is essentially the same as white knight and involves sell out of shares to a company that is not interested in the takeover. As a consequence, the management of the target company retains its control over the company.
- Golden Parachutes When a company offers hefty compensations to its managers if they get ousted due to takeover, the company is said to offer golden parachutes.
- Pac-man Defense This strategy aims at the target company making a counter bid for the acquirer company. This would force the acquirer to defend itself and consequently may call off its proposal for takeover.

Special Purpose Acquisition Companies

An entity is set up with the objective to raise funds through an IPO to finance a merger or acquisition of an unidentified target within a specific time. It is commonly known as a blank cheque company.

Money raised is kept in an escrow account. Shareholders have the option to redeem their shares if they are not interested in participating in the proposed merger. In case the acquisition is not made within stipulated period the SPAC is delisted, and the money is returned.

Reverse Merger

A smaller company gains control of a larger one.

The three tests should be fulfilled before an arrangement can be termed as a reverse takeover:-

(i) the assets of the transferor company are greater than the transferee company,

(ii) equity capital to be issued by the transferee company pursuant to the acquisition exceeds its original issued capital, and

(iii) the change of control in the transferee company through the introduction of a minority holder or group of holders.

This type of merger is also known as 'back door listing'. This kind of merger has been started as an alternative to go for public issue without incurring huge expenses and passing through cumbersome process. Thus, it can be said that reverse merger leads to the following benefits for acquiring company:

- Easy access to capital market.
- Increase in visibility of the company in corporate world.
- Tax benefits on carry forward losses acquired (public) company.
- Cheaper and easier route to become a public company.

Divestiture

It means a company selling one of the portions of its divisions or undertakings to another company or creating an altogether separate company. The following are some of the 'sell-side' imperatives

- ✓ Competitor's pressure is increasing.
- ✓ Sale of company seems to be inevitable because company is facing serious problems
- ✓ Window of opportunity: Possibility to sell the business at an attractive price in the best interest of the shareholders
- ✓ Focus on core competencies

Different Forms of divestment or demerger or divestitures are as follows:

1. Sell off / Partial Sell off A sell off is the sale of an asset, factory, division, product line or subsidiary by one entity to another for a purchase consideration payable either in cash or in the form of securities.
2. Spin-off In this case, a part of the business is separated and created as a separate firm. The existing shareholders of the firm get proportionate ownership. The reasons for spin off may be:

   (i) Separate identity to a part/division.

   (ii) To avoid the takeover attempt by a predator by making the firm unattractive to him since a valuable division is spun-off.

   (iii) To create separate Regulated and unregulated lines of business.
3. Split-up This involves breaking up of the entire firm into a series of spin off (by creating separate legal entities).The parent firm no longer legally exists and only the newly created entities survive. Since de-merged units are relatively smaller in size, they are logistically more convenient and manageable and likely to enhance shareholders value and bring efficiency and effectiveness.
4. Equity Carve outs This is like spin off, however, some shares of the new company are sold in the market by making a public offer, so this brings cash.
5. Sale of a Division In the case of sale of a division, the seller company is demerging its business whereas the buyer company is acquiring a business.
6. Demerger or Division of Family-Managed Business The family-owned companies are, under extraordinary pressure to yield control to professional managements. So, many of these companies are arranging to hive off their unprofitable businesses or divisions with a view to meeting a variety of succession problems.

Ownership Restructuring

1. Going Private a listed company is converted into a private company by buying back all the outstanding shares from the markets.

   Rationale - When there are no longer significant benefits to be garnered as a public company.
2. Management Buyouts Buyouts initiated by the management team of a company are known as management buyouts. In this type of acquisition, the company is bought by its own management team. MBOs are considered as a useful strategy for exiting those divisions that do not form part of core business of the entity.

3. Leveraged Buyout (LBO) An acquisition of a company or a division of another company which is financed entirely or partially (50% or more) using borrowed funds is termed as a leveraged buyout. The target company no longer remains public after the leveraged buyout; hence the transaction is also known as going private. The deal is usually secured by the acquired firm's physical assets.

   The intention behind an LBO transaction is to improve the operational efficiency of a firm and increase the volume of its sales, thereby increasing the cash flow of the firm. This extra cash flow generated will be used to pay back the debt in LBO transaction. After an LBO, the target entity is managed by private investors, which makes it easier to have a close control over its operational activities. The LBOs do not stay permanent. Once the LBO is successful in increasing its profit margin and improving its operational efficiency, the debt is paid back and it will go public again.

4. Equity buyback company buys back its own shares back from the market. This results in reduction in the equity capital of the company. This strengthens the promoter's position by increasing his stake in the equity of the company.

Cross-Border M&A

Cross-border M&A is a popular route for global growth and overseas expansion.

Other major factors that motivate multinational companies to engage in cross-border M&A include the following:

- Globalization of production and distribution of products and services.
- Integration of global economies.
- Expansion of trade and investment relationships on International level.
- Many countries are reforming their economic and legal systems, and providing generous investment and tax incentives to attract foreign investment.
- Privatisation of state-owned enterprises and consolidation of the banking industry.

Security Valuation Business Valuation

Fundamental Analysis

Fundamental Analysis is based on the assumption that share prices depend on future dividends.

It involves:

(1) Economic Analysis

Factors affecting Economic Analysis	• Growth rates of national income and related measures • Growth rates of industrial sector • Inflation • Monsoon
Techniques used in Economic Analysis	Indicators used to assess performance of economy are as follows: • Anticipatory surveys • Barometer/Indicator approach Indicators have been classified as under: ➢ Leading indicators ➢ Roughly coincidental indicators ➢ Lagging indicators • Economic model building approach

(2) Industry Analysis

Factors affecting Industry Analysis	• Product life cycle • Demand supply gap • Barriers to entry • Government attitude
Techniques used in Industry Analysis	Indicators used to assess performance of industry are as follows: • Regression analysis • Input - Output analysis

(3) Company Analysis

Factors affecting Company Analysis	• Net worth and book value • Sources and uses of funds • Growth record • Financial analysis
Techniques used in Company Analysis	Indicators used to assess performance of company are as follows: • Decision tree analysis • Trend analysis • Correlation & regression analysis

Role and Responsibilities of Valuers

Role of Valuers

The valuations made by Valuers are required statutorily for the following purposes: -

(a) Mergers/Acquisitions/ De-Mergers/Takeovers Valuation is mandated by the Income Tax Act, 1961 for determining tax payable.

(b) Slump Sale/ Asset Sale/ IPR Sale Valuation is required by Insolvency and Bankruptcy Code, 2016 to ascertain fair value or liquidation value.

(c) Conversion of Debt/ Security Valuation is necessitated by RBI for Inbound Foreign Investment, Outbound Foreign Investment and other business transactions.

(d) Capital Reduction SEBI regulations such as ICDR/ LODR/ Preferential Allotment etc. also require valuations to be made for listed securities for various purposes on a period basis.

(e) Strategic Financial Restructuring Various statutes such as Companies Act, 2013, SARFAESI Act, 2002, Arbitration and Conciliation Act 1996 etc., warrant valuations to be made for meeting various statutory requirements. Valuation is also made for fulfilling IND AS purposes and may also be made on Court Orders.

Responsibilities of Valuers

Under Rule 12(e) of the Companies (Registered Valuers and Valuation) Rules, 2017 the Model Code of Conduct for Registered Valuers is as follows:

Integrity and Fairness

A valuer should

- Follow high standards of integrity and fairness
- Be honest, straightforward, and forthright in all professional relationships.
- Provide true and adequate information and shall not misrepresent any facts or situations.
- Refrain from any action that would disrepute the profession.

Professional Competence and Due Care

A valuer should

- Render at all times high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment.
- Follow the relevant technical and professional standards
- Continuously maintain professional knowledge and skill
- In the preparation of a valuation report, should not disclaim liability for his expertise or deny his duty of care, except to the extent that the assumptions are statements of fact provided by the company and not generated by the valuer.
- Have a duty to carry out with care and skill, the compatible instructions of the client

Independence and Disclosure of Interest

A valuer should

- Act with objectivity by ensuring that his decisions are made without any bias, conflict of interest, coercion, or undue influence
- Not take up an assignment if he or any of his relatives or associates is not independent in relation to the company and assets being valued.
- Maintain complete independence in his professional relationships
- Disclose possible sources of conflicts of duties and interests,
- Not deal in securities of subject company
- Not indulge in “mandate snatching” or “convenience valuations” in order to cater to the company’s needs or client needs.
- As an independent valuer, the valuer should not charge success fee.
- In any fairness opinion or independent expert opinion, declare the past association with the company.

Confidentiality

- A valuer should not use or divulge any confidential information without proper and specific authority or unless there is a legal or professional right or duty to disclose.

Information Management

A valuer should

- Maintain written contemporaneous records for any decision taken, the reasons and evidence in support of such decision.
- Provide all information and records for inspections and investigations as may be required by the Registration Authority, the Tribunal, Appellate Tribunal, the Valuation Professional Organisation or any other statutory regulatory body.
- Maintain proper working papers for three years, for production before a regulatory authority or for a peer review. In the event of a pending case maintain record till the disposal of the case.

Gifts and hospitality

- A valuer, or his relative should not accept gifts or hospitality which affects his independence.
- A valuer should not offer gifts or hospitality or a financial or any other advantage to a public servant or any other person, intending to obtain or retain work for himself

Remuneration and Costs

A valuer should

- Provide services for a reasonable remuneration charged in a transparent manner, and is not inconsistent with the applicable rules.
- Not accept any fees or charges other than those which are disclosed to and approved by the persons fixing his remuneration.

Occupation, employability and restrictions

A valuer should

- Refrain from accepting too many assignments, if he is unlikely to be able to devote adequate time
- Not engage in any employment, except when he has temporarily surrendered his certificate of membership with the Valuation professional Organisation with which he is registered.
- Not conduct business which is inconsistent with the reputation of the profession.

Precautions Need to be Taken by A Valuer Before Accepting any Valuation Assignment

It should be evidently clear to the valuation professional as well as to the end consumer that a good valuation is much more than just numbers. It is equally important to have a comprehensive understanding of the narrative behind the valuation. Attention should be given to the following points while making a valuation:

1. A good valuation does not provide a precise estimate of value. A valuation by necessity involves many assumptions and is a professional estimate of value. The quality of a valuation will be directly proportional to the time spent in collecting the data and in understanding the firm being valued.
2. Valuing a company is much more than evaluating the financial statements of a company and estimating an intrinsic value based on numbers. This concept is getting more and more critical in today's day and age where most emerging business are valued not on their historical performances captured in the financial statement but rather on a narrative driven factors like scalability, ease of replication, growth potential, cross sell opportunities etc.
3. More often than not, investors/users tend to focus on either numbers or the story without attempting to reach a middle ground. In both these cases, investors will fail to capture opportunities that could have been unlocked had they been willing to reach some middle ground between the two concepts.
4. While it is true that a robust intrinsic value calculation using financial statements data and an error-free model makes investing a more technical subject, in reality, emotions play a massive role in moving stocks higher or lower. Not accounting for this fact, therefore, could become an obstacle in consistently getting the valuation right.

Impact of ESG on Valuation

Impact of ESG factors can be incorporated in computation of expected cash flows as follows:	
E of ESG	Risk of this factor (Environment) can be incorporated by carrying out 2-degree scenario analysis i.e. if temperature of the plant is increased by 2 degrees. Similarly, adjustment in cash flows can be made by considering carbon points.
S of ESG	Risk of this factor (Social) can be considered by adjusting impact of social measures cost (such as better labour working conditions) on the revenue.
G of ESG	Risk of this factor (Governance) can be considered by adjusting impact of poor governance on revenue in the form of penalty, fines, taxes etc.

Portfolio Management

Assumptions of CAPM

(i) Efficient market refers to the existence of competitive market with full information of risk and return available to all participants.

(ii) Rational investment goals Investors desire higher return for any acceptable level of risk or the lowest risk for any desired level of return.

(iii) Risk aversion in efficient market is adhered to although at times risk seeking behaviour is adopted for gains.

(iv) CAPM assumes that all assets are divisible and liquid assets.

(v) Investors are able to borrow freely at a risk less rate of interest

(vi) Securities can be exchanged without payment of brokerage, commissions or taxes and without any transaction cost.

(vii) Securities or capital assets face no bankruptcy or insolvency.

(viii) CAPM assumes that the Capital Market is in equilibrium,

Advantages of CAPM

[MTP Nov 2023]

(i) Risk Adjusted Return It provides a reasonable basis for estimating the required return on an investment which has risk inbuilt into it. Hence, it can also be used as Risk Adjusted Discount Rate in Capital Budgeting.

(ii) No Dividend Company It is useful in computing the cost of equity of a company which does not declare dividend.

Limitations of CAPM

[MTP Nov 2023]

(a) Reliability of Beta Statistically reliable Beta might not exist for shares of many firms. It may not be possible to determine the cost of equity of all firms using CAPM. All shortcomings that apply to Beta value applies to CAPM too.

(b) Other Risks By emphasising on systematic risk only, the unsystematic risk that are of importance too does not find place in a diversified portfolio.

(c) Information Available It is extremely difficult to obtain important information on risk free interest rate and expected return on market portfolio because depending upon the situations there can be multiple risk free rates and market being volatile its return varies from time to time.

Principles of Active Portfolio Strategy (APS)

MTP Nov 2024

(a) Market Timing

(b) Sector Rotation Overweigh the sector with positive outlook

(c) Security Selection search for under-priced security.

(d) Use of Specialised Investment Concept Such as growth stock, out of favour stocks cyclical stocks etc

Various Types of Alternative Investments

1.	Real Estates	4.	REITs	7.	Mutual Funds
2.	Gold	5.	Hedge Funds	8.	Commodities
3.	Private Equity	6.	Exchange Traded Funds	9.	Distressed Securities

Features of Alternative Investments

[MTP Nov 2023]

(i) High Fees Being a specific nature product the transaction fees are quite on higher side.

(ii) Limited Historical Rate The data for historic return and risk is verity limited where data for equity market for more than 100 years in available.

(iii) Illiquidity The liquidity of Alternative Investment is not good as next buyer may not be easily available due to limited market.

(iv) Less Transparency The level of transparency is not adequate due to limited public information available.

(v) Extensive Research Required Due to limited availability of market information extensive analysis is required by the Portfolio Managers.

(vi) Leveraged Buying Generally investment in alternative investments is highly leveraged.

Real Estates

Real Assets consists of land, buildings, offices, warehouses, shops etc. Every country has their own laws and paper works which makes investment in foreign properties less attractive. However, in recent time due to globalization investment in foreign real estate has increased.

Valuation Approaches

Comparing to financial instrument the valuation of Real Estate is quite complex as number of transactions or dealings comparing to financial instruments are very small. Following are some characteristics that make valuation of Real Estate quite complex:

(i) Inefficient market Information may not be freely available as in case of financial securities.

(ii) Illiquidity Real Estates are not as liquid as financial instruments.

(iii) Comparison Real estates are only approximately comparable to other properties.

(iv) High Transaction cost In comparison to financial instruments, the transaction and management cost of Real Estate is quite high.

(v) No Organized market There is no such organized exchange or market as for equity shares and bonds.

Valuation of Real Estates

Generally, following four approaches are used in valuation of Real estates:

(1) Sales Comparison Approach It is like Price Earning Multiplier as in case of equity shares. Benchmark value of similar type of property can be used to value Real Estate.

(2) Income Approach This approach is like value of Perpetual Debenture or Irredeemable Preference Shares. In this approach the perpetual cash flow of potential net income (after deducting expense) is discounted at market required rate of return.

(3) Cost Approach In this approach, the cost is estimated to replace the building in its present form plus estimated value of land. However, adjustment of other factors such as good location, neighbourhood is also made in it.

(4) Discounted After Tax Cash Flow Approach In comparison to NPV technique, PV of expected inflows at required rate of return is reduced by amount of investment.

Gold

Being a real asset, Gold is an attractive alternative form of investment since a long time especially among Indians, commonly done by buying the jewellery. However, this form of investment in gold suffers from a serious limitation of making charges because jeweller charge them both at the time of selling and buying back.

Other forms of investment in gold are:

(a) Gold Bars Investors can buy gold coins/ bar of different denominations. However, similar to jewellery this form of investment suffers from the limitation of cost of physical storage.

(b) Sovereign Gold Bonds (SGBs) offers a superior alternative to holding gold in physical form. SGBs are government securities denominated in grams of gold. They are substitutes for holding physical gold. Investors have to pay the issue price in cash and the bonds will be redeemed in cash on maturity. The Bond is issued by Reserve Bank on behalf of Government of India. The risks and costs of storage are eliminated. Investors are assured of the market value of gold at the time of maturity and periodical interest. SGB is free from issues like making charges and purity in the case of gold in jewellery form. The bonds are held in the books of the RBI or in demat form eliminating risk of loss of scrip etc.

(c) Gold Exchange Traded Funds (ETFs) is a hybrid of flexibility of stock investment and the simplicity of gold investments. Like any other company stock, they can be bought and sold continuously at market prices on Stock Exchanges.

Prices of Gold ETFs are based on gold prices and investment of fund amount is made in gold bullion. Further because of its direct gold pricing, there is a complete transparency on the holdings of an ETF. Compared to physical gold investments, the ETFs have much lower expenses.

(d) E-gold Started in 2010 in India, E-gold is offered by the National Spot Exchange Ltd (NSEL). It can be bought by setting up a trading account with an authorized participant with NSEL. Each unit of e-gold is equivalent to one gram of physical gold and is held in the Demat account (different from holding and transacting in equities). Like Gold ETFs, e-gold units are fully backed by an equivalent quantity of gold kept with the custodian and have less storage cost compared to physical gold.

Distressed securities

It is purchasing the securities of companies that are in or near bankruptcy. Since these securities are available at very low price, the main purpose of buying such securities is to make efforts to revive the sick company.

Profit can be earned from distressed securities by taking Long Position in Debt and Short Position in Equity. Now let us see how investor can earn arbitrage profit.

(i) In case company's condition improves because of priority, the investor will get his interest payment which shall be more than the dividend on his short position in equity shares.

(ii) If company's condition further deteriorates the value of both share and debenture goes down. He will make good profit from his short position.

Risks Analysis of Investment in Distressed Securities

(i) Liquidity Risk These securities may be saleable in the market.

(ii) Event Risk Any event that particularly effect the company not economy as a whole

(iii) Market Risk This is another type of risk though it is not important.

(iv) Human Risk The judge's decision on the company in distress also play a big role.

Risk Management

Various 'Types of Risk' a Business Organization face

1. Strategic Risk a risk in which a company's strategy becomes less effective due to technological changes, a new competitor entering the market, shifts in customer demand, increase in costs of raw materials etc.

   Example: Kodak failed to develop digital camera and left behind. Nokia failed to upgrade to touch screen mobile phones. A positive example is Xerox. Xerox was quick to lap up the opportunity and changed its business model to develop laser printing.

2. Compliance Risk Every business needs to comply with plethora of rules, regulations and guidelines. Non compliance leads to penalties in the form of fine and imprisonment. Eg Paytm

   Example, a company ventures into sugar business is subject to state laws applicable If company fails to comply, it poses a serious threat to its survival.

3. Operational Risk relates to internal risk and relates to failure to cope with day to day operational problems. Operational risk relates to 'people' as well as 'process'. Example, an employee paying out ₹1,00,000 from the account of the company instead of ₹10,000.

   An organization can employ another person to check or it can install an electronic system that can flag off an unusual amount.

4. Financial Risk Financial Risk is referred as the unexpected changes in financial conditions such as prices, exchange rate, Credit rating, and interest rate etc.

   Financial Risk can be divided into following categories.

   (i) Counter Party Risk non-honoring of obligations by the counter party which can be failure to deliver the goods, credit risk such as failure to make payment or repayment of borrowings and interest etc.

(ii) Political Risk Generally faced by overseas investors, as the adverse action by the Govt of host country

- Confiscation or destruction of overseas properties.
- Rationing of remittance to home country.
- Restriction on conversion of local currency of host country into foreign currency.
- Restriction as borrowings.
- Invalidation of Patents
- Price control of products

(iii) Interest Rate Risk Changes in value of asset and liabilities due to change in interest rate. This risk is more important for banking companies.

The risk is faced in both types i.e. fixed and floating.

A company who borrowed at floating rate faces risk of increase in interest rates.

A company who borrowed at fixed rate faces risk of fall in interest rates.

(iv) Currency Risk mainly affects organization dealing with foreign exchange.

Example, if rupee depreciates Importer faces increase in liability eg. Indian Oil Corp

If rupee appreciates Exporter faces decrease in value of Assets eg. Infosys

(v) Liquidity Risk inability of an organization to meet its liabilities whenever they become due. This risk is more prevalent in banking business where there may be a mismatch in maturities and receiving fresh deposits pattern.

Evaluation of Financial Risk

(a) From stakeholder's point of view Eg. equity shareholders view financial gearing i.e. ratio of debt in capital structure as risk

(b) From Company's point of view If a company borrows excessively or lend to someone who defaults, then it can be forced to go into liquidation.

(c) From Government's point of view Failure of any bank or down grading of any financial institution leading to spread of distrust among society at large. It includes sovereign debt crisis.

Appropriate Methods for Identification and Management of Financial Risk

[(4 Marks)Exam Nov 2023]

As we have classified financial risk in 4 categories, we shall discuss identification and management of each risk separately under same category.

(i) Counter Party risk: The various hints that may provide counter party risk are as follows:

- Failure to obtain necessary resources to complete the project or transaction undertaken.
- Any regulatory restrictions from the Government.
- Hostile action of foreign government.
- Let down by third party.
- Have become insolvent.

The various techniques to manage this type of risk are as follows:

(1) Carrying out Due Diligence before dealing with any third party.
(2) Do not over commit to a single entity or group or connected entities.
(3) Know your exposure limits.
(4) Review the limits and procedure for credit approval regularly.
(5) Rapid action in the event of any likelihood of defaults.
(6) Use of performance guarantee, insurance or other instruments.

(ii) Political risk: Since this risk mainly relates to investments in foreign country, company should assess country

- By referring political ranking published by different business magazines.
- By evaluating country's macro-economic conditions.
- By analyzing the popularity of current government and assess their stability.
- By taking advises from the embassies of the home country in the host countries.
- From the following actions by the Governments of the host country this risk can be identified:
  - Insistence on resident investors or labour.
  - Restriction on conversion of currency.
  - Repatriation of foreign assets of the local govt.
  - Price fixation of the products.

Following techniques can be used to mitigate this risk.

(i) Local sourcing of raw materials and labour.
(ii) Entering into joint ventures
(iii) Local financing
(iv) Prior negotiations

(iii) Interest Rate Risk: Generally, interest rate Risk is mainly identified from the following:

- Monetary Policy of the Government.
- Any action by Government such as demonetization etc.
- Economic Growth
- Release of Industrial Data
- Investment by foreign investors
- Stock market changes

The rearrangement of Interest risk has been discussed in Interest Rate Risk Management.

(iv) Currency Risk: [MTP April 2024] Just like interest rate risk the currency risk is dependent on the Government action and economic development.

Some of the parameters to identity the currency risk are as follows: [RTP S25, (4 Marks) Exam S25]

- Government Action: The Government action of any country has visual impact in its currency. For example, the UK Govt. decision to divorce from European Union i.e. Brexit brought the pound to its lowest since 1980's.
- Nominal Interest Rate: As per interest rate parity (IRP) the currency exchange rate depends on the nominal interest of that country.
- Inflation Rate: Purchasing power parity theory impact the value of currency.
- Natural Calamities: Any natural calamity can have negative impact.
- War, Coup, Rebellion etc.: All these actions can have far reaching impact on currency's exchange rates.
- Change of Government: The change of government and its attitude towards foreign investment also helps to identify the currency risk.

So far as the management of currency risk, it is covered in detail in a separate chapter viz Forex

Features of VAR

[MTP Sep 2025]

(i) Components of Calculations VAR calculation is based on following three components:
   (a) Time Period
   (b) Confidence Level – Generally 95% and 99%
   (c) Loss in percentage or in amount

(ii) Statistical Method It is a type of statistical tool based on Standard Deviation.

(iii) Time Horizon VAR can be applied for different time horizons say one day, one week, one month and so on.

(iv) Probability Assuming the values are normally attributed, probability of maximum loss can be predicted.

(v) Control Risk Risk can be controlled by setting limits for maximum loss.

(vi) Z Score Z Score indicates how many standard Deviations is away from Mean value of a population. When it is multiplied with Standard Deviation it provides VAR.

Application of VAR

MTP March 2024

VAR can be applied
   (a) to measure the maximum possible loss on any portfolio or a trading position.
   (b) as a benchmark for performance measurement of any operation or trading.
   (c) to fix limits for individuals dealing in front office of a treasury department.
   (d) to enable the management to decide the trading strategies.
   (e) as a tool for Asset and Liability Management especially in banks.

Mutual Funds

Trail Commission

It is the amount that a mutual fund investor pays to his advisor each year. The purpose of charging this commission from the investor is to provide incentive to the advisor to review their customer's holdings and to give advice from time to time.

Distributors usually charge a trail commission of 0.30-0.75% on the value of the investment for each year that the investor's money remains invested with the fund company.

This is calculated on a daily basis as a percentage of the assets under management of the distributor and is paid monthly. This is separate from any upfront commission that is usually paid by the fund company to the distributor out of its own pocket.

Side - Pocketing in Mutual Funds

It means separation of risky assets from other investments and cash holdings. The purpose is to make sure that money invested in a mutual fund, which is linked to stressed assets, gets locked, until the fund recovers the money from the company or could avoid distress selling of illiquid securities.

The modus operandi is simple. Whenever, the rating of a mutual fund decreases, the fund shifts the illiquid assets into a side pocket so that current shareholders can be benefitted from the liquid assets. Consequently, the Net Asset Value (NAV) of the fund will then reflect the actual value of the liquid assets.

Side Pocketing is beneficial for those investors who wish to hold on to the units of the main funds for long term. Therefore, the process of Side Pocketing ensures that liquidity is not the problem even in the circumstances of frequent allotments and redemptions.

Classification of Mutual Funds

There are three different types of classification of mutual funds - (1) Functional (2) Portfolio and (3) Ownership.

Functional Classification

Funds are divided into:

(1) Open-Ended funds investor can enter and exit any time. Also, the capital of the fund is unlimited, and the redemption period is indefinite.

(2) Close-Ended funds investor can invest into the scheme during New Fund Offer or from the stock market after the units have been listed. The scheme has a limited life at the end of which the corpus is liquidated. The investor can make his exit from the scheme by selling in the stock market, or at the expiry of the scheme or during repurchase period, if any, at his option.

(3) Interval Funds are a combination of an Open-Ended and a Close-Ended structure. These schemes are open for both purchase and redemption during pre-specified intervals (viz. monthly, quarterly, annually etc.) Interval funds are very similar to Close-Ended funds, but differ on the following points:

- Not required to be listed on the stock exchanges, as they have an in-built redemption window.
- Can make fresh issue of units during the specified interval period, at the prevailing NAV based prices.
- Maturity period is not defined.

Portfolio Classification

Funds are classified into Equity Funds, Debt Funds and Special Funds.

Equity Funds

Equity funds invest primarily in stocks. Unit holders profit in two ways - stock price increase & dividends

Equity Funds are of the following types viz.

(a) Growth Funds They seek to provide long term capital appreciation to the investor and are best suited to long term investors.

(b) Aggressive Funds They look for super normal returns for which investment is made in startups, IPOs and speculative shares. They are suited best to investors willing to take risks.

(c) Income Funds They seek to maximize present income of investors by investing in safe stocks which pay high dividends and in high yield money market instruments. They are best suited to investors seeking current income.

Debt Funds

Debt Funds are of two types viz.

(a) Bond Funds They invest in fixed income securities e.g. government bonds, corporate debentures, convertible debentures, money market instruments etc. Bond funds tend to be less volatile than equity mutual funds and often produce regular income hence helps in diversification. Bond funds have following risks.

- ❖ Interest Rate Risk
- ❖ Credit Risk
- ❖ Prepayment Risk This risk is related to early refund of money by the issuer of Bonds before the date of maturity.
- ❖ Reinvestment Risk

(b) Gilt Funds These funds invest into Treasury Bills & dated securities issued by the State & Central Govts.

Special Funds

Special Funds are of following types viz.

(a) Index Funds In Index, every share has a specific weightage and on an aggregate basis, it will become 100. The funds get invested in these stocks exactly in the same weightage which it bears in the Index. Index Funds are low-cost funds as they are passively managed Funds. The Fund Manager is not managing it actively, but it can influence the stock market. Index Funds deliver approx the same return what the market index delivers.

(b) International Funds A mutual fund which raises money in India but invests globally.

(c) Offshore Funds A mutual fund located outside India which raises money globally for investing in India.

(d) Sector Funds They invest their entire fund in a particular sector e.g., Infrastructure, Information & Technology, Pharmaceuticals etc.

(e) Money Market Funds These are debt-oriented mutual fund schemes, whose main objective is preservation of capital, easy liquidity and moderate income generation. They invest predominantly in safer short-term instruments like Commercial Papers, Certificate of Deposits, Treasury Bills, G-Secs etc.

These schemes are used to park surplus funds for short periods of time. These funds are less vulnerable from changes in the interest rate (lower volatility) and endeavour to capture the current yields prevailing in the market.

(f) Fund of Funds are schemes which invest in other mutual fund schemes. The concept is popular in markets where choosing a suitable scheme according to one's objective is tough. The underlying investments for a FoF is the units of other mutual fund schemes. Example, Indian Mutual Funds investing into the Schemes of International Mutual Funds.

(g) Capital Protection Oriented Fund The term 'capital protection oriented scheme' means a mutual fund scheme which is designed to protect the capital invested therein through suitable orientation of its portfolio structure. The orientation towards protection of capital originates from the portfolio structure of the scheme and not from any bank guarantee, insurance cover etc. SEBI stipulations require these types of schemes to be close-ended in nature, listed on the stock exchange and the intended portfolio structure would have to be mandatorily rated by a credit rating agency. A typical portfolio structure could be to set aside major portion of the assets for capital safety and could be invested in highly rated debt instruments. The remaining portion would be invested in equity or equity related instruments to provide capital appreciation. Capital Protection Oriented schemes should not be confused with 'capital guaranteed' schemes.

(h) Gold Funds The objective of these funds is to track the performance of Gold. The units represent the value of gold or gold related instruments held in the scheme. Gold Funds which are generally in the form of an Exchange Traded Fund (ETF) are listed on the stock exchange and offer investors an opportunity to participate in the bullion market without having to take physical delivery of gold.

(i) Quant Funds: Quant Fund works on a data-driven approach for stock selection and investment decisions based on pre-determined rules or parameters using statistics or mathematics-based models.

While an active fund manager selects the quantity, price of share and timing of investments (entry or exit) based on his/ her analysis and judgement, in case of Quant Fund a complete reliance is placed on an automated programme that helps in taking decision for quantum of investment as well as its timings and action and the concerned manager has to act accordingly.

The Fund Manager usually focuses on the robustness of the Models in use and if required some modification is done in the same.

The prime advantage of Quant Fund is that it eliminates the human biasness and subjectivity and by using model-based approach also ensures consistency in strategy across the market conditions.

Quant Fund normally follows passive strategy, hence their expense ratio generally tends to be lower than the actively managed Mutual Fund Schemes.

On the con side, since Quant Funds are tested based on historical data and past trends though cannot altogether be ignored but also cannot be used blindly as good indicators.

Ownership Classification

Funds are classified into three types

(i) Public Sector Mutual Fund is sponsored by a company/Bank of the public sector.

(ii) Private Sector Mutual Fund is sponsored by a company of the private sector.

(iii) Foreign Mutual Fund is sponsored by a foreign company operating from India, for raising funds in India, and investing those funds in India.

Direct Plans in Mutual Funds

Mutual fund direct plans are those plans where Asset Management Companies do not charge distribution expenses, trail fees and transaction charges. NAV of the direct plan is generally higher in comparison to a regular plan. 'Direct Plans' perform better than the 'Regular Plans' to the extent of lower fees charged by the Mutual Fund.

Types of Schemes

Balanced Funds

Make strategic allocation to both debt as well as equities to provide. stability, and growth.

Diversified Equity Funds

a. Flexicap Fund The Fund Manager is allowed to invest any proportion across market cap without any restrictions.

b. Multicap Fund The Fund Manager is mandated to invest at least 25% each into Large, Mid & Small cap stocks and remaining 25% at the discretion of the Fund Manager.

c. Contra fund invests in out-of-favour companies that have unrecognised value. Investors who invest in contra funds have an aggressive risk appetite.

d. Index fund seeks to track the performance of a benchmark market index like Sensex or Nifty by maintaining the portfolio of all the securities in the same proportion as stated in the benchmark index and earns the same return as earned by the market.

e. Dividend Yield fund invests in shares of companies having high dividend yields. The prices of dividend yielding stocks are generally less volatile than growth stocks.

There are two options for earning Income from Mutual Fund Schemes which are enumerated asunder:

1. Growth/Appreciation or Cumulative Option The investor doesn't get any intermittent income. The return gets accumulated & is paid back to the investor at the time of withdrawal in the form of capital gain.
2. Dividend Option At a regular frequency may be monthly/quarterly/half yearly or Annual, the Scheme declares dividend to the unitholders of the Scheme. Two sub-options are as under:
   - *Dividend Payout Option:* Dividends are paid out to the unit holders under this option. However, the NAV of the units falls to the extent of the dividend paid out and applicable statutory levies.
   - Dividend Re-investment Option: The dividend that accrues on units is reinvested back into the scheme at ex-dividend NAV and investors receive additional units.

Equity Linked Tax Savings Scheme

ELSS helps to save taxes under Section 80 C of the Income Tax Act. and offers the perfect way to participate in the growth of the capital market, having a lock-in-period of three years.

Sector Funds

Are highly focused on a particular industry and enables investors to take advantage of industry cycles, if the timing is perfect.

Thematic Funds

Focuses on trends that are likely to result in the 'out-performance' by certain sectors or companies. The theme could vary from multi-sector, international exposure, commodity exposure etc.

However, the downside is that the market may take a longer time to recognize views of the fund house with regards to a particular theme, which forms the basis of launching a fund.

Arbitrage Funds

Seeks to capitalize on the price differentials between the spot and the futures market. Typically these funds promise safety of deposits, but better returns, tax benefits and greater liquidity.

Hedge Fund

is a lightly regulated investment fund that escapes most regulations by being a sort of a private investment vehicle being offered to selected clients.

The big difference between a hedge fund and a mutual fund is that the former does not reveal anything about its operations publicly and charges a performance fee. Typically, if it outperforms a benchmark, it take a cut off the profits, but any losses are borne by the investors themselves. Hedge funds are aggressively managed portfolio of investments which use advanced investment strategies such as leveraged, long, short and derivative positions in both domestic and international markets with the goal of generating high returns. It is important to note that hedging is actually the practice of attempting to reduce risk, but the goal of most hedge funds is to maximize return on investment.

Cash Fund

is an open-ended liquid scheme that aims to generate returns with lower volatility and higher liquidity through a portfolio of debt and money market instrument.

Exchange Traded Funds

is a hybrid product that combines the features of listed stocks and an index fund. These funds are listed on the stock exchanges and their prices are linked to the underlying index. The authorized participants act as market makers for ETFs.

ETFs can be bought and sold like any other stock on an exchange during the market hours. There is no paper work involved for investing in ETF.

ETFs may be attractive as investments because of their low costs, tax efficiency, and stock-like features. An ETF combines the valuation feature of a mutual fund, which can be bought or sold at the end of each trading day for its net asset value, with the tradability feature of a closed-end fund, which trades throughout the trading day at prices that may be more or less than its net asset value.

Following types of ETF products are available in the market:

- Index ETFs attempt to replicate the performance of a stock market index.
- Commodity ETFs Commodity ETFs invest in commodities, such as precious metals and futures.
- Bond ETFs They thrive during economic recessions because investors pull their money out of the stock market and into bonds (for example, government treasury bonds or those issues by companies regarded as financially stable). Because of this cause and effect relationship, the performance of bond ETFs may be indicative of broader economic conditions.
- Currency ETFs The funds are total return products where the investor gets access to the FX spot change, local institutional interest rates and a collateral yield.

Fixed Maturity Plans

Fixed Maturity Plans (FMPs) are closely ended mutual funds in which an investor can invest during a New Fund Offer (NFO). FMPs usually invest in Certificates of Deposits (CDs), Commercial Papers (CPs), Money Market Instruments and Non-Convertible Debentures over fixed investment period. Sometimes, they also invest in Bank Fixed Deposits.

FMPs are later traded on the stock exchange but, the trading in FMPs is very less. hence are not liquid instruments.

The main advantage of Fixed Maturity Plans is that they are free from any interest rate risk because FMPs invest in debt instruments that have the same maturity as that of the fund. However, they carry credit risk, as there is a possibility of default by the debt issuing company.

FMPs assign some portions of the invested funds in AA and below rated debt instruments to earn higher interest.

Advantages of Mutual Fund

(a) Professional Management
(b) Diversification
(c) Convenient Administration
(d) Higher Returns
(e) Low Cost of Management
(f) Liquidity
(g) Transparency
(h) Highly Regulated
(i) Economies of scale
(j) Flexibility
(k) Convenience

Drawbacks of Mutual Fund

(a) No guarantee of Return
(b) Over Diversification
(c) Selection of Proper Fund is difficult
(d) High Cost Factor fund management fees, Exit Load etc

Evaluation of Mutual Funds

Generally, both Quantitative and Qualitative Parameters can be used to evaluate the performance of any Mutual Fund.

Quantitative Parameters

(1) Risk Adjusted Returns Basically it is the return of a Mutual Fund relative to the risk it assumed as benchmarked against the market and industry risk.

(2) Benchmark Returns Benchmark can be defined as the quality or set of standards against which performance of Mutual Fund can be measured. A good Mutual Fund performs over and above its benchmark during all phases of market, this excess return is known as 'Alpha'. Generally Equity funds are benchmarked to the Sensex or Nifty 50.

(3) Comparison to Peers the comparison of relative performance of fund with its peers (of same category) because a good mutual fund is supposed to consistently beat its peers to be worthwhile to hold it.

(4) Comparison of Returns across different economic and market cycles At the time of evaluating performance of any Mutual Fund it is not just looking across different time frames such as 6 months, 12 months etc. but performance during different economic and market cycles also needs to be evaluated because, due to some special economic or market condition a Mutual Fund might have outperformed/underperformed for a short time. It may not be necessary that such conditions shall be continued in future period for ever.

(5) Financial Measures [MTP April 2024] There are some financial measures that help in evaluation of performance of any Mutual Fund which are as follows:

(a) Expense Ratio Expense ratio ultimately impacts the return of a Mutual Fund Scheme.

(b) Sharpe Ratio It ratio measures the Mutual Fund's performance measured against the total risk (both systematic and unsystematic) taken.

(c) Treynor Ratio In mutual funds the Beta of a mutual fund measures volatility of a fund's return to return from its Benchmark. Treynor Ratio measures performance of a mutual fund against the systematic risk it has taken.

(d) Sortino Ratio A variation of Sharpe Ratio that considers and uses downside deviation instead of total standard deviation in denominator.

Qualitative Parameters

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(1) Quality of Portfolio Quality of stocks and securities in the portfolio of the Mutual Funds is an important qualitative parameter. eg. allocation in top Blue-chip companies, large companies and how diversified is the portfolio.

The style followed can be growth, value or blend of the same. In Debt Funds, the quality of portfolio is measured on the basis of credit quality, average maturity and modified duration of the fixed asset securities.

Under normal circumstances, the fund having lower Portfolio Turnover ratio is considered to be better.

(2) Track record and competence of Fund Manager Since Fund Manager decides about the selection of securities and takes investment decisions, his/her competence, knowledge, ability to manage and conviction plays a very big role.

(3) Credibility of Fund House Team Example administrative tasks also such as redemption of units, crediting of dividend, providing adequate information etc. which play a crucial role in qualitative assessment of any mutual fund house.

Role of Fund Managers in Mutual Funds

A Fund manager is a gatekeeper of funds of any Mutual Fund whose main responsibility is to ensure good performance of the fund he/she is managing

Actively Managed Funds

Fund Manager's role in these funds is more crucial as through use of his extensive research, judgement and due diligence, he/she has to outperform the market and generate positive alpha. Right stock picking can help him to outperform.

Passively Managed Funds

Fund Manager's main role is to match the return of the underlying index with the minimum Tracking Error.

Other key roles of a Fund Manager

(a) Compliances Fund Manager must ensure that:
- ❖ Compliance of various Guidelines as laid down by SEBI, AMFI etc.
- ❖ Ensuring various reporting such as Expenses Ratio, redemption of funds etc.
- ❖ Ensuring that investors are aware of various required details and rules.
- ❖ Ensuring that all required documents are furnished on time.

(b) Constant Monitoring the Performance of the Fund Fund Manager has to evaluate investments on a continuous basis. Decision to enter or exit market maximises the wealth of unit holders.

(c) Creation of Wealth and Protection The investments should be made after a thorough research using Fundamental Analysis and Technical Analysis techniques. Reckless assumption to risk should be avoided.

(d) Control over the works outsourced to third parties Fund Manager must exercise proper control over functioning of the third party to ensure error free operations.

Role of FIIs in Mutual Funds

Foreign Institutional Investors can buy units of domestic mutual funds either directly from the issuer of such securities or through a registered stock broker on a recognized stock exchange in India. These investments are subject to limits notified by SEBI. The FIIs plays an important role for Indian Economy through their investment in Mutual Funds because of following reasons:

(a) Enhanced Corporate Governance FIIs carries out thorough due diligence of Corporate Governance. Hence, Corporate Governance is improved to a great extent.

(b) Improved Competition in Market With the investment of FIIs in Mutual Funds improvement takes place in the capital market.

(c) Improved Inflow of Capital in the economy With the investment of funds in Mutual Funds in the economy not only employment is generated but the position of Foreign Exchange also improves.

Management of Bonds Portfolio

Fixed Income Portfolio Management Strategies

There are two strategies

(i) Passive Strategy (ii) Active Strategy

Passive Strategy

Passive Strategy is based on the premise that securities are fairly priced commensurate with the level of risk. Though investor does not try to outperform the market but it does not imply they remain totally inactive. Common strategies applied by passive investors of fixed income portfolios are as follows:

(i) Buy and Hold Strategy Investor continues with initial selection and do not attempt to churn bond portfolio

(ii) Indexation Strategy replication of a predetermined benchmark well known bond index

(iii) Immunization This strategy cannot exactly be termed as purely passive strategy but a hybrid strategy. This strategy is more popular among pension funds. Since pension funds promised to pay fixed amount to retiring people in the form of annuities any inverse movement in interest may threaten fund's ability to meet their liability timely. By building an immunized portfolio the interest rate risk can be avoided.

(iv) Matching Cash Flows Another stable approach to immunize the portfolio is Cash Flow Matching. This approach involves buying of Zero Coupon Bonds to meet the promised payment out of the proceeds realized.

Active Strategy

Active Strategy is usually adopted to outperform the market. Following are some of active strategies:

(1) Forecasting Returns and Interest Rates Since interest rate and bond values are inversely related if portfolio manager is expecting a fall in interest rate of bonds he/she should buy with longer maturity period. On the contrary, if he/she expected a fall in interest then he/she should sell bonds with longer period.

Based on short term yield movement following three strategies can be adopted:

(a) Bullet Strategy This strategy involves concentration of investment in one particular bond. This type of strategy is suitable for meeting the fund after a point of time such as meeting education expenses of children etc. For example, if 100% of fund meant for investing in bonds is invested in 5-years Bond.

(b) Barbell Strategy This strategy involves investing equal amount in short term and long term bonds. For example, half of fund meant for investment in bonds is invested in 1-year Bond and balance half in 10-year Bonds.

(c) Ladder Strategy This strategy involves investment of equal amount in bonds with different maturity periods. For example if 20% of fund meant for investment in bonds is invested in Bonds of periods ranging from 1 year to 5 years.

(2) Bond Swaps This strategy involves regularly monitoring bond process to identify mispricing and try to exploit this situation. Some of the popular swap techniques are as follows:

(a) Pure Yield Pickup Swap This strategy involves switch from a lower yield bond to a higher yield bonds of almost identical quantity and maturity. This strategy is suitable for portfolio manager who is willing to assume interest rate risk as in switching from short term bond to long term bonds to earn higher rate of interest, he may suffer a capital loss.

(b) Substitution Swap This swapping involves swapping with similar type of bonds in terms of coupon rate, maturity period, credit rating, liquidity and call provision but with different prices. This type of differences exits due to temporary imbalance in the market. The risk a portfolio manager carries if some features of swapped bonds may not be truly identical to the swapped one.

(c) International Spread Swap In this swap portfolio manager is of the belief that yield spreads between two sectors is temporarily out of line and he tries to take benefit of this mismatch. Since the spread depends on many factor and a portfolio manager can anticipate appropriate strategy and can profit from these expected differentials.

(d) Tax Swap This is based on taking tax advantage by selling existing bond whose price decreased at capital loss and set it off against capital gain in other securities and buying another security which has features like that of disposed one.

(3) Interest Rate Swap discussed in details in the chapter on Interest Rate Risk Management.

Term Structure Theories

The term structure theories explain the relationship between interest rates or bond yields and different terms or maturities. The different term structures theories are as follows:

(a) *Expectation Theory:* As per this theory the long-term interest rates can be used to forecast short-term interest rates in the future as long-term interest rates are assumed to unbiased estimator of the short term interest rate in future.

(B) *Liquidity Preference Theory:* As per this theory investors are risk averse and they want a premium for taking risk. Long-term bonds have higher interest rate risk because of higher maturity, hence, long-term interest rates should have a premium for such a risk. Further, people prefer liquidity and if they are forced to sacrifice the same for a longer period, they need a higher compensation for the same. Hence, as per this theory, the normal shape of a yield curve is Positive sloped one.

(c) *Preferred Habitat Theory (Market Segmentation Theory):* This theory states that though different investors may be having different preference for shorter and longer maturity periods and therefore, they have their own preferred habitat. Hence, the interest rate structure depends on the demand and supply of fund for different maturity periods for different market segments. In case there is a mismatch between these forces, the players of a particular segment should be compensated at a higher rate to pull them out from their preferred habitat; hence, that will determine the shape of the yield curve. Accordingly, shape of yield curve will be determined which can be sloping upward, falling or flat.

Money Market

The instruments of money market are characterised by

(a) Short duration

(b) Large volume

(c) De-regulated interest rates.

(d) The instruments are highly liquid.

(e) They are safe investments owing to issuers inherent financial strength.

Types of instruments of money market are discussed in the following paragraphs:

Call/Notice money: Call money market, or inter-bank call money market, is a segment of the money market where scheduled commercial banks lend or borrow on call (i.e., overnight) or at short notice (i.e., for periods upto 14 days) to manage the day-to-day surpluses and deficits in their cash-flows. However, under notice money market, funds are transacted for a period between two days and fourteen days.

Treasury Bills (Tbs) Among money market instruments TBs provide a temporary outlet for short-term surplus as also provide financial instruments of varying short-term maturities to facilitate a dynamic asset-liabilities management. The interest received on them is the discount which is the difference between the price at which they are issued and their redemption value. They have assured yield and negligible risk of default. The TBs are short-term promissory notes issued by Government of India at a discount.

Commercial Bills A commercial bill is one which arises out of a genuine trade transaction, i.e. credit transaction. As soon as goods are sold on credit, the seller draws a bill on the buyer for the amount due. The buyer accepts it immediately agreeing to pay amount mentioned therein after a certain specified date. Thus, a bill of exchange contains a written order from the creditor to the debtor, to pay a certain sum, to a certain person, after a creation period. A bill of exchange is a `self-liquidating' paper and negotiable; it is drawn always for a short period ranging between 3 months and 6 months.

Certificate of Deposit The Certificate of deposits (CDs) are negotiable term-deposits accepted by commercial bank from bulk depositors at market related rates. CDs are usually issued in demat form or as a Usance Promissory Note.

Commercial Paper CPs are unsecured and negotiable promissory notes issued by high rated corporate entities to raise short-term funds for meeting working capital requirements directly from the market instead of borrowing from banks. Its period ranges from 7 days to 1 year. CP is issued at discount to face value the issue of CP seeks to by-pass the intermediary role of the banking system through the process of securitisation.

Repurchase Options (Repo.) and Reverse Repurchase Agreement (Reverse Repo) The term Repurchase Agreement (Repo) and Reverse Repurchase Agreement (Reverse Repo) refer to a type of transaction in which money market participant raises funds by selling securities and simultaneously agreeing to repurchase the same after a specified time generally at a specified price, which typically includes interest at an agreed upon rate.

Following are major differences between Repo and Reverse Repo:

(a) Repo rate is the rate at which Reserve Bank of India (RBI) lends to Commercial Banks for a short period of time against Government Securities. On the other hand, Reverse Repo is the rate at which Commercial Banks lend to RBI.

(b) A transaction is called a Repo when viewed from the perspective of the seller of securities (the party acquiring funds) and Reverse Repo when described from the point of view of the supplier Of funds. Thus, whether a given agreement is termed a Repo or a Reverse Repo depends largely on which party initiated the transaction.

(c) The purpose of Repo is to fulfill the deficiency of funds. While the purpose of Reverse repo is to reduce excess liquidity in the economy.

(d) The Repo rate is comparatively high in comparison to Reverse Repo rate.

(e) The Repo rate strives to contain inflation in the economy. The Reverse repo aims to control money supply in the economy.

Derivatives Analysis & Valuation

Assumptions of Black - Scholes Model

The following assumptions accompany the model:

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

Contango & Backwardation

Contango means "Future Price > Spot Price" {Normal market scenario}

Backwardation means "Future Price < Spot Price" {Possible only if there are factors other than the cost of carry eg Dividends}

Option Greeks

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The Greeks are a collection of statistical values (expressed as percentages) that give the investor a better overall view of how a stock has been performing.

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

A deeply out-of-the-money call will have a delta very close to zero; a deeply in-the-money call will have a delta very close to 1.

The formula for a delta of a European call on a non-dividend paying stock is:
Delta = N (d1) {see Black-Scholes formula for how to calculate d1}

Call Deltas are positive; Put Deltas are negative. The delta is often called the Hedge Ratio.

Gamma It measures how fast the Delta changes for small changes in the underlying stock price i.e. the Delta of the Delta.

Theta The change in option price given a one day decrease in time to expiration. It is a measure of time decay.

Rho The change in option price given a one percentage point change in the risk-free interest rate. For example, a Rho of .060 indicates the option's theoretical value will increase by .060 if the interest rate is decreased by 1.0.

Vega Vega indicates an absolute change in option value for a one percent change in volatility. For example, a Vega of .090 indicates an absolute change in the option's theoretical value will increase by .090 if the volatility percentage is increased by 1.0.

Exotic Options

Exotic options are the classes of option contracts with structure, exercisability and features different from plain vanilla options i.e. American and European style options.

Exotic Vs. Traditional Option

a. An exotic option can vary in terms of pay off and time of exercise.

b. These options are more complex than vanilla options.

c. Mostly Exotic options are traded in OTC market.

Types of Exotic Options

(a) Chooser Options This option provides a right to the buyer of option after a specified period of time to decide whether purchased option is a call option or put option. It is to be noted that the decision can be made within a specified period prior to the expiration of contracts.

(b) Compound Options Also called split fee option or 'option on option'. As the name suggests this option provides a right or choice not an obligation to buy another option at specific price on the expiry of first maturity date. Thus, it can be said in this option the underlying is an option. Further the payoff depends on the strike price of second option.

(c) Barrier options Though it is similar to plain vanilla call and put options, but unique feature of this option is that contract will become activated only if the price of the underlying reaches a certain price during a predetermined period.

(d) Binary Options Also known as 'Digital Option', this option contract guarantees the pay -off based on the happening of a specific event. If the event has occurred, the pay-off shall be predecided amount and if event it has not occurred then there will be no pay -off.

(e) Asian Options These are the option contracts whose pay off are determined by the average of the prices of the underlying over a predetermined period during the lifetime of the option.

(f) Bermuda Option It is somewhat a compromise between a European and American options. Contrary to American option where it can be exercised at any point of time, the exercise of this option is restricted to certain dates or on expiration like European option.

(g) Basket Options In this type of contracts the value of option instead of one underlying depends on the value of a portfolio i.e., a basket. Generally, this value is computed based on the weighted average of underlying constituting the basket.

(h) Spread Options As the name suggests the payoff of these type of options depend on difference between prices of two underlying.

(i) Look back options Unlike other type of options whose exercise prices are pre-decided, in this option on maturity date the holder of the option is given a choice to choose a most favourable strike price depending on the minimum and maximum price of an underlying achieved during the life time of option.

Commodity Derivatives

Necessary Conditions / Attributes considered crucial to introduce Commodity Derivatives

1) a commodity should be durable and it should be possible to store it;
2) units must be homogeneous;
3) the commodity must be subject to frequent price fluctuations with wide amplitude; supply & demand must be large;
4) supply must flow naturally to market and there must be breakdowns in an existing pattern of forward contracting.

Commodity Swaps

Producers need to manage their exposure to fluctuations in the prices for their commodities. They are primarily concerned with fixing prices on contracts to sell their produce.

End-users need to hedge the prices at which they can purchase these commodities.

Speculators are funds or individual investors who can either buy or sell commodities by participating in the global commodities market. While many may argue that their involvement is fundamentally destabilizing, it is the liquidity they provide in normal markets that facilitates the business of the producer and of the end-user.

Types of Commodity Swaps

There are two types of commodity swaps:

(a) Fixed-Floating Swaps They are just like the fixed-floating swaps in the interest rate swap market with the exception that both indices are commodity based indices.

General market indices in the international commodities market with which many people would be familiar include the S&P Goldman Sachs Commodities Index (S&PGSCI) and the Commodities Research Board Index (CRB). These two indices place different weights on the various commodities so they will be used according to the swap agent's requirements.

(b) Commodity-for-Interest Swaps They are similar to the equity swap in which a total return on the commodity in question is exchanged for some money market rate (plus or minus a spread).

Weather Derivatives

There are companies whose performance is liable to be adversely affected by the weather. For example, airline companies, farmers etc. Weather Derivatives helps **to hedge their volumetric risk** resulting from unfavourable weather patterns. The payoffs depend upon the price of an underlying "asset", a measure of 'weather', in the present case. "Weather", has several dimensions: rainfall, temperature, humidity, wind speed, etc. The underlying of weather derivatives is represented by a weather measure, which influences the trading volume of goods. This, in turn, means that the primary objective of weather derivatives is to hedge volume risk, rather than price risk, that results from a change in the demand for goods due to a change in weather.

Weather derivatives represent an alternative tool to the usual insurance contract to protect against unforeseen weather events. The main difference is the type of coverage provided by the two instruments. Insurance provides protection to extreme, low probability weather events, such as earthquakes, hurricanes and floods, etc. Instead, derivatives can also be used to protect the holder from all types of risks, including uncertainty in normal conditions that are much more likely to occur. This is very important for industries closely related to weather conditions for which less dramatic events can also generate huge losses.

Like other derivatives, a Weather derivative is a contract between a buyer and a seller wherein the seller of a weather derivative receives a premium from a buyer with the understanding that the seller will provide a monetary amount in case the buyer suffers any financial loss due to adverse weather conditions. In case no adverse weather condition occurs, then the seller makes a profit through the premium received.

Pricing a weather derivative is quite challenging as it cannot be stored and following issues are involved: -

- Data The reliability of data is a big challenge as the availability of data quite differs from one country to another and even agency to agency within a country.
- Forecasting of weather Though various models can be used to make short term and longterm predictions about evolving weather conditions but it is difficult to predict the future weather behaviour as it is governed by various dynamic factors. Generally, forecasts address seasonal levels but not the daily levels of temperature.
- Temperature Modelling Temperature is one of the important underlying for weather derivatives. The temperature normally remains quite constant across different months in a year. Hence, there is no such Model that can claim perfection and universality.

Electricity Derivatives

The purchase and sale of power in India takes place through state-owned distribution companies which enter into Power Purchase Agreements (PPAs) with power generators. Such long -term contracts (usually around 20-25 years) are needed given the high capital and operational expenditure requirements of these projects.

Since electricity spot prices in India, are generally volatile, due to smaller market size, change in fuel supply positions, weather conditions, transmission congestion, variation in Renewable Energy there is a need for hedging instruments that reduces price risk exposures for market participants i.e., generators, buyers and load serving entities.
Electricity derivative contracts linked with spot electricity prices as underlying helps to hedge price risk. This will help the buyer to pay a fixed price irrespective of variation in spot electricity prices as variations are absorbed by derivative instruments.

Like other derivatives the vanilla forms of electricity derivatives are:
(i) forwards, (ii) futures, and (iii) swaps.

Not only that being traded either on the exchanges or over the counters, these power contracts play the primary roles in offering future price discovery and price certainty to generators, distributing companies and other buyers.

Electricity Forwards

Electricity Forward contracts represent the obligation to buy or sell a fixed amount of electricity at a pre-specified contract price, known as the forward price, at a certain time in the future (called maturity or expiration time). Electricity forwards are custom-tailored supply contracts between a buyer and a seller, where the buyer is obligated to take power and the seller is obligated to supply. The payoff of a forward contract promising to deliver one unit of electricity at price F at a future time T is: Payoff of a Forward Contract = (ST - F)

The settlement price ST is usually calculated based on the average price of electricity over the delivery period at the maturity day "T".

Electricity Futures

Electricity Futures are contracts for the delivery of a certain quantity of electricity at a specified price and a specified time in the future, sellers can sell a proportion of their production in the future market, while consumers can buy a specific amount of the power they need.

Electricity futures contracts are standardized contracts in terms of trading locations, transaction requirements and settlement procedures. The delivery quantity of power specified in electricity futures contracts is often significantly smaller than that in forward contracts.

Electricity futures are traded on the organized exchanges and Electricity forwards are usually traded over the counter. As a result, the electricity futures prices are more transparent than forward prices being reflective of higher market consensus. Most electricity futures contracts are settled by financial payments rather than physical delivery resulting in lowering of the transaction costs. In addition, credit risks and monitoring costs in trading futures are much lower than those in trading forwards since exchanges implement strict margin requirements to ensure the financial performance of all trading parties. The fact that the gains and losses of Electricity Futures are paid out daily, as opposed to forward contract being cumulated and paid out in a lump sum at maturity time thus reduces the credit risks. Overall, as compared to Electricity Forwards, the advantages of Electricity Futures lie in market consensus, price transparency, trading liquidity, and reduced transaction and monitoring costs though there are limitations of various basis risks associated with the rigidity in futures specification and the limited transaction quantities specified in the contracts.

Electricity Swap

Electricity Swaps are financial contracts that enable their holders to pay a fixed price for underlying electricity, regardless of the floating electricity price, or vice versa, over the contracted time. They are typically established for a fixed quantity of power referenced to a variable spot price at either a generator's or a consumer's location. Electricity Swaps are widely used in providing short-to-medium term price certainty for up to a couple of years. Similar to financial swaps, Electricity Swap can be considered as a strip of electricity forwards with multiple settlement dates and identical forward prices for each settlement.

Another variant of Electricity Swap is Electricity Locational Basis Swaps wherein a holder of an electricity swap agrees to either pay or receive the difference between a specified futures contract price and another locational spot price of interest for a fixed constant cash flow at the time of the transaction. These swaps are used to lock-in a fixed price at a geographic location that is different from the delivery point of a futures contract and hence are effective financial instruments for hedging the risk-based on the price difference between power prices at two different physical locations.

Uses/Advantages of Stock Index Futures

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Investors can use stock index futures to perform myriad tasks. Some common uses are:

(1) To change the weightings or risk exposures of their investment portfolios. Example, An investor want to increase their systematic risk to the U.S. market and reduce these risks to the Japanese market, can do this by buying U.S. stock index futures contracts and selling Japanese contracts.

(2) To separate market timing from market selection decisions. For instance, investors may want to take advantage of increases in an equity market but not certain which securities to buy; can do this by purchasing stock index futures.

(3) Investors can also make money from stock index futures through index arbitrage, Investors seek to gain profits whenever a futures contract is trading out of line with the fair price of the securities underlying it.

(4) Investors often use stock index futures to hedge the value of their portfolios i.e. to provide insurance protection for a stock portfolio in a falling market.
(5) Stock index futures add flexibility to his or her portfolio as a hedging and trading instrument.
(6) Create the possibility of speculative gains using leverage.
(7) One major advantage of futures markets is liquidity i.e. one can sell contracts as readily as he or she can buy them.
(8) Transfer risk quickly and efficiently. Whether one is speculating, looking for insurance protection (hedging), or temporarily substituting futures for a later cash transaction, most stock index futures trades can be accomplished quickly and efficiently.

Credit Derivatives

Credit Derivatives is summation of two terms, Credit + Derivatives.

Initially started in 1996, due to the need of the banking institutions to hedge their exposure of lending portfolios today it is one of the popular structured financial products.

Plainly speaking the financial products are subject to following two types of risks:

(a) Market Risk Due to adverse movement of the stock market, interest rates and foreign exchange rates.
(b) Credit Risk Also called counter party or default risk, this risk involves non-fulfilment of obligation by the counter party.

While, financial derivatives can be used to hedge the market risk, credit derivatives emerged out to mitigate the credit risk. Accordingly, the credit derivative is a mechanism whereby the risk is transferred from the risk averse investor to those who wish to assume the risk.

Below are two types of credit Derivatives 'Collateralised Debt Obligation' and 'Credit Default Swap'.

Collateralized Debt Obligations (CDOs)

While in securitization the securities issued by SPV are backed by the loans and receivables the CDOs are backed by pool of bonds, asset backed securities, REITs, and other CDOs. Accordingly, it covers both Collateralized Bond Obligations (CBOs) and Collateralized Loan Obligations (CLOs).

Types of CDOs

The various types of CDOs are as follows:

(a) Cash Flow Collateralized Debt Obligations (Cash CDOs) Cash CDO is CDO which is backed by cash market debt or securities which normally have low risk weight. This structure mainly relies on the collateral's risk weight and collateral's ability to generate sufficient cash to pay off the securities issued by SPV.

(b) Synthetic Collateralized Debt Obligations It is similar to Cash Flow CDOs but with the difference that instead of transferring ownerships of collateral to SPV (a separate legal entity), synthetic CDOs are structured in such a manner that credit risk is transferred by the originator without actual transfer of assets.

Normally the structure resembles the hedge funds where in the value of portfolio of CDO is dependent upon the value of collateralized instruments and market value of CDOs depends on the portfolio manager's ability to generate adequate cash and meeting the cash flow obligations (principal and interest) in timely manner. a

While in cash CDO the collateral assets are moved away from Balance Sheet, in synthetic CDO there is no actual transfer of assets instead economic effect is transferred.

This effect of transfer economic risk is achieved by creating provision for Credit Default Swap (CDS) or by issue of Credit Linked Notes (CLN), a form of liability.

Accordingly, this structure is mainly used to hedge the risk rather than balance sheet funding. Further, for banks, this structure also allows the customer's relations to be unaffected. This was started mainly by banks who want to hedge the credit risk but not interested in taking administrative burden of sale of assets through securitization.

Technically, speaking synthetic CDO obtain regulatory capital relief benefits vis-à-vis cash CDOs. Further, they are more popular in European market due to the reason of less legal documentation requirements. Synthetic CDOs can also be categorized as follows:

(i) Unfunded It will be comprised only CDS.

(ii) Fully Funded It will be through issue of Credit Linked Notes (CLN).

(iii) Partially Funded It will be partially through issue of CLN and partially through CDS.

(c) Arbitrage CDOs Basically, in Arbitrage CDOs, the issuer captures the spread between the return realized on collateral underlying the CDO and cost of borrowing to purchase these collaterals. In addition to this, issuer also collects the fee for the management of CDOs. This arbitrage arises due to acquisition of relatively high yielding securities with large spread from open market.

Risks involved in CDOs MTP March 2024

CDOs are structured products and just like other financial products are also subject to various types of Risk. The main types of risk associated with investment in CDOs are as follows:

(a) Default Risk Also called 'credit risk', it emanates from the default of underlying party to the instruments. The prime sufferers of these types of risks are equity or junior tranche in the waterfall.

(b) Interest Rate Risk Also called Basis risk and mainly arises due to different basis of interest rates. For example, asset may be based on floating interest rate but the liability may be based on fixed interest rates. Techniques such as swaps, caps, floors, collars etc. can be used to mitigate the interest rate risk.

(c) Liquidity Risk Another major type of risk by which CDOs are affected is liquidity risks as there may be mismatch in coupon receipts and payments.

(d) Prepayment Risk This risk results from unscheduled or unexpected repayment of principal amount underlying the security. Generally, this risk arises in case assets are subject to fixed rate of interest and the debtors have a call option. Since, in case of falling interest rates they may pay back the money.

(e) Reinvestment Risk This risk is generic in nature as the CDO manager may not find adequate opportunity to reinvest the proceeds when allowed for substitutions.

(f) Foreign Exchange Risk If CDOs are comprised of debts and loans from countries other than the country of issue, CDOs are also subject to the foreign exchange rate risk.

Credit Default Swaps (CDSs)

It is a combination of following 3 words:

Credit Loan given

Default Non payment

Swap Exchange of Liability or Risk

Accordingly, CDS can be defined as an insurance (not in stricter sense) against the risk of default on a debt which may be debentures, bonds etc.

Under this arrangement, one party (called buyer) needing protection against the default pays a periodic premium to another party (called seller), who in turn assumes the default risk. Hence, in case default takes place then there will be settlement and in case no default takes place no cash flow will accrue to the buyer alike option contract and agreement is terminated. Although it resembles the options but since element of choice is not there it more resembles the swap arrangements.

Amount of premium mainly depends on the price of underlying and especially when the credit risk is more.

Main Features of CDS

The main features of CDS are as follows:

(a) CDS is a non-standardized private contract between the buyer and seller. Therefore, it is covered in the category of Forward Contracts.

(b) They are normally not traded on any exchange and hence remains free from the regulations of Governing Body.

(c) The International Swap and Derivative Association (ISAD) publishes the guidelines and general rules used normally to carry out CDS contracts.

(d) CDS can be purchased to protect from default of borrowers. Eg. an investor buying bonds can purchase CDS to protect from insolvency of that company.

(f) The cost or premium of CDS has a positive relationship with risk attached with loans. Therefore, higher the risk attached to Bonds or loans, higher will be premium or cost of CDS.

(g) If an investor buys a CDS without being exposed to credit risk of the underlying bond issuer, it is called "naked CDS".

Uses/Purpose of Credit Default Swap

(a) Hedging Using CDS to neutralize or reduce risk to which CDS is exposed to. Thus, by buying CDS, risk can be passed on to CDS seller or writer.

(b) Arbitrage It involves buying a CDS and entering into an asset swap. For example, a fixed coupon payment of a bond is swapped against a floating interest stream.

(c) Speculation CDS can be used to make profit by exploiting price changes. For example, a CDS writer assumed risk of default, will gain from contract if credit risk does not materialize during the tenure of contract or if compensation received exceeds potential payout.

Parties to CDS

In a CDS at least three parties are involved which are as follows:

i. The initial borrowers It is also called a 'reference entity', which are owing a loan or bond obligation.

ii. Buyer It is also called 'investor' i.e. the buyer of protection. The buyer will make regular payment to the seller for the protection from default or credit event of reference entity.

iii. Seller It is also called 'writer' of the CDS and makes payment to buyer in the event of credit event of reference entity. It receives a regulara pay off from the buyer of CDS.

Example

Suppose BB Corp. buys CDS from SS Bank for the Bonds amounting $ 10 million of Danger Corp. In such case, the BB Corp. will become the buyer, SS Bank becomes seller and Danger Corp. becomes the reference entity. BB Corp. will make regular payment to SS Bank of the premium and if Danger Corp. defaults on its debts, the BB Corp. will receive one time payment and CDS contract is terminated.

Settlement of CDS

Broadly, following are main ways of settlement of CDS.

(i) Physical Settlement This is the traditional method of settlement. It involves the delivery of Bonds or debts of the reference entity by the buyer to the seller and seller pays the buyer the par value.

For example, as mentioned above suppose Danger Corp. defaults then SS Bank will pay $ 10 Million to BB Corp. and BB Corp will deliver $10 Million face value of Bonds to SS Bank.

(ii) Cash Settlement Under this arrangement seller pays the buyer the difference between par value and the market price of a debt (whatever may be the market value) of the reference entity. Continuing the above example suppose, the market value of Bonds is 30%, as market is of belief that bond holder will receive 30% of the money owed in case company goes into liquidation. Thus, the SS Bank shall pay BB Corp. $ 10 Million - $3 million (100% - 30%) = $ 7 Million.

To make Cash settlement even more transparent, the credit event auction was developed. Credit event auction set a price for all market participants that choose to cash settlement.

Lessons from Derivative Mishaps

Following are some of the important lessons can be learnt from Derivative Mishaps.

1. Don't buy any derivative product that you don't understand

2. Due diligence before making Treasury Department as a Profit Centre
   The objective of Treasury Department is to reduce financing costs and manage risk optimally. But it has been seen that Treasury Department later starts taking more risks in anticipation of higher profit. The best way to avoid this situation is to avoid linking the treasurer's salary with the profit he made for the organization.

3. Specify the Risk Limits
   Proper monitoring is a prerequisite.

   The best way to avoid the situation of overtrading is to limit the sizes positions that can be taken by a trader.

4. Separation of Front, Middle and Back Offices
   The three offices though are interlinked but they discharge separate functions. Accordingly, there should be a firewall in the functioning of these offices i.e. person of one office should not have the access to the functioning of other office.

   It is essential that role and functions of each office should be clearly defined and followed.

5. Ensure that a hedger should not become a speculator
   In most of the cases hedgers/arbitrageur have become speculators and leveraged their position.

   To avoid this situation, it is essential that clear cut risk limits should be defined. Further before entering into any trading strategy proper risk analysis should be carried out and if proposed strategy is crossing the limits of Risk Appetite of the company it should be avoided.

6. Carry out Stress Test, Scenario Analysis etc.
   VAR analysis should always be followed by Scenario Analysis because as tendency a human being normally can anticipate two to three scenarios. It will be better to refer the data of at least 10 to 20 years to anticipate a Black Swan event.

   Further even Simulation Test can be applied to analyze the results in various possible situations.

Technical Analysis

Technical Analysis

Technical Analysis is a method of share price movements based on a study of price graphs or charts on the assumption that share price trends are repetitive, that since investor psychology follows a certain pattern, what is seen to have happened before' is likely to be repeated.

Principles of Technical Analysis

Technical analysis is based on the following three principles:

a. The market discounts everything.
b. Price moves in trends.
c. History tends to repeat itself.

a. The Market Discounts Everything

Many experts criticize technical analysis because it only considers price movements and ignores fundamental factors. The argument against such criticism is based on the Efficient Market Hypothesis, which states that a company's share price already reflects everything. So, technical analysts generally have the view that a company's share price includes everything including the fundamentals of a company.

b. Price Moves in Trends

Technical analysts believe that prices move in trends. In other words, a stock price is more likely to continue a past trend than move in a different direction.

c. History Tends to Repeat Itself

Technical analysts believe that history tends to repeat itself. Technical analysis uses chart patterns to analyze subsequent market movements to understand trends. While many form of technical analysis have been used for many years, they are still are considered to be significant because they illustrate patterns in price movements that often repeat themselves.

Theories of Technical Analysis

1. **The Dow Theory** The Dow Theory is a helpful tool for determining the relative strength of the stock market.

The Dow Theory is based upon the movements of two indices, constructed by Charles Dow:-

- ✓ Dow Jones Industrial Average (DJIA), and
- ✓ Dow Jones Transportation Average (DJTA).

The movements of the market are divided into three classifications, all going at the same time:-

- ✓ the Primary Movement is the main trend which lasts from 1 to 3 Year or longer. This trend is commonly called bear or bull market.
- ✓ the Secondary Movement is shorter in duration than the primary movement, and is opposite in direction. It lasts from two weeks to a month or more.
- ✓ the Daily Fluctuations are the narrow movements from day-to-day and are not part of the Dow Theory interpretation, however, must be carefully studied as they go to make up the longer movement in the market.

Thus, the Dow Theory's purpose is to determine where the market is and where is it going, although not how far or high. If the cyclical swings of the stock market averages are successively higher and the successive lows are higher, then the market trend is up and a bullish market exists. Contrarily, if the successive highs and successive lows are lower, then the direction of the market is down and a bearish market exists.

Charles Dow proposed that the primary uptrend would have three moves up,

(i) the first one being caused by accumulation of shares by the far-sighted, knowledgeable investors,

(ii) the second move would be caused by the arrival of the first reports of good earnings by corporations, and

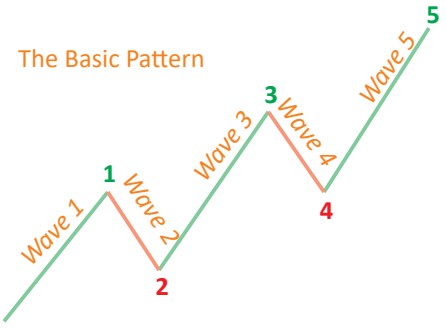
(iii) the last move up would be caused by widespread report of financial well-being of corporations. The third stage would also see rampant speculation in the market.

Towards the end of the third stage, the far-sighted investors, realizing that the high earnings levels may not be sustained, would start selling, starting the first move down of a downtrend, and as the non-sustainability of high earnings is confirmed, the second move down would be initiated and then the third move down would result from distress selling in the market.

2. **Elliot Wave Theory** Mr Ralph defined price movements in terms of waves. The markets exhibited certain repeated patterns or waves. Wave is a movement of the market price from one change in the direction to the next change in the same direction resulting from buying and selling impulses emerging from the demand and supply pressures on the market.

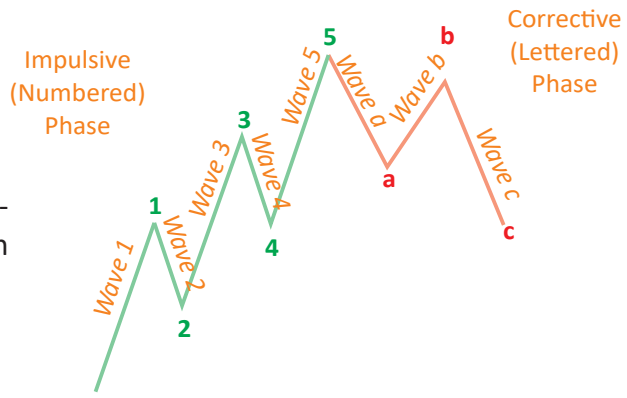
As per this theory, waves can be classified into two parts:-

- Impulsive patterns (Basic Waves) - In this pattern there will be 3 or 5 waves in a given direction (going upward or downward). These waves shall move in the direction of the basic movement. This movement can indicate bull phase or bear phase.
- Corrective patterns (Reaction Waves) - These 3 waves are against the basic direction of the basic movement. Correction involves correcting the earlier rise in case of bull market and fall in case of bear market.



As shown in the left-side diagram waves 1, 3 and 5 are directional movements, which are separated or corrected by wave 2 & 4, termed as corrective movements.

Complete Cycle As shown in right-side figure five-wave impulses is following by a threewave correction (a,b & c) to form a complete cycle of eight waves



One complete cycle consists of waves made up of two distinct phases, bullish and bearish. On completion of full one cycle i.e. termination of 8 waves movement, the fresh cycle starts with similar impulses arising out of market trading.

3. Random Walk Theory The behaviour of stock market prices is unpredictable and that there is no relationship between the present prices of the shares and their future prices. Prices on the stock exchange behave exactly the way a drunk would behave while walking in a blind lane, i.e., up and down , with an unsteady way going in any direction he likes, bending on the side once and on the other side the second time.

The supporters of this theory put out a simple argument. It folzqlows that:

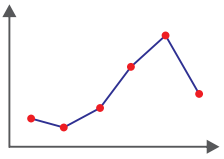
(a) Prices of shares in stock market can never be predicted.

(b) The reason is that the price trends are not the result of any underlying factors, but that they represent a statistical expression of past data.

(c) There may be periodical ups or downs in share prices, but no connection can be established between two successive peaks (high price of stocks) and troughs (low price of stocks).

Charting Techniques

(i) Line Chart lines are used to connect successive day's prices. The closing price for each period is plotted as a point and joined by a line to from the chart. The period may be a day, a week or a month.



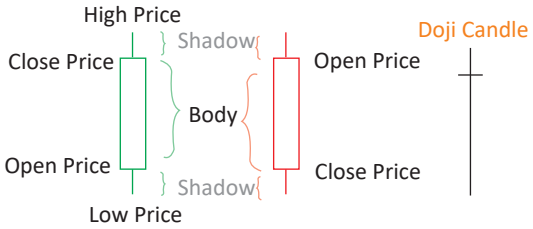
(ii) Bar Chart a vertical line (Bar) represents the lowest to the highest price, with a short horizontal line protruding from the bar representing the closing price for the period.

(iii) Japanese Candlestick Chart It shows - Opening, Closing, Highest and Lowest Prices information. The lowest and highest prices are indicated by vertical bar and opening and closing prices are shown in the form of rectangle placed between this bar.

Green / White Color candle denotes Bullishness

Red / Black Color candle denotes Bearishness

Doji Candle denotes Indecision



Period	Price
1	24
2	26
3	27
4	26
5	28
6	27
7	26
8	25
9	26
10	23

30							
29							
28			X	0			
27	X	0	X	0			
26	X	0	X	0	X	0	
25	X			0	X	0	
24	→					0	
23						0	
22							

(iv) Point and Figure Chart Point and figure charts are more complex than line or bar charts. They are used to detect reversals in a trend. For plotting a point and figure chart, we have to first decide the box size and the reversal criterion.

The box size is the value of each box on the chart, for example each box could be ₹1, ₹2 or ₹0.50.

The reversal criterion is the box size, the more sensitive would the chart be to price change. The reversal criterion is the number of boxes required to be retraced to record prices in the next column in the opposite direction.

Market Indicators

RTP Sep 2025

(i) Breadth Index It is an index that covers all securities traded. It is computed by dividing the net advances or declines in the market by the number of issues traded.

If breadth index supports the movement of the Index, this is considered sign of technical strength and if it does not support the averages, it is a sign of technical weakness i.e. a sign that the market will move in the opposite direction.

(ii) Volume of Transactions provides useful clues on how the market would behave in the near future.
A rising index/price with increasing volume would signal buy behaviour because the situation reflects an unsatisfied demand in the market.
Similarly, a falling market with increasing volume signals a bear market and the prices would be expected to fall further.

(iii) Confidence Index reveals how willing the investors are to take a chance in the market.
It is the ratio of high-grade bond yields to low-grade bond yields.
A rising confidence index is expected to precede a rising stock market, and a fall in the index is expected to precede a drop in stock prices.
A fall in the confidence index represents the fact that low-grade bond yields are rising faster or falling more slowly than high grade yields.

(iv) Relative Strength Analysis suggests that the prices of some securities rise relatively faster in a bull market or decline more slowly in a bear market than other securities i.e. some securities exhibit relative strength. Investors will earn higher returns by investing in securities which have demonstrated relative strength in the past.

(v) Odd - Lot Theory This theory is a contrary - opinion theory. It assumes that the average person is usually wrong and that a wise course of action is to pursue strategies contrary to popular opinion.

Support and Resistance Levels

When the index/price goes down from a peak, the peak becomes the resistance level.

When the index/price rebounds after reaching a trough subsequently, the lowest value reached becomes the support level.

The price is then expected to move between these two levels.

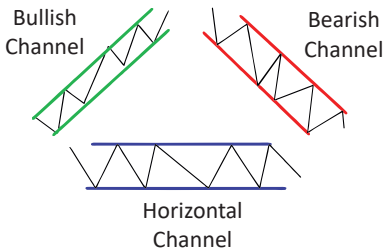
Whenever the price approaches the resistance level, there is a selling pressure because all investors who failed to sell at the high would be keen to liquidate, while whenever the price approaches the support level, there is a buying pressure as all those investors who failed to buy at the lowest price would like to purchase the share.

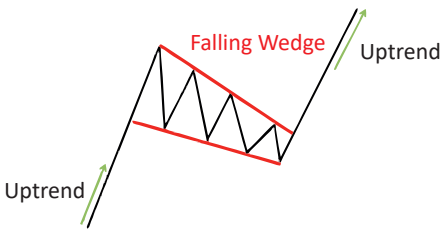
A breach of these levels indicates a distinct departure from status quo, and an attempt to set newer levels.

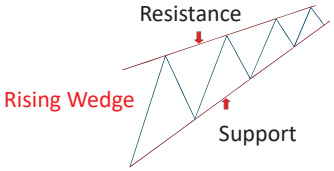
Interpreting Price Patterns

(a) Channel A series of uniformly changing tops and bottoms gives rise to a channel formation. A downward sloping channel would indicate declining prices and an upward sloping channel would imply rising prices.

(b) Wedge A wedge is formed when the tops (resistance levels) and bottoms (support levels) change in opposite direction (that is, if the tops, are decreasing then the bottoms are increasing and vice versa), or when they are changing in the same direction at different rates over time.



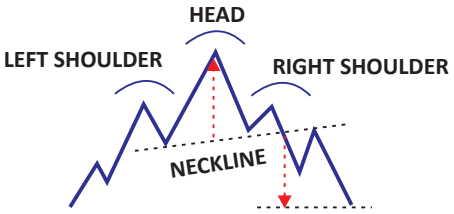




(c) Head and Shoulders It is a distorted drawing of a human form, with a large lump (for head) in the middle of two smaller humps (for shoulders). This pattern indicates a reversal of price trend. The neckline of the pattern is formed by joining points where the head and the shoulders meet. The price movement after the formation of the second shoulder is crucial. If the price goes below the neckline, then a drop in price is indicated, with the drop expected to be equal to the distance between the top of the head and the neckline.

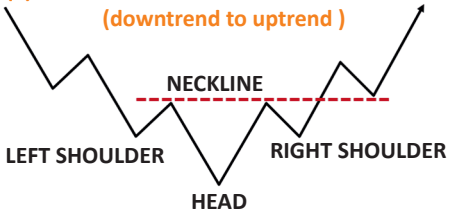
(i) *Head and Shoulder Top Pattern:* Such formation represents bearish development. If the price falls below the neck line (line drawn tangentially to the left and right shoulders) a price decline is expected. Hence it's a signal to sell.

(i) HEAD & SHOULDERS REVERSAL PATTERN
(uptrend to downtrend)



Downside target = neckline at right shoulder minus distance from neckline to head

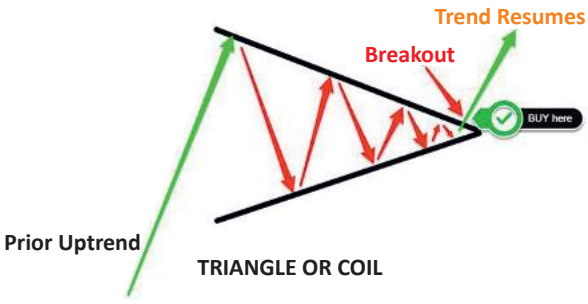
(ii) HEAD & SHOULDERS REVERSAL PATTERN
(downtrend to uptrend)

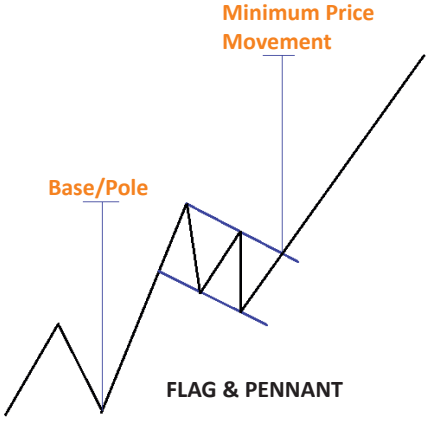


(ii) *Inverse Head and Shoulder Pattern:* It reflects a bullish development. The price rise to above the neck line suggests price rise is imminent and a signal to purchase.

(d) Triangle or Coil Formation This formation represents a pattern of uncertainty and is difficult to predict which way the price will break out.

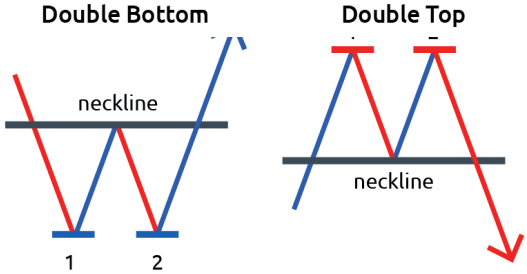
(e) Flags and Pennants Form This from signifies a phase after which the previous price trend is likely to continue.





(f) Double Top Form This form represents a bearish development, signals that price is expected to fall.

(g) Double Bottom Form This form represents bullish development signalling price is expected to rise.



(h) Gap A gap is the difference between the opening price on a trading day and the closing price of the previous trading day. The wider the gap the stronger the signal for a continuation of the observed trend.

Evaluation of Technical Analysis

MTP Nov 2024, (4 Marks) Exam Sep 2025

Argument in favour of Technical Analysis :

(a) Under influence of crowd psychology trend persist for some time. Tools of technical analysis help in identifying these trends early and help in investment decision making.

(b) Shift in demand and supply are gradual rather than instantaneous. Technical analysis helps in detecting this shift rather early and hence provides clues to future price movements.

(c) Fundamental information about a company is observed and assimilated by the market over a period of time. Hence price movement tends to continue more or less in same direction till the information is fully assimilated in the stock price.

Arguments against Technical Analysis:

(a) Most technical analysts are not able to offer a convincing explanation for the tools employed by them.

(b) Empirical evidence in support of random walk hypothesis cast its shadow over the usefulness of technical analysis.

(c) By the time an up trend and down trend may have been signalled by technical analysis it may already have taken place.

(d) Ultimately technical analysis must be self defeating proposition. With more and more people employing it, the value of such analysis tends to decline.

Fundamental Analysis vs Technical Analysis

S.No	Basis	Fundamental Analysis	Technical Analysis
1	Method	Prospects are measured by analyzing economy's macro factors such as country's GDP, Inflation Rate, Interest Rate, Growth Rate etc. and company's micro factors like its Sales, Profitability, Solvency, Asset & Liabilities and Cash position etc.	Predicts future prices and their direction using purely historical market data and information such as their Price Movements, Volume, Open Interest etc.
2	Rule	Prices of a share discounts everything.	Price captures everything
3	Usefulness	For Long-Term Investing	For Short-term Investing

Buy and Sell Signals Provided by Moving Average Analysis [RTP Sep 2025]

Buy Signal	Sell Signal
(a) Stock price line rise through the moving average line when graph of the moving average line is flattening out.	(a) Stock price line falls through moving average line when graph of the moving average line is flattening out.
(b) Stock price line falls below moving average line which is rising.	(b) Stock price line rises above moving average line which is falling.
(c) Stock price line which is above moving average line falls but begins to rise again before reaching the moving average line	(c) Stock price line which is slow moving average line rises but begins to fall again before reaching the moving average line.

Foreign Exchange Exposure & Risk Management

Role of Swift in Foreign Exchange

Foreign Exchange Dealers/Traders use a network of communication to carry out their business transactions called SWIFT (Society for Worldwide Interbank Financial Telecommunication) which is purely a messaging system. Swift is a non-profit organization. It has offices around the world. It employs a dedicated computer network system for communicating fund transfers. Since each country has their own symbol to communicate their currency, to avoid miscommunication SWIFT has assigned codes to currencies of each country. These codes are 3 lettered codes (e.g. USD, GBP, INR etc.) and are used internationally in cross border communications.

SWIFT uses common language for financial transactions and uses a centralized data processing system. It is important to note that SWIFT is only a standardized communication system and not a transaction settlement system.

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The SWIFT plays an important role in Foreign Exchange dealings because of the following reasons:

- In addition to validation statements and documentation it is a form of quick settlement as messaging takes place within seconds.
- Because of security and reliability helps to reduce Operational Risk.
- Since it enables its customers to standardise transaction it brings operational efficiencies and reduced costs.
- It also ensures full backup and recovery system.
- Acts as a catalyst that brings financial agencies to work together in a collaborative manner for mutual interest.

International Financial Management

International Sources of Finance | Instruments of International Finance

(1) Foreign Currency Convertible Bonds (FCCBs)

A type of convertible bond issued in a currency different than the issuer's domestic currency. The money being raised by the issuing company is in the form of a foreign currency. A convertible bond is a mix between a debt and equity instrument. It acts like a bond by making regular coupon and principal payments, but these bonds also give the bondholder the option to convert the bond into stock.

Advantages of FCCBs

(i) flexibility to convert the bond into equity at a price or redeem the bond at the end of a specified period

(ii) delayed dilution of equity allows company to avoid any current dilution in EPS that a further issuance of equity would cause.

(iii) easily marketable as investors enjoys option of conversion into equity if resulting to capital appreciation. Further investor is assured of a minimum fixed interest earnings.

(2) American Depository Receipts (ADRs)

A depository receipt is basically a negotiable certificate, denominated in a currency not native to the issuer, that represents the company's publicly-traded local currency equity shares.

Depository receipts issued by a company in the United States of America (USA) in accordance with the provisions stipulated by the Securities and Exchange Commission of USA (SEC) is known as American Depository Receipts (ADRs).

An ADR is generally created by the deposit of the securities of a Non-United States company with a custodian bank in the country of incorporation of the issuing company. The custodian bank informs the depository in the United States that the ADRs can be issued. ADRs are United States dollar denominated and are traded in the same way as are the securities of United States companies. The ADR holder is entitled to the same rights and advantages as owners of the underlying securities in the home country

(3) Global Depository Receipts (GDRs) The Depository Receipts issued outside USA are called as GDR's. These are often listed on Luxembourg stock exchange.

(4) Euro-Convertible Bonds (ECBs)

A convertible bond is a debt instrument which gives the holders of the bond an option to convert the bond into a predetermined number of equity shares of the company. Usually, the price of the equity shares at the time of conversion will have a premium element. The bonds carry a fixed rate of interest. If the issuer company desires, the issue of such bonds may carry.

(i) Call Options and
(ii) Put Options

(5) Other Sources

- *Euro-Convertible Zero Coupon Bonds* These bonds are structured as a convertible bond. No interest is payable on the bonds. But conversion of bonds takes place on maturity at a pre-determined price. Usually there is a 5 years maturity period and they are treated as a deferred equity issue.
- *Euro-bonds with Equity Warrants* These bonds carry a coupon rate determined by the market rates. The warrants are detachable. Pure bonds are traded at a discount. Fixed income funds may like to invest in these bonds for the purposes of regular income.
- *Syndicated bank loans* It is one of the earlier ways of raising funds in the form of large loans from banks with good credit rating, can be arranged in reasonably short time and with few formalities.
- *Euro-bonds* These are basically debt instruments denominated in a currency issued outside the country of that currency for examples Yen bond floated in France. Primary attraction of these bonds is the refuge from tax and regulations and provide scope for arbitraging yields. These are usually bearer bonds and can take the form of
  (i) Traditional Fixed Rate Bonds. (ii) Floating Rate Notes (FRNs) (iii) Convertible Bonds.
- *Foreign Bonds* Foreign bonds are denominated in a currency which is foreign to the borrower and sold at the country of that currency. Such bonds are always subject to the restrictions and are placed by that country on the foreigners funds.
- *Euro Commercial Papers* These are short term money market securities usually issued at a discount, for maturities less than one year.

International Financial Centre (Gift City)

Exam May 2024

International Financial Centre (IFC) is the financial center that caters to the needs of the customers outside their own jurisdiction. Broadly, speaking IFC is a hub that deals with flow of funds, financial products and financial services even though in own land but with different set of regulations and laws.

Thus, these centers provide flexibility in currency trading, insurance, banking and other financial services. This flexible regime attracts foreign investors which is of potential benefit not only to the stakeholders but as well as for the country hosting IFC itself.

Benefits of IFC

(i) Opportunity for qualified professionals working outside India come here and practice their profession.
(ii) A platform for qualified and talented professionals to pursue global opportunities without leaving their homeland.
(iii) Stops Brain Drain from India.

(iv) Bringing back those financial services transactions presently carried out abroad by overseas financial institutions/entities or branches or subsidiaries of Indian Financial Market.

(v) Trading of complicated financial derivative can be started from India.

Constituents of IFC

(i) Highly developed Infrastructure A leading edge infrastructure is a prerequisite for creating a platform t o offer internationally competitive financial services.

(ii) Stable Political Environment Destabilized political environment brings country risk for investment by foreign nationals. Hence, to accelerate foreign participation in growth of financial center, stable political environment is a prerequisite.

(iii) Strategic Location The geographical location of the finance center should be strategic such as near to airport, seaport and should have friendly weather.

(iv) Quality Life The quality of life at the center should be good as center retains highly paid professionals from own country as well from outside.

(v) Rationale Regulatory Framework Rationale legal regulatory framework is another prerequisite of international finance center as it should be fair and transparent.

(vi) Sustainable Economy The economy should be sustainable and should possess capacity to absorb all the shocks as it will boost investors' confidence.

GIFT City - India's International Financial Services Centre

To compete with its rival financial services centres situated in Dubai, Hong Kong etc. the idea of setting up an International Financial Center in India was coined in 2007. The main motive of setting up IFC in India was to retain the financial services businesses in India which moves out of India.

Since foreign investors normally remain hesitant to get registered in India, GIFT city provides them a separate jurisdiction where it is easy to do business because of relaxed tax and other laws.

Accordingly, Government of India operationalized International Financial Services Centre (IFSC) at GIFT Multi Services SEZ in April 2015. The Union Budget 2016 provided competitive tax regime for the IFSC at GIFT SEZ.

With the objective of achieving sustainable growth and achieving above cited objective India has established its first International Exchange – India INX, a wholly owned subsidiary of Bombay Stock Exchange on 9/1/2017. The India INX has stated trading in Index, currency, commodity and equity derivatives.

On 5th June, 2017, National Stock Exchange the competitor of Bombay Stock Exchange also launched its trading at GIFT. Initially, it started trading in derivative products in equity, currency, interest rate futures and commodities.

GIFT IFSC provides very competitive cost of operations with very competitive tax regime, single window clearance; relax company law provisions, international arbitration centre with overall facilitation of doing business. GIFT IFSC is now moving toward unified regulatory mechanism.

GIFT City is a new Financial & Technology Gateway of India for the World. To be internationalized, exchange controls cannot apply. So, FEMA is not applicable at GIFT city.

More and more financial institutions are setting business units in GIFT as they will pay reduced taxes as valid for special economic zones and can easily offer foreign currency loans to Indian Companies abroad and foreign firm.

Sovereign Funds

A Sovereign Wealth Fund (SWF) is a state-owned investment fund comprised of money generated by the government. Since it is created by the Government the legal basis on which these are created varies from Government to Government. The legal basis for a sovereign wealth fund can be Constitutive Law, Fiscal Law, Constitution, Company Law or any Other Laws and Regulations.

The popular sources for funding SWF are:

- ❖ Surplus reserves from state-owned natural resource revenues and trade surpluses,
- ❖ Bank reserves that may accumulate from budgeting excesses,
- ❖ Foreign currency operations,
- ❖ Money from privatizations, and
- ❖ Governmental transfer payments.

Targeted purpose / common objectives of a sovereign wealth fund are as follows: -

- Protection & Stabilization of the budget and economy from excess volatility in revenues/exports
- Diversify from non-renewable commodity exports
- Earn better returns than returns on foreign exchange reserves
- Assist monetary authorities dissipate unwanted liquidity
- Increase savings for future generations
- Fund social and economic development
- Ensuring Sustainable long term capital growth for target countries
- Political strategy

Various types of Sovereign Investment Vehicles are:

- Sovereign Wealth Funds (SWFs)
- Public Pension Funds
- State-Owned Enterprises
- Sovereign Wealth Enterprises (SWEs)

Objectives of International Cash Management	
Main Objectives	Main objectives of effective system of international cash management are: • Minimise currency exposure risk. • Minimise overall cash requirements of company. • Minimise transaction costs. • Minimise country's political risk. • Advantage of economies of scale.
Basic Objectives	International cash management also has two basic objectives: • Optimising cash flow movements. • Investing excess cash.

ADVANCED CAPITAL BUDGETING

Real Options

How Real Option is different from Financial Option

Basis	Financial Options	Real Options
Underlying	Have underlying assets that are normally traded in the market i.e. shares, stocks, bonds, commodity etc.	Have underlying the projects that are not traded in the market.
Pay-off	In most of the cases it is specified in the contracts and hence is fixed.	It is estimated from the project cash flows and hence can be varied.
Exercise Period	Mostly the period of these options is short and can go maximum upto 1 year.	The period of these options mostly starts from the end of 1st year and higher than the Financial Options.
Approach	Since these options are normally traded in the market they are "Priced".	Since these options are used to make decisions, they are "Valued".

Interest Rates Risk Management

Various Types of Interest Rate Risk Faced by Companies / Banks

MTP Nov 2024

1. Gap Exposure A gap or mismatch risk arises from holding assets and liabilities and off-balance sheet items with different principal amounts, maturity dates or re-pricing dates, thereby creating exposure to unexpected changes in the level of market interest rates. This exposure is more important in banking business. The positive Gap indicates that banks have more interest Rate Sensitive Assets (RSAs) than interest Rate Sensitive Liabilities (RSLs). A positive or asset sensitive Gap means that an increase in market interest rates could cause an increase in Net Interest Income (NII).

   A negative gap indicates that banks have more RSLs than RSAs. The Gap is used as a measure of interest rate sensitivity.
   Positive or Negative Gap is multiplied by the assumed interest rate changes to derive the Earnings at Risk (EaR).

   The periodic gap analysis indicates the interest rate risk exposure of banks over distinct maturities and suggests magnitude of portfolio changes necessary to alter the risk profile.
   Problems with Gap Report:

   (i) The Gap report quantifies only the time difference between re-pricing dates of assets and liabilities but fails to measure the impactof basis and embedded option risks.

   (ii) The Gap report also fails to measure the entire impact of a change in interest rate (Gap report assumes that all assets and liabilities are matured or re-priced simultaneously) within a given time-band and effect of changes in interest rates on the economic or market value of assets, liabilities and off-balance sheet position.

   (iii) It also does not take into account any differences in the timing of payments that might occur as a result of changes in interest rate environment.

   (iv) Further, the assumption of parallel shift in yield curves seldom happen in the financial market.

   (v) The Gap report also fails to capture variability in non-interest revenue and expenses, a potentially important source of risk to current income.

2. Basis Risk The risk that the interest rate of different assets, liabilities and off-balance sheet items may change in different magnitude is termed as basis risk. For example while assets may be benchmarked to Fixed Rate of Interest, liabilities may be benchmarked to floating rate of interest.

3. Embedded Option Risk Significant changes in market interest rates encourage prepayment of cash credit/demand loans/term loans and exercise of call/put options on bonds/debentures and/or premature withdrawal of term deposits before their stated maturities. The faster and higher the magnitude of changes in interest rate, the greater will be the embedded option risk to the banks' NII. Banks should endeavour to stipulate appropriate penalties based on opportunity costs.

4. Yield Curve Risk (non-parallel shift in yield curve) In case the banks use two different instruments maturing at different time horizon for pricing their assets and liabilities, any non-parallel movements in yield curves would affect the NII.

5. Price Risk (Parallel shift in yield curve) In the financial market, bond prices and yields are inversely related. Price risk occurs when assets are sold before their stated maturities.
   Banks which have an active Bond trading book should, therefore, formulate policies to limit the portfolio size, holding period, duration, defeasance period, stop loss limits, marking to market, etc.

6. Reinvestment Risk Uncertainty with regard to interest rate at which the future cash flows could be reinvested is called reinvestment risk.

7. Net Interest Position Risk Where banks have more earning assets than paying liabilities, interest rate risk arises when the market interest rates adjust downwards. Thus, banks with positive net interest positions will experience a reduction in NII as the market interest rate declines and increases when interest rate rises.
   Thus, large float is a natural hedge against the variations in interest rates.

Hedging Interest Rate Risk - Asset and Liability Management (ALM)

Exam Nov 2022

Q. Briefly explain Asset and Liability Management (ALM).

Asset-Liability Management (ALM) is one of the important tools of risk management in commercial banks of India. Indian banking industry is exposed to a number of risks prevailing in the market such as market risk, financial risk, interest rate risk etc. The net income of the banks is very sensitive to these factors or risks.

ALM is a comprehensive and dynamic framework for measuring, monitoring and managing the market risk of a bank. It is the management of structure of Balance Sheet (liabilities and assets) in such a way that the net earnings from interest are maximized within the overall risk preference (present and future) of the institutions. The ALM functions extend to liquidly risk management, management of market risk, trading risk management, funding and capital planning and profit planning and growth projection.

Banks and other financial institutions provide services which expose them to various kinds of risks like credit risk, interest risk, and liquidity risk. Asset liability management is an approach that provides institutions with protection that makes such risk acceptable. Asset-liability management models enable institutions to measure and monitor risk, and provide suitable strategies for their management.

It is therefore appropriate for institutions (banks, finance companies, leasing companies, insurance companies, and others) to focus on asset-liability management when they face financial risks of different types. Asset-liability management includes not only a formalization of this understanding, but also a way to quantify and manage these risks.

In a sense, the various aspects of balance sheet management deal with planning as well as direction and control of the levels, changes and mixes of assets, liabilities, and capital.

Table 1 : Natural logs, e^x and e^{-x} Values (Only relevant Excerpt)

X	$\ln^x$	e^x	e^{-x}
0.01	- 4.60517	1.01005	0.99005
0.02	- 3.91202	1.02020	0.98020
0.03	- 3.50666	1.03045	0.97045
0.04	- 3.21888	1.04081	0.96079
0.05	- 2.99573	1.05127	0.95123
0.06	- 2.81341	1.06184	0.94176
0.07	- 2.65926	1.07251	0.93239
0.08	- 2.52573	1.08329	0.92312
0.09	- 2.40795	1.09417	0.91303
0.10	- 2.30259	1.10517	0.90484
0.11	- 2.20728	1.11628	0.89583
0.12	- 2.12026	1.12750	0.88692

X	$\ln^x$	e^x	e^{-x}
0.97	- 0.03046	2.63794	0.37908
0.98	- 0.02020	2.66446	0.37531
0.99	- 0.01005	2.69123	0.37158
1.00	- 0.00000	2.71828	0.36788
1.01	0.00995	2.74560	0.36422
1.02	0.01980	2.77319	0.36059
1.03	0.02956	2.80107	0.35701
1.04	0.03922	2.82922	0.35345
1.05	0.04879	2.85765	0.34994
1.06	0.05827	2.88637	0.34646
1.07	0.06766	2.91538	0.34301
1.08	0.07696	2.94468	0.33960
1.09	0.08618	2.97427	0.33622
1.10	0.09531	3.00417	0.33287

Table 2 : The values in this Table give areas between mean μ and z (Only relevant Excerpt)

Z	00	01	02	03	04	05	06	07	08	09
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990