

STRATEGIC FINANCIAL MANAGEMENT

REVISION MATERIAL

**(RTP from May 2012 to Nov 2020 and exam
papers from May 2012 to Nov 2019)**

FOR CA FINAL

BY CA. DINESH JAIN

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Summary of syllabus

S.No	Topic	Old Syllabus	New Syllabus
1	Value at Risk	Not included	Chapter 2
2	Walter's and Gordon's Model	Chapter 4	Chapter 4
3	Rights issue and buyback	Chapter 6	Chapter 4
4	Valuation of shares	Chapter 6	Chapter 4
5	Valuation of convertible instruments	Chapter 6	Chapter 4
6	Bond valuation	Chapter 6	Chapter 4
7	Enterprise valuation	Not included	Chapter 4
8	Basics of portfolio theory	Chapter 7	Chapter 5
9	Optimum weights for risk reduction	Chapter 7	Chapter 5
10	Security and portfolio Beta	Chapter 7	Chapter 5
11	Systematic and unsystematic risk	Chapter 7	Chapter 5
12	Characteristic line, CML and SML	Chapter 7	Chapter 5
13	Factor sensitivity analysis and Arbitrage pricing theory	Chapter 7	Chapter 5
14	Beta and leverage	Chapter 7	Chapter 5
15	Portfolio strategies	Chapter 7	Chapter 5
16	MF return	Chapter 9	Chapter 7
17	Calculation of NAV	Chapter 9	Chapter 7
18	Mutual Funds - Performance Evaluation	Chapter 9	Chapter 7
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27	Premium/ discount and appreciation/ depreciation	Chapter 12	Chapter 9
28	IRPT and PPT	Chapter 12	Chapter 9
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32	Netting	Chapter 12	Chapter 9
33	Forward contract	Chapter 12	Chapter 9
34	Money market hedge	Chapter 12	Chapter 9
35	Exchange position and cash position	Chapter 12	Chapter 9
36	Currency futures and options	Chapter 12	Chapter 9
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38	Multiple forex hedging strategies	Chapter 12	Chapter 9
39	Inflation in capital budgeting	Chapter 2	Chapter 10
40	International capital budgeting	Chapter 11	Chapter 10
41	Interest rate futures and options	Chapter 5	Chapter 11
42	Forward rate agreements	Chapter 5	Chapter 11
43	Interest rate swap	Chapter 5	Chapter 11
44	Economic value added	Chapter 6	Chapter 12

S.No	Topic	Old Syllabus	New Syllabus
45	Valuation of business	Chapter 13	Chapter 12
46	Market value added and shareholder value added	Not included	Chapter 12
47	Synergy gain and swap ratio	Chapter 13	Chapter 13
48	Basics of capital budgeting	Chapter 2	Not included
49	Investment decision	Chapter 2	Not included
50	Replacement decision and life disparity	Chapter 2	Not included
51	Long term funds versus equity approach	Chapter 2	Not included
52	Capital rationing and adjusted present value	Chapter 2	Not included
53	Risk analysis in capital budgeting - Basics	Chapter 2	Not included
54	RADR versus CEF	Chapter 2	Not included
55	Sensitivity analysis, scenario analysis, simulation and decision tree	Chapter 2	Not included
56	Option in capital budgeting	Chapter 2	Not included
57	Leasing decision - Lessor evaluation	Chapter 3	Not included
58	Leasing decision - Lessee evaluation	Chapter 3	Not included
59	Financial services	Chapter 8	Not included
60	Money Market operations	Chapter 10	Not included

Note: This includes coverage of RTP from May 2012 to November 2020 (18 RTP) and May 2012 to November 2019 (16 exams)

- Students can register for SFM and SCMPE classes at www.instamojo.com/bharadwajinstitute
- Both regular and revision classes are available
- For sample lectures visit youtube channel of Dinesh Jain

Chapter 2 – Risk Management**Theory to Solve Problems****Concept of value at risk:**

- ❖ As per Wikipedia, 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 loss?
- ❖ It was first applied in 1922 in New York Stock Exchange, entered the financial world in 1990s and become world's most widely used measure of financial risk.

Application of VAR:

VAR can be applied

- ❖ to measure the maximum possible loss on any portfolio or a trading position.
- ❖ as a benchmark for performance measurement of any operation or trading.
- ❖ to fix limits for individuals dealing in front office of a treasury department.
- ❖ to enable the management to decide the trading strategies.
- ❖ as a tool for Asset and Liability Management especially in banks.

How VAR is calculated?

A VAR statistic has three components:

- ❖ Time period – This can be for a week, month or a year
- ❖ Confidence level – Confidence level can be 95% or 99%. The multiple for 95 percent is 1.65 and for 99 percent is 2.33
- ❖ **Loss amount:**
 - Loss for a single day = Daily standard deviation * Multiple for respective confidence level
 - Loss for 20 days = Daily loss $\times \sqrt{20}$
 - Loss for 250 days = Daily loss $\times \sqrt{250}$

Practical Problems**1. Simple problem on VAR:**

Consider a portfolio consisting of a Rs. 200,00,000 investment in share XYZ and a Rs. 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?

Answer:

WN 1: Computation of SD of portfolio:

$\text{Variance} = (W_{XYZ} \times \sigma_{XYZ})^2 + (W_{ABC} \times \sigma_{ABC})^2 + 2W_{XYZ} W_{ABC} \sigma_{XYZ} \sigma_{ABC} \text{COR}_{ABCXYZ}$
$\text{Variance} = (0.5 \times 1)^2 + (0.5 \times 1)^2 + 2(0.5)(0.5)(1)(1)(0.3)$
$\text{Variance} = 0.25 + 0.25 + 0.15 = 0.65\%$
$\text{Standard Deviation} = \sqrt{0.65} = 0.8062\%$

WN 2: Computation of Value at Risk:

Daily standard deviation (in Rs.) = $0.8062\% \times 400 \text{ lacs} = 3.2248 \text{ lacs}$
Loss for single day = Daily SD in rupees $\times$ Multiple for 99% VAR
Loss for single day = $3.2248 \times 2.33 = 7.5138 \text{ lacs}$
Loss for ten days = Loss for single day $\times \sqrt{10}$
Loss for ten days = $7.5138 \times \sqrt{10} = \text{Rs. } 23.7607 \text{ lacs}$

2. Determination of maximum loss:

Suppose you hold Rs.2 Crores shares of X Limited whose market price standard deviation is 2% per day. Assuming 252 trading days a year, determine maximum loss over the period of 1 trading day and 10 trading days with 99% confidence level.

Answer:

Daily std deviation in %	2%

Daily std deviation in Rs	200 Lakhs $\times$ 2% = 4 Lakhs
Daily loss at 99% (VAR)	4 Lakhs $\times$ 2.33 = 9.32 Lakhs
Maximum loss for 10 days	Daily loss $\times \sqrt{10}$ = $9.32 \times \sqrt{10}$ = 29.47 Lakhs

3. Determination of portfolio risk:

ABC Limited is holding the portfolio of XYZ shares that is worth Rs.18,480. The volatility of the returns on the share is 21% per annum. How could you measure the risk of the portfolio over the next one month?

Answer:

Annual SD in %	21%
Annual SD in Rs	18,480 $\times$ 21% = Rs.3880.80
VAR at 95% confidence level for a year	Rs.3,880.80 $\times$ 1.65 = Rs.6,403
VAR at 99% confidence level for a year	Rs.3,880.80 $\times$ 2.33 = Rs.9,042
VAR at 95% confidence level for a month	VAR for year = $\frac{6,403}{\sqrt{12}}$ = Rs. 1,848
VAR at 99% confidence level for a month	VAR for year = $\frac{9,042}{\sqrt{12}}$ = Rs. 2,610

Chapter 3 – Security Analysis**Theory to solve problems****Concept 1: How Exponential moving averages are calculated?**

- ❖ **Step 1:** Compute the difference between current value and previous day EMA.
- ❖ **Step 2:** EMA Adjustment = Value of exponent x Value as per step 1
- ❖ **Step 3:** EMA of current day = EMA of previous day $\pm$ EMA Adjustment

Concept 2: How to test market efficiency?

- ❖ Capture the closing index value for all days and mention the sign of price change. Sign of price change is +(positive) if index has moved up and it will be -(negative) if index has come down
- ❖ **Compute the no. of positive changes (n1) and no. of negative changes (n2). Also compute no of times sign has changed from positive to negative(r).** For example, the sign of price change is positive, negative, negative, positive, positive, positive, negative and positive. In this example r will be taken as 5 (we started with positive and then it shifted to negative on day 2. It again got changed to positive on day 3. Then sign changed to negative on day 7 and it got changed to positive on day 8).
- ❖ Compute $\mu_r = \frac{2n_1n_2}{n_1+n_2} + 1$
- ❖ Compute $\sigma_r = \sqrt{\frac{2n_1n_2(2n_1n_2-n_1-n_2)}{(n_1+n_2)^2(n_1+n_2-1)}}$
- ❖ Compute lower limit and upper limit for the given level of significance. We should apply t-test for n-1 degrees of freedom
 - Lower limit = $\mu_r - (\sigma_r \times t\text{-value})$
 - Upper limit = $\mu_r + (\sigma_r \times t\text{-value})$
- ❖ If the computer r lies between these limits then market exhibits weak form of efficiency

Practical Problems**1. Exponential moving average (May 2017 RTP, May 2018)**

Closing values of BSE Sensex from 6th to 17th day of the month of January of the year 200X were as follows:

Day	Date	Day	Sensex
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 Sensex during the above period. The 30 days simple moving average of Sensex can be assumed as 15,000. The value of exponent for 30 days EMA is 0.062. Give detailed analysis on the basis of your calculations.

Answer:**Author's Note:**

- This is an area which is different from normal questions and students normally find it difficult to remember steps. I would advise students to revise this day before exam so that they can answer in exams if it is tested

Computation of Exponential Moving Average:

Date	Sensex	EMA of previous day	Change (Col 2 - Col 3)	EMA Adjustment (Col 3 × 30-day exponent)	New EMA (Col 3 ± Col 5)
6	14,522	15,000.00	-478	-29.64	14,970.36
7	14,925	14,970.36	-45.36	-2.81	14,967.55
10	15,222	14,967.55	254.45	15.78	14,983.33
11	16,000	14,983.33	1,016.67	63.03	15,046.36
12	16,400	15,046.36	1,353.64	83.93	15,130.29
13	17,000	15,130.29	1,869.71	115.92	15,246.21
17	18,000	15,246.21	2,753.79	170.73	15,416.94

Conclusion: The market is bullish as the value of EMA is on increasing trend. 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.

2. Test of market efficiency:

The closing value of Sensex for the month of October, 2007 is given below

Date Closing	Sensex
1.10.07	2800
3.10.07	2780
4.10.07	2795
5.10.07	2830
8.10.07	2760
9.10.07	2790
10.10.07	2880
11.10.07	2960
12.10.07	2990
15.10.07	3200
16.10.07	3300
17.10.07	3450
19.10.07	3360
22.10.07	3290
23.10.07	3360
24.10.07	3340
25.10.07	3290
29.10.07	3240
30.10.07	3140
31.10.07	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.

Answer:

Author's Note:

- This is an area which is different from normal questions and students normally find it difficult to remember steps. I would advise students to revise this day before exam so that they can answer in exams if it is tested

WN 1: Computation of positive changes and negative changes:

Date	Sensex	Sign of Price Change
1.10.07	2800	
3.10.07	2780	-
4.10.07	2795	+

5.10.07	2830	+
8.10.07	2760	-
9.10.07	2790	+
10.10.07	2880	+
11.10.07	2960	+
12.10.07	2990	+
15.10.07	3200	+
16.10.07	3300	+
17.10.07	3450	+
19.10.07	3360	-
22.10.07	3290	-
23.10.07	3360	+
24.10.07	3340	-
25.10.07	3290	-
29.10.07	3240	-
30.10.07	3140	-
31.10.07	3260	+

- ❖ No of positive changes(n_1) = 11
- ❖ No of negative changes(n_2) = 8
- ❖ No of times sign has changed from positive to negative (r) = 8

WN 2: Computation of upper and lower limit for test of significance:

Particulars	Formula	Calculation	Amount
μ_r	$\frac{2n_1n_2}{n_1 + n_2} + 1$	$\frac{2(11)(8)}{11 + 8} + 1$	10.26
σ_r	$\sqrt{\frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)}}$	$\sqrt{\frac{2(11)(8) \times (2(11)(8) - 11 - 8)}{(11 + 8)^2(11 + 8 - 1)}}$	2.06
Test of significance at 5%			
Lower Limit	$\mu_r - (\sigma_r \times t\text{-value})$	$10.26 - (2.06 \times 2.101)$	5.932
Upper Limit	$\mu_r + (\sigma_r \times t\text{-value})$	$10.26 + (2.06 \times 2.101)$	14.588
Test of significance at 10%			
Lower Limit	$\mu_r - (\sigma_r \times t\text{-value})$	$10.26 - (2.06 \times 1.734)$	6.688
Upper Limit	$\mu_r + (\sigma_r \times t\text{-value})$	$10.26 + (2.06 \times 1.734)$	13.832

Conclusion:

Computed r lies between the limits and hence the market exhibits weak form of efficiency.

Chapter 4 – Security Valuation

Theory to Solve Problems

Walter's and Gordon's Model:**Basic approach to dividend - Common Sense approach (ALL OR NOTHING APPROACH)**

Nature of Firm	Equation	Payout
Growth	$K < R$	0%
Decline	$K > R$	100%
Normal	$K = R$	Indifferent

Note:

- ❖ K equal to cost of capital and refer to **rate of return which the investors want to earn**
- ❖ R equal to the rate of return **actually being earned by the company**

Dividend Relevance Theory:

- ❖ The market price of a share is the **present value of expected future dividends** discounted at the time value of money
- ❖ The answer to the question **"DOES DIVIDEND AFFECT MARKET PRICE"** determines the nature of the models:
 - If "YES" then dividend relevance model applies
 - If "NO" then dividend irrelevance model applies

1. WALTER'S MODEL:

- ❖ The market price of a share is the present value of infinite cash flows of
 - Constant dividend
 - Capital gain

$$P_0 = D/K_e + r/K_e \times E - D/K_e$$

Where:

 P_0 = Current Market Price; D = Dividend per shareE = Earnings per share; r = Rate of return ; K_e = Cost of equity

THE COST OF EQUITY AT TIMES IS EXPRESSED AS THE INVERSE OF PE RATIO AND THIS WOULD MEAN THAT ALL EARNINGS ARE DISTRIBUTED AND THAT THERE IS NO GROWTH IN DIVIDEND

$$K_e = D_1/P_0 + \text{Growth rate}; K_e = \text{EPS}/\text{MPS}$$

2. GORDON'S MODEL

- ❖ The MP of a share is the Present Value of a stream of constantly growing dividend. This is similar to PV of growing perpetuity

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

Where

 P_0 = Current Market Price; D_1 = Dividend of next year K_e = Cost of equity; G = Growth rate in dividend

Growth rate = Retention ratio * Return on equity

Fair Market Price and Investment Decision:

Relationship	Valuation	Action
AMP < FMP	Undervalued	Buy
AMP > FMP	Overvalued	Sell
AMP = FMP	Correctly valued	Hold

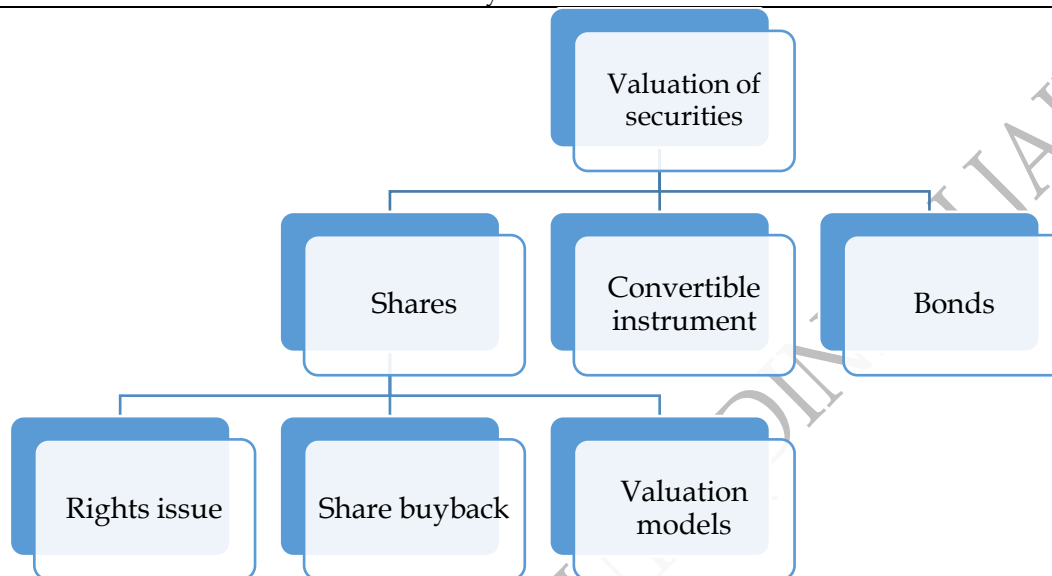
Note:

- ❖ FMP under Walter's and Gordon's model is ex-dividend price. D_0 refers to nearby dividend and D_1 refers to distant dividend
- ❖ If shares are **trading cum-dividend** then we must add the **nearby dividend** to the ex-dividend FMP to get the fair market price.

- ❖ **Example:** Today is April 10, 2017 and the share is quoting at Rs.180. The next dividend is payable on 20th April, 2017 is Rs.8 and is factored in the CMP. The dividend for 20th April, 2018 is expected to be 10% higher. If the cost of equity is 15%, arrive at FMP and take an investment decision?

$$P_0 = \frac{D_1}{K_e - G}; P_0 = \frac{8 + 10\%}{15\% - 10\%} = \text{Rs. } 176$$

- The above computed price is ex-dividend price. We need to add current dividend to the price to get cum-dividend price
- Cum-dividend price = Rs.176 + 8 = Rs.184
- Share is currently quoting at Rs.180. Current market price is lower than fair market price. Share is undervalued and hence we should buy the share



Rights Issue:

- ❖ A rights issue is an invitation to existing shareholders to purchase additional shares in the company
- ❖ The shares are normally issued at a discount to the fair market price
 - Every shareholder will be given an option to subscribe to the rights shares. The shareholders are also allowed to sell their right. The buyer of the right will get the option to buy the shares at special price
- ❖ A rights issue will not alter the wealth of the shareholder in case he either subscribes to the issue or sells the right. However, in case the shareholder takes no action then his wealth will come down

Theoretical ex – rights price = $\frac{(\text{Existing shares} \times \text{Existing Price}) + (\text{New shares} \times \text{Rights Price})}{\text{Existing shares} + \text{New shares}}$

Value of one right = Theoretical ex-rights price – Rights Issue price

Buyback of Shares:

- ❖ Buyback refer to repurchase of shares by companies for capital reduction
- ❖ Buyback can be done due to following reasons:
 - Company has surplus cash
 - Large scale change in capital structure
 - To build confidence among investors
 - To defend against hostile takeover
- ❖ Buyback price means the price at which the shares will be bought back
- ❖ The term theoretical post buyback price means the price at which the share is expected to trade after buyback. The buyback price is fixed that it is equal to theoretical post buyback price

Valuation of shares:

Model	Explanation
Gordon's model or perpetual growth model	❖ The current market price of the share is calculated with the help of formula for present value of growing perpetuity $P_0 = \frac{D_1}{K_e - G}$

Model	Explanation
Walter's model	$P_0 = \left(\frac{D}{K_e} \right) + \frac{\left(\frac{r}{K_e} \right) \times (E - D)}{K_e}$
Step-up growth model	❖ This refers to a scenario where growth happens in multiple stages ○ Initial stage ○ Intermediate stage ○ Final stage Step 1: Calculate dividends till the end of second stage Step 2: Calculate market price at the end of second stage using Gordon's formula Step 3: Discount the above cash flow at investor's required rate of return (K_e) to get the current market price
Price earning multiple method	MPS = EPS * PE Multiple
Free cash flow approach	$P_0 = \frac{FCF_1}{K_e - G}$ FCF = PAT - Equity funding for net capex Net capex = Capital expenditure - depreciation

Convertible instrument:

Term	Explanation
Meaning	Convertible instrument refers to those instruments which have an option of converting them into specified number of equity shares within specified period
Conversion value	Value of the instrument post conversion of them into equity shares. This will be valued based on the current market price of equity shares
Conversion premium	Difference between conversion value and the current market price of the convertible instrument. This can be expressed either as a percentage of conversion value or per equity share or per convertible instrument
Straight value	Straight value refers to the present value of future cash flows of convertible instrument discounted at investor's required rate of return
Downside risk	Possible fall in the value of the convertible instrument. A convertible bond trades at higher value than its intrinsic value due to option of conversion. However in case the conversion is not going to happen then the bond value will fall to its intrinsic value (straight value) Downside risk = Current Market Price - Intrinsic value
Conversion parity price or market conversion price	Price of an equity share at which the holder of the instrument will have no loss on conversion. CPP = $\frac{\text{CMP of convertible instrument}}{\text{Conversion ratio}}$
Favorable income differential	A convertible instrument before conversion would give interest income and post conversion would give dividend income. Favorable income differential refers to additional income generated out of convertible instrument
Premium payback period	Conversion premium can be recovered through favourable income differential. This refers to the number of years taken to recover the conversion premium Premium Payback Period = $\frac{\text{Conversion Premium per share}}{\text{Favorable income differential per share}}$

Bond valuation:

Term	Meaning
Face value or coupon value	Value written across the face of the certificate
Coupon rate	Interest rate written on the face of the certificate
Maturity value	Value payable at the end of the life of a bond
Yield to maturity	The rate of return earned by an investor who buys the bond today and holds it until maturity
Current yield	Current yield refers to the ratio of interest to current market price

Bond's yield:

- ❖ A bond will trade above face value if it gives investors a return which is higher than the yield on comparable investments. Such a bond is called premium bond
- ❖ A bond will trade at a discount if the rate of return is lower than the expected return on comparable instruments. Such a bond is called as discount bonds
- ❖ The price changes will occur unless the yield is equal to the yield on comparable instruments and then the price will stabilize

Calculation of YTM:

Method 1	Calculate IRR of the bond considering the future cash flows
Method 2 (Short-cut method)	$\frac{\text{Post tax interest income} + \text{Average other income}}{\text{Average funds employed}}$ Where: $\text{Post tax interest income} = \text{Interest income} \times (1 - \text{Tax rate})$ $\text{Average other income} = \frac{\text{Redemption value} - \text{Net investment}}{\text{Life of instrument}}$ $\text{Average funds employed} = \frac{\text{Redemption value} + \text{Net investment}}{2}$

Realized yield:

- ❖ Realized yield assumes that interim cash flows from a bond will be reinvested at a realistic reinvestment rate
- ❖ Terminal value of cash flows is calculated with the reinvestment rate and the same is compared with initial outflow
- ❖ The IRR of the revised cash flows is the realized yield

Duration:

- ❖ Duration refers to the number of years at which the bond will have no impact due to interest rate movement
- ❖ The time period of a bond at which there is no interest rate risk (Immunization)

Steps in computing duration:

- ❖ Step 1: Compute cash flows of bond till maturity
- ❖ Step 2: Determine PVF using YTM
- ❖ Step 3: Market price is sum of present value of cash flow discounted at PVF of step 2
- ❖ Step 4: Divide each year's cash flow by market to get weights
- ❖ Step 5: Sum of (time * weights) is duration

Duration of a normal bond = $\frac{1+y}{y} - \frac{(1+y) + t(c-y)}{c((1+y)^t - 1) + y}$
Where y = Required yield (YTM); c = Coupon Rate for the period t = time to maturity
Duration of a perpetual bond = $\frac{1+y}{y}$
Duration of zero-coupon bond = Life of bond

Format for calculation of duration:

Year	Cash flow	PVF @ YTM	DCF	Weight	Year * Weight
1	Interest				
2	Interest				
3	Interest				
4	Interest				
5	Interest + Principal				
Total					

Volatility:

- ❖ Interest rates and bond prices are inversely related
 - If interest rates go up, then bond prices will come down
 - If interest rates comes down, then bond prices will go up
- ❖ The % change in bond prices can be computed with the help of the following formula

$$\text{Volatility} = \frac{\text{Duration}}{1 + \text{YTM}}$$

Bond refunding:

- ❖ Refunding of a bond is an exercise in capital budgeting, since the cash flow structure represents investment decision as shown below

Repayment made today (Y0) = -1000
 Interest saved (Y1 to Y5) = 150
 Repayment saved (Y5) = 1000

- ❖ If the NPV of the above cash flow structure is positive then we should refund the bond
- ❖ If a bond is being refunded and a fresh bond is being raised then this would be similar to replacement decision
- ❖ All rules that apply to replacement decision will equally apply here

Enterprise value:

- ❖ Enterprise value is the true economic value of a company. It is calculated by adding market capitalization, long term debt, minority interests minus cash and cash equivalents
- ❖ Enterprise value is of the following three types:
 - Total Enterprise value = Equity + Debt + Minority Interest – Cash and cash equivalents
 - Operating Enterprise value = Total enterprise value – market value of non-operating assets such as investments in associates
 - Core Enterprise value = Operating enterprise value – Value of non-core assets

Multiples relating to enterprise value:

- ❖ **Enterprise value to sales:** This multiple is used for the corporates who maintain negative cash flows or negative earnings. Technological firms generally use this multiple
- ❖ **Enterprise value to EBITDA:** EBITDA is the amount available to both debt and equity holders of a company. This multiple is used for valuing capital intensive companies, which generally have substantial depreciation and amortization expenses. An analyst prefers this multiple because it is not affected by depreciation policy and changes in capital structure. The inverse of this multiple is the cash return on total investment

Practical Problems**Overview:**

- Part I – Walter's and Gordon's Model
- Part II – Rights issue and buyback
- Part III – Valuation of shares
- Part IV – Valuation of convertible instruments
- Part V – Bond valuation
- Part VI – Enterprise Valuation

Part I – Walter's and Gordon's Model**1. Target Payout Ratio – Walter's Model (May 2017)**

You are requested to find out the approximate dividend payment ratio as to have the share price at Rs.56 by using Walter Model, based on following information available for a company.

Particulars	Amount
Net Profit	50 lakhs
Outstanding 10% preference shares	80 lakhs
Number of equity shares	5 lakhs
Return on investment	15%
Cost of capital after tax (Ke)	12%

Answer:**Note 1: Computation of Earnings per share:**

Particulars	Amount (in lacs)
Profit after tax	50
Less: Preference Dividend	(8)
Earnings available to equity shareholders	42
No of shares	5
Earnings per share (42/5)	Rs.8.4 per share

Note 2: Computation of Dividend per share to have price of Rs.56:

$$\text{Price} = \frac{\text{Dividend}}{K_e} + \frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}$$

$$56 = \frac{D}{12\%} + \frac{\left(\frac{15\%}{12\%}\right) \times (8.4 - D)}{12\%}$$

$$56 = \frac{D + 1.25(8.4 - D)}{12\%}$$

- ❖ $(56 \times 12\%) = D + 10.5 - 1.25D$
- ❖ $6.72 = 10.5 - 0.25D$
- ❖ $0.25D = 3.78$
- ❖ Dividend per share = Rs.15.12

Note 3: Computation of payout ratio:

- ❖ Dividend payout ratio = $(\text{Dividends}/\text{Earnings}) \times 100$
- ❖ Dividend payout ratio = $(15.12/8.40) \times 100 = 180\%$
- ❖ Dividend pay-out ratio would be zero, as pay-out ratio more than 100% of EPS seems to be illogical

2. Walter's model - Optimum Payout Ratio (November 2014)

Goldilocks Limited was started a year back with equity capital of Rs.40 lakhs. The other details are as under:

Earnings of the company	4,00,000
Price Earnings Ratio	12.5
Dividend Paid	Rs.3,20,000
Number of shares	40,000

Find the current market price of the share. Use Walter's Model. Also Find whether the company's D/P ratio is optimal.

Answer:**Computation of current market price:****Note 1: Base data:**

- ❖ Dividend per share = $\text{Rs.}3,20,000/40,000 = \text{Rs.}8$ per share
- ❖ Earnings per share = $\text{Rs.}4,00,000/40,000 = \text{Rs.}10$ per share
- ❖ Cost of equity* = $(1/\text{PE Multiple}) = (1/12.5) = 8$ percent
- ❖ Return on equity = $\frac{\text{Total earnings}}{\text{Value of equity}} = \frac{4,00,000}{40,00,000} \times 100 = 10$ percent

* Cost of equity can be taken as inverse of PE Multiple only if the payout ratio is 100 percent. In this case payout ratio is 80 percent and hence this formula should not be used. However, we do not have any alternative data to compute cost of equity and hence the same has been taken as inverse of PE Multiple.

Note 2: Computation of Market Price:

$$\text{Price} = \frac{\text{Dividend}}{K_e} + \frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}$$

$$\text{Price} = \frac{8}{8\%} + \frac{\left(\frac{10\%}{8\%}\right) \times (10 - 8)}{8\%}$$

$$\text{Price} = 100 + \left(\frac{2.5}{8\%} \right)$$

$$\text{Price} = 100 + 31.25 = \text{Rs.131.25 per share}$$

Comments on Dividend payout ratio:

- ❖ Dividend payout ratio is dependent on Cost of Equity and Return on Investment. In this case Return on Investment (10%) is higher than cost of equity (8%). This is a case of growing firm and hence the optimal payout ratio is zero percent.
- ❖ The company is currently paying out dividend of 80% and hence is not following optimal payout ratio

3. Walter's model - Optimum Payout Ratio (November 2012 RTP)

The following information is supplied to you:

	Amount
Total earnings	Rs.2,00,000
No of equity shares (of Rs.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?

Answer:

WN 1: Computation of Return on equity and Cost of Equity:

Return on equity	$\frac{\text{Total Earnings}}{\text{Value of Equity}} \times 100$	$\frac{2,00,000}{(20,000 \times 100)} \times 100$	10%
Cost of equity	$\frac{1}{\text{PE Multiple}}$	$\frac{1}{12.5} \times 100$	8%

Conclusion:

- ❖ Return on equity is higher than cost of equity and hence the optimal dividend payout ratio is 0%
- ❖ The company is currently paying out 75% (1,50,000/2,00,000) of earnings and hence it is not following an optimal dividend payout policy

Note:

- ❖ Cost of equity can be taken as inverse of PE Multiple only when there is 100 percent payout of dividend. However, in this case we do not have additional information to compute K_e and hence we take K_e as inverse of PE Multiple

WN 2: Identification of PE ratio at which dividend policy will have no impact on share price:

- ❖ Dividend policy will have no impact on share price if Return on equity is equal to cost of equity
- ❖ In this question return on equity is 10% and hence cost of equity should be equal to 10%
- ❖ Target $K_e = 10\%$; PE Multiple = $1/K_e$; PE Multiple = $1/10\%$; PE Multiple = 10 Times

WN 3: Analysis of Dividend Policy if PE Multiple is 8 Times

Cost of equity	$\frac{1}{\text{PE Multiple}}$	$\frac{1}{8} \times 100$	12.5%

Conclusion:

- ❖ Return on equity is lower than cost of equity and hence the optimal dividend payout ratio is 100%
- ❖ The company is currently paying out 75% (1,50,000/2,00,000) of earnings and hence it is not following an optimal dividend payout policy

4. Walter's model - Limiting value and computation of cost of equity (May 2012)

X Ltd has an internal rate of return of 20%. It has declared dividend @ 18% on its equity shares, having face value of Rs.10 each. The payout ratio is 36% and Price Earning 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.

Answer:

WN 1: Computation of Cost of Equity:**Base data:**

Particulars	Calculation	Amount
Return on equity	Given	20%
Dividend per share	Rs.10 x 18%	1.80
Earnings per share	1.80/36%	5.00
Market price	EPS x PE Multiple 5 x 7.25	36.25

Computation of cost of equity:

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
36.25	=	$\left(\frac{1.80}{K_e}\right) + \left(\frac{\left(\frac{0.20}{K_e}\right) \times (5 - 1.80)}{K_e}\right)$
36.25	=	$\left(\frac{1.80}{K_e}\right) + \left(\frac{0.64}{K_e^2}\right)$
36.25	=	$\left(\frac{1.80K_e + 0.64}{K_e^2}\right)$
$36.25K_e^2$	=	$1.80K_e + 0.64$
Final equation	=	$36.25K_e^2 - 1.80K_e + 0.64 = 0$

Solving the quadratic equation:

- ❖ We will need two numbers when added become -1.80 and when multiplied becomes Rs.23.20 (36.25 x 0.64)
- ❖ Two numbers satisfying the above conditions are 4 and -5.80
- ❖ $36.25K_e^2 - 5.80K_e + 4K_e + 0.64 = 0$
- ❖ $36.25K_e(K_e - 0.16) + 4(K_e - 0.16) = 0$
- ❖ $(36.25K_e + 4)(K_e - 0.16) = 0$
- ❖ $K_e = -11.03\%$ (or) $K_e = 16\%$
- ❖ **Final cost of equity is equal to 16% as cost of equity cannot be negative**

WN 2: Computation of limiting value:

- ❖ The return on equity is 20% whereas cost of equity is 16%. The optimum payout ratio in this case is 0%
- ❖ **Limiting value will be calculated at a payout ratio which is opposite of optimum payout ratio.**
- ❖ In this question limiting value will be calculated at payout ratio of 100%

Price	=	$\left(\frac{D}{K_e}\right) + \left(\frac{\left(\frac{r}{K_e}\right) \times (E - D)}{K_e}\right)$
Price	=	$\left(\frac{5}{0.16}\right) + \left(\frac{\left(\frac{0.20}{0.16}\right) \times (5 - 5)}{0.16}\right)$
Price	=	31.25 + 0
Limiting value	=	Rs.31.25 per share

5. Gordon's model (May 2015)

The following information is collected from the annual reports of J Limited:

Profit before tax	Rs.2.50 Crores
Tax rate	40 percent
Retention ratio	40 percent
Number of outstanding shares	50,00,000
Equity capitalization rate	12 percent
Rate of return on investment	15 percent

What should be the market price per share according to Gordon's model of dividend policy?

Answer:**Base data**

Particulars	Amount
Profit before tax	2,50,00,000
Less: Tax @ 40%	(1,00,00,000)
Profit after tax/Earnings available to equity shareholders	1,50,00,000
No of shares	50,00,000
Earnings per share (EAES/No of shares)	3.00
Dividend per share (EPS x Payout ratio)	1.80
Growth rate (ROE x Retention ratio) = (15% x 40%)	6%

Computation of share price:

- ❖ One important assumption under Gordon's model is on Dividend per share. DPS of Rs.1.80 can either be assumed as Nearby Dividend (D₀) or Distant Dividend (D₁)
- ❖ Nearby dividend is also called as current year dividend and is expected to be paid within 3 months (near term). Distant dividend is also called as next year dividend and is expected to be paid over longer period (>3 months)
- ❖ In this question we are assuming DPS of Rs.1.80 as nearby Dividend (D₀)

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{1.80 + 6\%}{12\% - 6\%} \right)$
Price	=	Rs.31.80

Alternate answer if DPS of Rs.1.80 is assumed as distant dividend (D₁):

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{1.80}{12\% - 6\%} \right)$
Price	=	Rs.30.00

6. Computation of cost of equity (May 2012, November 2018 RTP)

In December, 2011 AB Co.'s share was sold for Rs. 146 per share. A long term earnings growth rate of 7.5% is anticipated. AB Co. is expected to pay dividend of Rs. 3.36 per share.

- What rate of return an investor can expect to earn assuming that dividends are expected to grow along with earnings at 7.5% per year in perpetuity?
- It is expected that AB Co. will earn about 10% on book Equity and shall retain 60% of earnings. In this case, whether, there would be any change in growth rate and cost of Equity?

Answer:**WN 1: Computation of rate of return when dividends are expected to grow at 7.5%:**

Rate of return (or) Cost of equity (K _e)	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{3.36}{146} + 7.5\%$	$0.0230 + 0.0750 = 0.098 \text{ or } 9.8\%$

WN 2: Computation of growth rate and cost of equity if the company will earn 10% on book equity:**Note 1: Computation of growth rate:**

- ❖ Growth rate = ROE/IRR x Retention ratio
- ❖ Growth rate = 10% x 60% = 6%

Note 2: Computation of dividends (D₁):

- ❖ The company had growth rate of 7.5 percent in the past and hence retention ratio in the past would have been:
 - Retention ratio = Growth rate/IRR = 7.5%/10% = 75%
- ❖ The firm had retention rate of 75% and hence payout ratio would have been 25%.
- ❖ EPS of year 1 = (Dividend of year 1/Payout ratio) = 3.36/25% = Rs.13.44
- ❖ Revised dividend of year 1 = 13.44 x 40% = Rs.5.376

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (K_e)	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{5.376}{146} + 6.0\%$	$0.0368 + 0.06 = 0.0968$ (or) 9.68%

7. Valuation of share (Nov 2020 RTP)

The following information is given for QB Ltd.

Earning per share	Rs.12
Dividend per share	Rs.3
Cost of capital	18%
Internal Rate of Return on investment	22%

Calculate the market price per share using

- ❖ Gordon's formula
- ❖ Walter's formula

Answer:

WN 1: Computation of share price as per Gordon's model:

Base data:

Particulars	Calculation	Amount
Dividend per share	Given	3
Earnings per share	Given	12
Payout ratio	$3/12$	25%
Retention ratio	$100\% - 25\%$	75%
Growth rate	$\text{IRR/ROE} \times \text{Retention ratio}$ $22\% \times 75\%$	16.50%

Note:

- ❖ It is assumed that Dividend per share of Rs.3 as D_1 (Distant dividend)

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{3}{18\% - 16.5\%} \right)$
Price	=	Rs.200

Alternate answer if DPS of Rs.3 is assumed as D_0 (Nearby dividend)

Price	=	$\left(\frac{D_1}{K_e - G} \right)$
Price	=	$\left(\frac{3 + 16.5\%}{18\% - 16.5\%} \right)$
Price	=	Rs.233

WN 2: Computation of share price as per Walter's model:

Price	=	$\left(\frac{D}{K_e} \right) + \left(\frac{\left(\frac{r}{K_e} \right) \times (E - D)}{K_e} \right)$
Price	=	$\left(\frac{3}{0.18} \right) + \left(\frac{\left(\frac{0.22}{0.18} \right) \times (12 - 3)}{0.18} \right)$
Price	=	$16.67 + 61.11$
Price	=	Rs.77.78 per share

8. Computation of cost of equity and market price (November 2013)

A share of Tension-free Economy Ltd. is currently quoted at a price earnings ratio of 7.5 times. The retained earning being 37.5% is Rs. 3 per share.

Calculate

- (i) The company's cost of equity, if investors' expected rate of return is 12%.
- (ii) Market price of share, if anticipated growth rate is 13% per annum with same cost of capital.
- (iii) Market price per share, if the company's cost of capital is 18% and anticipated growth rate is 15% per annum, assuming other conditions remaining the same.

Answer:

Part 1: Computation of cost of equity:

Note 1: Computation of growth rate:

- ❖ Investor's expected rate of return is 12%. This has been interpreted in ICAI solution as company's ROE. This assumption is needed to solve the problem as the information on ROE is not available in the question to calculate ROE
- ❖ Growth rate = ROE x Retention ratio = 37.5% x 12% = 4.5%

Note 2: Computation of Dividend (D1):

- ❖ Retained earnings is Rs.3 per share and the same represent 37.5%
- ❖ Total earnings = (3/37.5%) = Rs.8 per share
- ❖ Dividend per share = Total earnings - Retained earnings = Rs.8 - Rs.3 = Rs.5 per share
- ❖ It is assumed that Rs.5 per share as distant dividend (D1). Distant dividend is one which will be paid over a longer term (>3 months) whereas nearby dividend (D0) would be paid immediately (<3 months)

Note 3: Computation of market price:

- ❖ Market price = Earnings per share x PE Multiple
- ❖ Market price = 8 x 7.5 times = Rs.60 per share

Note 4: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{5}{60} + 4.5\%$	$0.0833 + 0.0450 = 0.1283$ or 12.83%

Part 2: Computation of market price:

- ❖ Growth rate of the company is 13% whereas the cost of equity is 12.83%. We will not be able to calculate the market price as the growth rate is more than cost of equity

Part 3: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{5}{(18\% - 15\%)}$	Rs.166.67 per share

9. Cost of equity and market price computation

Shares of Voyage Limited are being quoted at a price-earning ratio of 8 times. The company retains 45% of its earnings which are Rs.5 per share.

You are required to compute:

- The cost of equity to the company if the market expects a growth rate of 15% p.a.
- If the anticipated growth rate is 16% per annum, calculate the indicative market price with the same cost of capital
- If the company's cost of capital is 20% p.a. & the anticipated growth rate is 19% p.a., calculate the market price per share

Answer:**Part 1: Computation of cost of equity:****Note 1: Computation of Dividend (D1):**

- ❖ Retained earnings is Rs.5 per share and the same represent 45%
- ❖ Total earnings = (5/45%) = Rs.11.11 per share
- ❖ Dividend per share = Total earnings - Retained earnings = Rs.11.11 - Rs.5 = Rs.6.11 per share
- ❖ It is assumed that Rs.6.11 per share as distant dividend (D1).

Note 2: Computation of market price:

- ❖ Market price = Earnings per share x PE Multiple
- ❖ Market price = 11.11 x 8 times = Rs.88.88 per share

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{6.11}{88.88} + 15\%$	$0.0687 + 0.1500 = 0.2187$ or 21.87%

Part 2: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{6.11}{(21.87\% - 16\%)}$	Rs.104.09 per share

Part 3: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{6.11}{(20\% - 19\%)}$	Rs.611 per share

Alternative solution:

- ❖ The company retains 45% of its earnings which are Rs.5 per share. This sentence can also be interpreted as total earnings being Rs.5 per share.

Part 1: Computation of cost of equity:**Note 1: Computation of Dividend (D1):**

- ❖ Dividend per share = Rs.5 per share x 55% = Rs.2.75 per share
- ❖ It is assumed that Rs.2.75 per share as distant dividend (D1).

Note 2: Computation of market price:

- ❖ Market price = Earnings per share x PE Multiple
- ❖ Market price = 5 x 8 times = Rs.40 per share

Note 3: Computation of cost of equity:

Rate of return (or) Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{2.75}{40} + 15\%$	$0.0687 + 0.1500 = 0.2187$ or 21.87%

Part 2: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.75}{(21.87\% - 16\%)}$	Rs.46.85 per share

Part 3: Computation of market price:

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.75}{(20\% - 19\%)}$	Rs.275 per share

10. Investor's expectations and price relationship (May 2014 RTP)

Mr. A is contemplating purchase of 1,000 equity shares of a Company. His expectation of return is 10% before tax by way of dividend with an annual growth of 5%. The Company's last dividend was Rs. 2 per share. Even as he is contemplating, Mr. A suddenly finds, due to a Budget announcement Dividends have been exempted from Tax in the hands of the recipients. But the imposition of Dividend Distribution Tax on the Company is likely to lead to a fall in dividend of 20 paise per share. A's marginal tax rate is 30%. Calculate what should be Mr. A's estimates of the price per share before and after the Budget announcement?

Answer:**WN 1: Computation of share price before budget announcement:**

- ❖ Dividends were taxable before budget announcement and the investor's required pre-tax rate of return (ke) is 10%
- ❖ We will use Gordon's formula to solve this and both D1 and Ke will be taken as pre-tax number. This is because Dividends are taxable and hence Cost of equity should be pre-tax cost of equity

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{2.10}{(10\% - 5\%)}$	Rs.42 per share

WN 2: Computation of share price post budget announcement:

- ❖ Dividends are now taxable in the hands of shareholder and hence relevant cost of equity is post-tax cost of equity. Post-tax cost of equity = $10\% \times (1 - 30\%) = 7\%$
- ❖ Dividends are expected to fall by 20 paise and hence Rs.2 per share is likely to become Rs.1.80 per share. It is assumed that Rs.1.80 is nearby dividend and hence the dividend for next year will be Rs.1.89 (Rs.1.80 + 5%) [Alternate assumptions exist for this]

Market Price	$\frac{D1}{(Ke - G)}$	$\frac{1.89}{(7\% - 5\%)}$	Rs.94.50 per share

11. Maintenance of dividend income (May 2016)

SAM Ltd has just paid a dividend of Rs. 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 Rs. 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 Rs. 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%.

Answer:

WN 1: Impact on market price:

Before Project:

Market Price	$\frac{D1}{(K_e - G)}$	$\frac{2 + 6\%}{(8\% - 6\%)}$	Rs.106 per share

After new project:

P3	$\frac{D4}{(K_e - G)}$	$\frac{2.50}{(8\% - 7\%)}$	Rs.250 per share
P2	$\frac{P3}{(1 + K_e)}$	$\frac{250}{(1 + 8\%)}$	Rs.231.48 per share
P1	$\frac{P2}{(1 + K_e)}$	$\frac{231.48}{(1 + 8\%)}$	Rs.214.33 per share
P0	$\frac{P1}{(1 + K_e)}$	$\frac{214.33}{(1 + 8\%)}$	Rs.198.45 per share

❖ Share price will increase from Rs.106 to Rs.198.45 due to new project

WN 2: Maintenance of Dividend Receipt:

Year	Income needed	Share price	No of shares to be sold
1	2,000	214.33	9.33 shares rounded to 10 shares
2	2,000	231.48	8.64 shares rounded to 9 shares
3	2,000	250.00	8 shares

Note: The investor needed minimum income of Rs.2,000 and hence 9.33 shares have been rounded upwards to 10 shares. 9 shares would not have provided the receipt of Rs.2,000

Dividend income of Year 4 = $2.50 \times (1,000 - 10 - 9 - 8) = \text{Rs.}2,432.50$

Conclusion:

❖ The investor can maintain target receipt of Rs.2,000 by selling shares in first three years and thereafter he can earn higher dividend income of Rs.2,432.50 growing at the rate of 7%

12. Impact of new project on share price (November 2017)

Rahim Enterprises is a manufacturer and exporter of woollen garments to European countries. Their business is expanding day by day and in the previous financial year the company has registered a 25% growth in export business. The company is in the process of considering a new investment project. It is an all equity financed company with 10,00,000 equity shares of face value of Rs. 50 per share. The current issue price of this share is Rs. 125 ex-dividend. Annual earning are Rs. 25 per share and in the absence of new investments will remain constant in perpetuity. All earnings are distributed at present. A new investment is available which will cost Rs. 1,75,00,000 in one year's time and will produce annual cash inflows thereafter of Rs. 50,00,000. Analyse the effect of the new project on dividend payments and the share price.

Answer:

WN 1: Computation of impact of new project on Dividends:

Year	Earnings	Investment	Dividends	DPS
1	2,50,00,000 [10,00,000 × 25]	1,75,00,000	75,00,000	7.50 [75,00,000/10,00,000]
2 to ∞	3,00,00,000 [2,50,00,000 + 50,00,000]	0	3,00,00,000	30.00 [3,00,00,000/10,00,000]

WN 2: Computation of impact on share price:

Part 1: Computation of Cost of equity:

Cost of equity (Ke)	$\frac{D1}{P0} + \text{Growth rate}$	$\frac{25}{125} + 0\%$	$0.20 + 0.00 = 0.20$ (or) 20%

Part 2: Computation of Share Price:

Year	Cash flow	PVF @ 20%	DCF
1	7.50	0.8333	6.25
1	150 [Note 1]	0.8333	125
Expected share price			131.25

Note 1: Computation of PV of Dividends of 2 to ∞

- ❖ Dividends is expected to remain same from year 2 till infinity. We can use Gordon's formula and calculate the share price at the end of year 1

P1	$\frac{D2}{(Ke - G)}$	$\frac{30}{(20\% - 0\%)}$	Rs.150 per share

Conclusion:

Share price will increase from Rs.125 to Rs.131.25 due to the new project.

Part II - Rights Issue and Buyback**13. Rights issue (Nov 2014 RTP, Nov 2018 RTP)**

ABC Limited has issued 75,000 equity shares of Rs.10 each. The current market price per share is Rs. 24. The company has a plan to make a rights issue of one new equity share at a price of Rs.16 for every four share held.

You are required to:

- ❖ Calculate the theoretical post-rights price per share;
- ❖ Calculate the theoretical value of the right alone;
- ❖ Show the effect of the rights issue on the wealth of a shareholder, who has 1,000 shares assuming he sells the entire rights; and
- ❖ Show the effect, if the same shareholder does not take any action and ignores the issue.

Answer:**WN 1: Computation of post-rights price:**

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights Price} = \frac{(75,000 \times 24) + (18,750 \times 16)}{75,000 + 18,750} = \text{Rs. 22.40 per share}$$

WN 2: Computation of value of right:

Particulars	Amount
Ex-rights price	22.40
Rights Price	16
Value of one right	6.40
Value of one right (per share)	1.60 [6.40/4]

WN 3: Effect on shareholder's wealth:

Particulars	Sells rights	Ignores the issue
Existing shares	1,000	1,000
Existing Price	24	24
Existing wealth	24,000	24,000
Rights acquired (1,000/4)	250	0
Sales price of right (WN 1)	6.40	0
Money earned by selling rights[A]	1,600	0
Shares held post rights issue	1,000	1,000
Ex-rights price	22.40	22.40

Value of shares post rights issue [B]	22,400	22,400
Revised Wealth [A+B]	24,000	22,400
Impact on shareholder's wealth	0	Fall by Rs.1,600

14. Rights issue (May 2014 RTP)

AB Limited's shares are currently selling at Rs.130 per share. There are 10,00,000 shares outstanding. The firm is planning to raise Rs.2 Crores for finance new project.

Required:

What is ex-rights price of shares and value of a right, if:

- The firm offers one right share for every two shares held
- The firm offers one right share for every four shares held
- How does the shareholder's wealth change from (i) to (ii)? How does rights issue increase shareholder's wealth?

Answer:**WN 1: Computation of ex-rights price and value of a right for two situations:**

Particulars	Offer I	Offer II
Amount to be raised	2,00,00,000	2,00,00,000
Rights ratio	1:2	1:4
No of rights shares to be issued	5,00,000 [10,00,000 x (1/2)]	2,50,000 [10,00,000 x (1/4)]
Rights Price	Rs.40 [2,00,00,000/5,00,000]	Rs.80 [2,00,00,000/2,50,000]
Existing shares	10,00,000	10,00,000
Existing Price	130	130

Ex-rights price calculation:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price})}{\text{Existing shares} + \text{New shares}}$$

$$\text{Situation 1} = \frac{(10,00,000 \times 130) + (5,00,000 \times 40)}{10,00,000 + 5,00,000} = \text{Rs. 100}$$

$$\text{Situation 2} = \frac{(10,00,000 \times 130) + (2,50,000 \times 80)}{10,00,000 + 2,50,000} = \text{Rs. 120}$$

Value of right calculation:

Particulars	Offer I	Offer II
Ex-rights price	100	120
Rights Price	40	80
Value of one right	60	40
Value of one right (per share)	30 [60/2]	10 [40/4]

WN 2: Impact on shareholder's wealth:

Let us assume the shareholder owns 100 shares

Particulars	Offer I	Offer II
Existing shares	100	100
Existing Price	130	130
Existing wealth	13,000	13,000
Rights shares acquired	50	25
Rights Price	40	80
Amount paid for purchasing shares [A]	2,000	2,000
Revised shares post rights issue	150	125
Ex-rights price	100	120
Value of shares post rights issue [B]	15,000	12,500
Revised Wealth [B-A]	13,000	13,000

Shareholder's wealth remains same before and after rights issues in both offers. Hence rights issue has no impact on shareholder's wealth

15. New issue versus rights issue (November 2015 RTP)

Telbel Limited is considering undertaking a major expansion involving outlay of Rs.150 Crores. The Board of Director of company are expecting to generate an additional profit of Rs.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 Rs.10 each. The current market price of each share is Rs. 22.60 (cum dividend). The company has declared a dividend of Rs. 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:

- ❖ A right issue on ratio of 1:5 at price of Rs.15 per share.
- ❖ 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.

Answer:

WN 1: Computation of NPV of new project:

Part 1: Computation of Cost of equity:

Cost of equity (K_e)	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{1.40 + 6\%}{21.20} + 6\%$	$0.07 + 0.06 = 0.13$ (or) 13%

Note: Market price in Gordon's model is ex-dividend price. This is because share will quote at ex-dividend price once the dividends are paid out by the company

Part 2: Computation of NPV:

Particulars	Calculation	Amount
Cost of project	Given	150 crores
Value of Project	$\frac{CF_1}{K_e - \text{Growth}} = \frac{15.30 \text{ cr}}{13\% - 4\%}$	170 crores
NPV of Project		20 Crores

- ❖ The company should go ahead with project as the same generates positive NPV of Rs.20 Crores

WN 2: Computation of ex-rights price:

$$\text{Ex - rights Price} = \frac{(\text{Existing shares} \times \text{existing price}) + (\text{New shares} \times \text{rights price}) + \text{NPV of Project}}{\text{Existing shares} + \text{New shares}}$$

$$\text{Ex - rights Price} = \frac{(50 \text{ cr} \times 21.20) + (10 \text{ cr} \times 15) + 20 \text{ cr}}{50 \text{ cr} + 10 \text{ cr}} = \frac{1230 \text{ cr}}{60 \text{ Cr}} = \text{Rs. 20.50 per share}$$

WN 3: Computation of shares to be issued and issue price for new issue:

- ❖ Let us assume issue price as x
- ❖ No of shares to be issued = (150 Crores/x)
- ❖ We need to ensure that issue price and post-issue price as same. This will ensure that there is no loss for new shareholder

Particulars	Calculation	Amount
Post-issue market capitalization		1,230 crores
No of shares post issue		$50 \text{ Crores} + \frac{150 \text{ Cr}}{X}$
Post issue price (X)	=	$\frac{(1,230)}{(50 + (\frac{150}{X}))}$

$X = \frac{(1,230)}{(50 + (\frac{150}{X}))}$
$X (50 + (\frac{150}{X})) = 1,230$
$50X + 150 = 1,230$
$50X = 1,080$
X = 21.60 per share

- ❖ Issue price for public issue = Rs.21.60 per share
- ❖ No of shares to be issued = $(150 \text{ cr} / 21.60) = 6.94 \text{ Crores}$

WN 4: Computation of net benefit from expansion for existing shareholders:

Particulars	Rights issue	New issue
Existing wealth:		
No of shares	50 Crores	50 Crores
Market price	21.20	21.20
Existing wealth	1,060 Crores	1,060 Crores
Revised wealth		
No of shares held by existing shareholders	60 Crores	50 Crores
Market price	20.50	21.60
Value of shares (A)	1,230 Crores	1,080 Crores
Amount borrowed to buy rights issue shares (B)	150 Crores	
Net wealth (A - B)	1,080 Crores	1,080 Crores
Increase in wealth (New wealth - Existing wealth)	20 Crores	20 Crores

16. Buyback of shares (Nov 2013 RTP, Nov 2017 RTP)

Rahul Ltd. has surplus cash of Rs. 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 Rs. 3. You are required to determine:

1. The price at which the shares can be re-purchased, if the market capitalization of the company should be Rs. 210 lakhs after buyback,
2. The number of shares that can be re-purchased, and
3. The impact of share re-purchase on the EPS, assuming that net income is the same.

Answer:**WN 1: Computation of buyback price:**

- ❖ Let us assume the buyback price to be x
- ❖ The price after buyback will be 10 percent higher and hence the post buyback price will be 1.1x

Particulars	Calculation	Amount
Surplus cash		100 lacs
Buyback size	100 lacs x 27%	27 lacs
Buyback price		X
No of shares bought back		$\frac{27 \text{ lacs}}{x}$
Post-buyback market capitalization		210 lacs
Shares post buyback		$10 \text{ lacs} - (\frac{27 \text{ lacs}}{x})$

Post buyback price = $\frac{\text{Market capitalization}}{\text{No of shares}}$
$1.1X = \frac{210}{(10 - (\frac{27}{x}))}$
$1.1x (10 - (\frac{27}{x})) = 210$
$11x - 29.7 = 210$
$11x = 239.70$
X = 21.79 per share

- ❖ Hence the buyback price will be Rs.21.79 per share

WN 2: Computation of shares to be bought back:

Particulars	Calculation	Amount
Buyback size		27,00,000
Buyback price	WN 1	21.79
Shares bought back	$\frac{27,00,000}{21.79}$	1,23,910 shares

WN 3: Computation of EPS post buyback:

Particulars	Calculation	Amount
Existing EPS		3
Existing shares		10,00,000
Existing earnings	$3 \times 10,00,000$	30,00,000
Shares post buyback	$10,00,000 - 1,23,910$	8,76,090
New EPS	$\frac{30,00,000}{8,76,090}$	Rs.3.42 per share

17. Computation of post-buyback EPS (Nov 2018)

Eager Ltd. has a market capitalization of Rs. 1,500 crores and the current market price of its share is Rs. 1,500. It made a PAT of 200 crores and the Board is considering a proposal to buy back 20% of the shares at a premium of 10% to the current market price. It plans to fund this through a 16% bank loan. You are required to calculate the post buy back Earnings Per Share (EPS). The company's corporate tax rate is 30%.

Answer:

Particulars	Amount
Market capitalization	1,500 crores
Current Market Price	1,500
Existing shares (1,500 crores/1,500)	1 Crore
Shares to be bought back	20 lacs [1 crore x 20%]
Buy-back price	1,650 [1,500 + 10%]
Buy-back size	330 crores [1,650 x 20 lacs]
Interest on loan (330 crores x 16%)	52.8 crores
Post-tax interest cost (52.8 crores x 70%)	36.96 crores
Revised PAT [200 crores – 36.96 crores]	163.04 crores
Revised shares (1 crore – 0.2 crores)	0.8 crores
Post-buyback EPS [163.04/0.8]	203.8

Part III – Valuation of shares**18. Valuation of share – Beta and cost of equity (May 2017 RTP)**

A Company pays a dividend of Rs.2.00 per share with a growth rate of 7%. The risk free rate is 9% and the market rate of return is 13%. The Company has a beta factor of 1.50. However, due to a decision of the Finance Manager, beta is likely to increase to 1.75. Find out the present as well as the likely value of the share after the decision.

Answer:**Computation of share price before and after decision:**

Particulars	Existing	Revised
Risk free rate	9%	9%
Market return	13%	13%
Beta	1.50	1.75
Cost of equity [$K_e = R_f + \beta(R_m - R_f)$]	15%	16%
Current Dividend (D_0)	2	2
Dividend of next year (D_1)	2.14	2.14

Share price = $\left(\frac{D_1}{K_e - G} \right)$	$\left(\frac{2.14}{15\% - 7\%} \right)$ Rs.26.75	$\left(\frac{2.14}{16\% - 7\%} \right)$ Rs.23.78

19. Decision on holding/buy/sell of shares (Nov 2014)

An investor is holding 5,000 shares of X Limited. Current year dividend rate is Rs.3/share. Market price of the share is Rs.40 each. The investor is concerned about several factors which are likely to change during the next financial year as indicated below:

Particulars	Current Year	Next Year
Dividend paid/anticipated per share	3	2.5
Risk free rate	12%	10%
Market risk premium	5%	4%
Beta value	1.3	1.4
Expected growth	9%	7%

In view of the above, advise whether the investor should buy, hold or sell the shares

Answer:

WN 1: Computation of fair price as per existing conditions:**Note 1: Computation of Cost of Equity:**

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 12\% + 1.3 (5\%) = 18.50\%$

Note 2: Computation of fair market price:

Fair Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{3 + 9\%}{(18.5\% - 9\%)}$	Rs.34.42 per share

WN 2: Computation of fair price as per revised conditions:**Note 1: Computation of Cost of Equity:**

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 10\% + 1.4 (4\%) = 15.60\%$

Note 2: Computation of fair market price:

Fair Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{2.5 + 7\%}{(15.6\% - 7\%)}$	Rs.31.10 per share

Market price of share of Rs.40 is higher in comparison to current fair market price of Rs.34.42 and revised fair market price of Rs.31.10. Hence the investor should sell the share

20. Step-up growth model (November 2015, May 2019 RTP, May 2020 RTP)

X Limited is a shoes manufacturing company. It is all equity financed and has a paid-up capital of Rs.10,00,000 (Rs.10 per share). X Limited has hired swastika consultants to analyse the future earnings. The report of swastika consultants states as follows:

- ❖ The earnings and dividend will grow at 25% for the next two years
- ❖ Earnings are likely to grow at the rate of 10% from 3rd year onwards
- ❖ Further, if there is reduction in earnings growth, dividend payout ratio will increase to 50%

The other data related to the company are as follows:

Year	EPS	Net Dividend per share	Share Price
2010	6.30	2.52	63.00
2011	7.00	2.80	46.00
2012	7.70	3.08	63.75
2013	8.40	3.36	68.75
2014	9.60	3.84	93.00

You may assume that the tax rate is 30% (not expected to change in future) and post tax cost of capital is 15%. By using the dividend valuation model, calculate

- ❖ Expected market price per share
- ❖ P/E Ratio

Answer:

WN 1: Computation of Dividends till the first year of stabilization phase:

- ❖ Earnings and dividends will grow at 25% for two years. Growth will stabilize at 10% from third year. Hence, we should compute dividends till third year

Year	EPS	DPS
1	12.00 [9.60 + 25%]	4.80 [3.84 + 25%]
2	15.00 [12 + 25%]	6.00 [4.80 + 25%]
3	16.50 [15 + 10%]	8.25 [16.50 × 50%]

WN 2: Valuation of share:

Year	Cash flow	PVF @ 15%	DCF
1	4.80	0.870	4.18
2	6.00	0.756	4.54
2	165 [Note 1]	0.756	124.74
Expected share price			133.46

Note 1: Computation of PV of Dividends of 3 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 3. We can use Gordon's formula and calculate the share price at the end of year 2

P2	$\frac{D_3}{(K_e - G)}$	$\frac{8.25}{(15\% - 10\%)}$	Rs.165 per share

WN 3: Computation of PE Multiple:

Particulars	Amount
Expected Price	133.46
EPS of current year	9.60
PE Multiple (MPS/EPS)	13.90 Times

21. Valuation of shares as per step-up growth model (May 2019 RTP)

Seawell Corporation, a manufacturer of do-it-yourself hardware and housewares, reported earnings per share of € 2.10 in 2003, on which it paid dividends per share of €0.69. Earnings are expected to grow 15% a year from 2004 to 2008, during this period the dividend payout ratio is expected to remain unchanged. After 2008, the earnings growth rate is expected to drop to a stable rate of 6%, and the payout ratio is expected to increase to 65% of earnings. The firm has a beta of 1.40 currently, and is expected to have a beta of 1.10 after 2008. The market risk premium is 5.5%. The Treasury bond rate is 6.25%.

Required:

- (a) What is the expected price of the stock at the end of 2008?
 (b) What is the value of the stock, using the two-stage dividend discount model?

Answer:**WN 1: Computation of Dividend till first year of stabilization phase:**

- ❖ Earnings are expected to grow at 15% for 2004 to 2008 and the stabilization will happen from 2009 onwards. Hence, we need to calculate dividends till 2009.

Year	Earnings	Dividend
2004	2.42	0.79
2005	2.78	0.91
2006	3.19	1.05
2007	3.67	1.21
2008	4.22	1.39
2009	4.48 [4.22 + 6%]	2.91 [4.48 × 65%]

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from 2009 and hence Market price has to be calculated at end of 2008

Market Price (2008)	$\frac{\text{Dividend of 2009}}{(K_e - G)}$	$\frac{2.91}{(12.30\% - 6\%)}$	Rs.46.19 per share

- ❖ We are computing the market price at end of 2008 and hence we should dividends of 2009 and cost of equity which would prevail post 2009

Note 1: Computation of cost of equity for 2004 to 2008

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 6.25\% + (1.4 \times 5.5\%) = 13.95\%$

Note 2: Computation of cost of equity post 2008:

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ $K_e = 6.25\% + (1.1 \times 5.5\%) = 12.30\%$

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 13.95%	DCF
2004	0.79	0.878	0.70
2005	0.91	0.771	0.70
2006	1.05	0.677	0.70
2007	1.21	0.594	0.72
2008	1.39	0.521	0.72
2008	46.19	0.521	24.06
Fair market price			27.60

Final Solution:

- ❖ Expected price at end of 2008 = Rs.46.19 per share
- ❖ Current market price as per two-stage dividend discount model = Rs.27.60 per share

22. Valuation of shares as per PE Multiple and Earnings growth model (November 2012)

Given the following information:

Current Dividend	5.00
Discount rate	10%
Growth rate	2%

Required:

- i. Calculate the present value of the stock
- ii. Is the stock overvalued if the price is Rs.40, ROE = 8% and EPS = Rs.3.00? Show your calculations under the PE Multiple approach and Earnings Growth model

Answer:**Part one:**

Market Price	$\frac{D_1}{(K_e - G)}$	$\frac{5 + 2\%}{(10\% - 2\%)}$	Rs.63.75 per share

Part two:**Valuation of share as per PE Multiple Approach:**

Particulars	Amount
Return on equity	8%
PE Multiple (1/ROE)	12.5
EPS	3.00
Fair market price (EPS x PE Multiple)	37.50

Actual stock price is higher than fair market price and hence share is overvalued

Valuation of share as per Earnings Growth Model:

Market Price	$\frac{E_1}{(K_e - G)}$	$\frac{3 + 2\%}{(8\% - 2\%)}$	Rs.51 per share

Note:

- ❖ For this part of the problem ROE has been taken as cost of equity. Alternatively, we could have used cost of equity as 10% as given in part one of the problem.
- ❖ Earnings Growth model works in the same manner as in Dividend growth model. However, we use numerator as Earning of year 1 and not Dividends of year 1
- ❖ **Actual stock price is lower than fair market price and hence share is undervalued**

23. Valuation of share - dividend discount model (May 2013, Nov 2018 RTP)

X Limited, just declared a dividend of Rs.14.00 per share. Mr. B is planning to purchase the share of X

Limited, anticipating increase in growth rate from 8% to 9%, which will continue for three years. He also expects the market price of this share to be Rs. 360.00 after three years. You are required to determine:

- I. the maximum amount Mr. B should pay for shares, if he requires a rate of return of 13% per annum.
- II. the maximum price Mr. B will be willing to pay for share, if he is of the opinion that the 9% growth can be maintained indefinitely and require 13% rate of return per annum.
- III. the price of share at the end of three years, if 9% growth rate is achieved and assuming other conditions remaining same as in (ii) above.

Answer:

WN 1: Computation of maximum amount Mr.B can pay:

Note 1: Computation of Dividends for first three years:

Year	DPS
1	15.26 [14 + 9%]
2	16.63 [15.26 + 9%]
3	18.13 [16.63 + 9%]

Note 2: Maximum price to be paid:

Year	Cash flow	PVF @ 13%	DCF
1	15.26	0.885	13.51
2	16.63	0.783	13.02
3	378.13	0.693	262.04
Expected share price			288.57

WN 2: Computation of maximum price if growth rate of 9 percent can be maintained for indefinite period:

P0	$\frac{D1}{(Ke - G)}$	$\frac{15.26}{(13\% - 9\%)}$	Rs.381.50 per share

WN 3: Computation of price at end of three years if growth rate of 9 percent can be maintained for indefinite period:

P3	$\frac{D4}{(Ke - G)}$	$\frac{19.76}{(13\% - 9\%)}$	Rs.494 per share

- Dividend of year 4 = Dividend of year 3 + 9% = Rs.19.76 per share

24. Calculation of cost of equity (November 2018 RTP)

Piyush Loonker and Associates presently pay a dividend of Re. 1.00 per share and has a share price of Rs.20.00.

- i. If this dividend were expected to grow at a rate of 12% per annum forever, what is the firm's expected or required return on equity using a dividend-discount model approach?
- ii. Instead of this situation in part (i), suppose that the dividends were expected to grow at a rate of 20% per annum for 5 years and 10% per year thereafter. Now what is the firm's expected, or required, return on equity?

Answer:

WN 1: Computation of required rate of return:

- Required rate of return on equity is known as cost of equity (K_e)

K_e	$\frac{D_1}{P_0} + \text{Growth rate}$	$\frac{1.12}{20} + 0.12$	$0.056 + 0.12 = 0.176 \text{ or } 17.60\%$

WN 2: Computation of required rate of return if growth rate is 20% for 5 years and then the growth rate is 10 percent post 5 years:

- Growth rate is 20 percent for 5 years and then growth rate reduces to 10 percent. We cannot use the above formula and calculate cost of equity due to multiple growth rates
- We need to assume discount rate and calculate NPV of cash flows. If NPV is zero, then assumed discount rate is IRR of cash flows. IRR basically indicates the return earned by the investor and the

same would be taken as expected or required return (Cost of equity)

Let us assume Discount rate to be 18% (Discount rate closer to earlier Ke of 17.60%):

Note 1: Computation of dividends till sixth year (first year of stabilization phase):

Year	Calculation	Dividends
1	1 + 20%	1.20
2	1.20 + 20%	1.44
3	1.44 + 20%	1.73
4	1.73 + 20%	2.08
5	2.08 + 20%	2.50
6	2.50 + 10%	2.75

Note 2: Computation of NPV if discount rate is 18%

Year	Cash flow	PVF @ 18%	DCF
0	(20)	1.000	(20.00)
1	1.20	0.847	1.02
2	1.44	0.718	1.03
3	1.73	0.609	1.05
4	2.08	0.516	1.07
5	2.50	0.437	1.09
5	34.38 [Note 3]	0.437	15.02
NPV			0.28

Note 3: Computation of PV of Dividends of 6 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 6. We can use Gordon's formula and calculate the share price at the end of year 5

P6	$\frac{D_8}{(K_e - G)}$	$\frac{2.75}{(18\% - 10\%)}$	Rs.34.38 per share

Note 4: Let us assume discount rate to be 19% (discount rate is increased as we got positive NPV at 18%):

Computation of NPV if discount rate is 18%

Year	Cash flow	PVF @ 19%	DCF
0	(20)	1.000	(20.00)
1	1.20	0.840	1.01
2	1.44	0.706	1.02
3	1.73	0.593	1.03
4	2.08	0.499	1.04
5	2.50	0.419	1.05
5	30.56 [Note 5]	0.419	12.80
NPV			-2.06

Note 5: Computation of PV of Dividends of 6 to ∞

- ❖ Dividends is expected to grow at constant rate of 10 percent from year 6. We can use Gordon's formula and calculate the share price at the end of year 5

P6	$\frac{D_8}{(K_e - G)}$	$\frac{2.75}{(19\% - 10\%)}$	Rs.30.56 per share

Note 6: Computation of IRR/Cost of equity:

- Share has positive NPV of 0.28 at discount rate of 18% and negative NPV of 2.06 at discount rate of 19%

IRR	$L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$	$18 + \frac{0.28}{0.28 - (-2.06)} \times (19 - 18)$	18.12%

25. Subjective assessment of cost of equity (May 2017 RTP)

Capital structure of Sun Ltd., as at 31.3.2003 was as under:

Particulars	Rs. (in lakhs)
Equity share capital	80
8% preference share capital	40
12% debentures	64
Reserves	32

Sun Ltd., earns a profit of Rs.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:

- ❖ Profit after tax covers fixed interest and fixed dividends at least 3 times.
- ❖ Capital gearing ratio is 0.75.
- ❖ 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.

Answer:

WN 1: Income statement of Sun Limited:

Particulars	Amount
Profit before Interest and Taxes	32,00,000
Less: Interest on debentures (64,00,000 x 12%)	(7,68,000)
Profit before tax	24,32,000
Less: Tax @ 35% (24,32,000 x 35%)	(8,51,200)
Profit after tax	15,80,800
Less: Preference Dividend (40,00,000 x 8%)	(3,20,000)
Earnings available to equity shareholders	12,60,800
Less: Equity Dividend (80,00,000 x 8%)	(6,40,000)
Retained earnings	6,20,800

WN 2: Computation of fixed interest and fixed dividend coverage:

$$\text{Fixed interest and fixed dividend coverage} = \frac{\text{PAT} + \text{Fixed interest}}{\text{Fixed interest} + \text{Fixed Dividend}}$$

$$\text{Fixed interest and fixed dividend coverage} = \frac{15,80,800 + 7,68,000}{7,68,000 + 3,20,000} = 2.16 \text{ Times}$$

Note:

- PAT should cover interest and dividend atleast 3 times. We have added fixed interest to PAT while calculating the ratio as we need to compare

WN 3: Computation of capital gearing ratio:

$$\text{Capital gearing ratio} = \frac{\text{Fixed charge bearing funds}}{\text{Equity shareholder funds}} = \frac{\text{Debentures} + \text{Preference capital}}{\text{Equity} + \text{Reserves}}$$

$$\text{Capital gearing ratio} = \frac{40 + 64}{80 + 32} = 0.93 \text{ Times}$$

WN 4: Computation of required yield (in %):

There is a scope for assumptions regarding the rates (in terms of percentage for every one time of difference between Sun Ltd. and Industry Average) of risk premium involved with respect to Interest and Fixed Dividend Coverage and Capital Gearing Ratio. The below solution has been worked out by assuming the risk premium as:

- 1% for every one time of difference for Interest and Fixed Dividend Coverage
- 2% for every one time of difference for Capital Gearing Ratio

Particulars	%
Required yield of similarly placed companies	9.6
Add: Extra yield due to weaker capital gearing [0.93 - 0.75] x 2	0.36
Add: Extra yield due to weaker interest and dividend coverage [3-2.16] x 1	0.84
Target yield for Sun Limited	10.80

WN 5: Computation of yield (in Rs.):

Particulars	Amount
50% of distributed profits [6,40,000 x 50%]	3,20,000
5% of undistributed profits [6,20,800 x 5%]	31,040
Total Yield (A)	3,51,040
No of shares (B)	8,00,000
Yield per share (A/B)	0.4388

Note: It is assumed that face value per share is Rs.10 and hence no of shares has been calculated as 8,00,000 [80 lacs/10]

WN 6: Computation of value per share:

Particulars	Amount
Yield per share (in Rs.)	0.4388
Yield per share (in %)	10.80%
Value per share (Yield in Rs./Yield in %)	4.06

26. Valuation of share – Free cash flow approach (Nov 2014 RTP)

Calculate the value of share from the following information:

Profit of the company	Rs. 290 crores
Equity capital of company'	Rs.1,300 crores
Par value of share	Rs.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 return	10.3%
Capital expenditure per share	Rs. 47
Depreciation per share	Rs. 39
Change in working capital	Rs. 3.45 per share

Answer:

WN 1: Computation of Free Cash Flow per share:

- Question has given data on depreciation, capital expenditure, working capital per share and hence we can compute Free Cash Flow per share approach to value shares

Particulars	Calculation	Amount
Total Profit		290 crores
No of shares	[1,300/40]	32.50 crores
EPS	290/32.50	8.9231
Capex per share		47
Depreciation per share		39
Net capex per share		8
WC requirement per share		3.45
Total capex and WC per share		11.45
Funded with debt (Note 1)	27% x 11.45	3.0915
Funded with equity	73% x 11.45	8.3585
Free cash flow per share	8.9231 – 8.3585	0.5646

Note:

- The term debt ratio indicates proportion of capital employed represented by debt. The company has total funding requirement of 11.45 per share. 27% of the funding will come from debt and balance 73% of funding will come from equity
- $K_e = R_f + \beta \times (R_m - R_f)$; $K_e = 8.7 + 0.1 \times (10.3 - 8.7)$; $K_e = 8.86\%$

WN 2: Valuation of equity share:

$$P_0 = \frac{FCFE_1}{K_e - \text{Growth}} = \frac{0.5646 \times 1.08}{8.86\% - 8\%} = 70.90 \text{ per share}$$

27. Valuation of share (May 2016 RTP)

Following Financials are available for PQR Ltd. for the year 2008:

	Rs. In lakhs
8% Debentures	125

10% bonds (2007)	50
Equity shares (Rs.10 each)	100
Reserves and surplus	300
Total assets	600
Assets turnover ratio	1.1
Effective interest rate	8%
Effective tax rate	40%
Operating margin	10%
Dividend payout ratio	16.67%
Current market price of share	Rs.14
Required rate of return of investors	15%

You are required to:

- Draw income statement for the year
- Calculate its sustainable growth rate
- Calculate the fair price of the Company's share using dividend discount model, and
- What is your opinion on investment in the company's share at current price

Answer:

WN 1: Income statement of PQR Limited of next year:

Particulars	Calculation	Amount
Sales (Note 1)		660
Less: Operating expenses	660 x 90%	(594)
Operating profit/EBIT		66
Less: Interest (Note 2)	175 x 8%	(14)
Earnings before tax		52
Less: Tax @ 40%	52 x 40%	(20.80)
Earnings after tax/EAES		31.20
Equity dividend	31.20 x 16.67%	5.20
Retained earnings	31.20 - 5.20	26.00

Note:

- Assets turnover ratio is 1.1 Times. This would mean that assets are rotated 1.1 times in a year and sales will be 1.1 times of total assets. Hence sales is 660 lacs
- The company has 8% debentures and 10% bonds. Interest should have been calculated based on these percentages. However, question also provides effective rate of interest and hence calculation has been done at 8%. This is possible if some debt is issued mid of year

WN 2: Computation of growth rate:

Particulars	Calculation	Amount
Return on equity	$\frac{\text{EAES}}{\text{Amount of equity}} = \frac{31.20}{400} \times 100$	7.80%
Retention ratio	100% - Payout ratio; 100% - 16.67%	83.33%
Growth	ROE x Retention ratio $7.80\% \times 83.33\%$	6.50%

WN 3: Computation of fair price:

Particulars	Calculation	Amount
Dividend per share	$\frac{5.20}{10}$	0.52
Cost of equity		15%
Fair price	$\frac{D_1}{K_e - G} = \frac{0.52 + 6.5\%}{15\% - 6.50\%}$	6.52

Note:

- It is assumed that Dividend of 0.52 per share as current dividend(D₀) and hence growth rate of 6.5 percent is added to compute fair price

Conclusion:

Since the current market price of share is ` 14, the share is overvalued. Hence the investor should not invest in the company

28. Calculation of Number of GDR and Cost of GDR (Nov 2014, May 2018)

Odessa Limited has proposed to expand its operations for which it requires funds of \$ 15 million, net of issue expenses which amount to 2% of the issue size. It proposed to raise the funds through a GDR issue. It considers the following factors in pricing the issue:

- ❖ The expected domestic market price of the share is Rs.300
- ❖ 3 shares underly each GDR
- ❖ Underlying shares are priced at 10% discount to the market price
- ❖ Expected exchange rate is Rs.60/\$

You are required to compute the number of GDR's to be issued and cost of GDR to Odessa Limited, if 20% dividend is expected to be paid with a growth rate of 20%.

Answer:

WN 1: Computation of number of GDR's to be issued:

Particulars	Calculation	\$
Money to be raised		1,50,00,000
Issue expenses		2%
Gross amount to be raised	$\frac{1,50,00,000}{98\%}$	1,53,06,122
Issue price per GDR	Note 1	13.50
Number of GDR to be issued	$\frac{1,53,06,122}{13.50}$	11,33,787

Note:

1. One GDR (Global Depository Receipt) consist of 3 shares. Current market price of a share is Rs.300. Hence issue price of one GDR is expected to be Rs.900. Company plans to price issue at 10 percent discount and hence issue price will be Rs.810. Exchange rate is 1 USD = Rs.60. Consequently, issue price of one GDR is Rs.810 (or) \$ 13.50

WN 2: Computation of cost of GDR:

- GDR is an instrument having the same characteristics as that of equity. GDR will get dividends income like equity and cost of GDR can be computed using Gordon formula

$$K_e = \frac{D_1}{P_0 - F} + \text{Growth rate}; K_e = \frac{6}{810 - 2\% \text{ of } 810} + 20\%;$$

$$K_e = 0.76\% + 20\% = 20.76\%$$

Note:

- It is assumed that face value of share is Rs.10 and hence 20% dividend would be Rs.2 per share. One GDR has 3 shares and hence dividend per GDR would be Rs.6
- Issue price is Rs.810 and floatation cost is 2% and hence net proceeds for cost of GDR computation is Rs.793.80 per GDR
- We can convert dividend as well as net proceeds in USD and do the calculations. However, answer would remain same

29. Computation of maximum purchase price (Nov 2019 RTP)

Mr. A is thinking of buying shares at Rs. 500 each having face value of Rs. 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 Rs. 900 each. Incidental expenses for purchase and sale of shares are estimated to be 5% of the market price. He expects a minimum return of 12% per annum.

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

Answer:

WN 1: Decision on purchase of share:

Year	Cash flow	PVF @ 12%	DCF
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	0.452	463.75
PV of future cash inflows			563.68
Less: Purchase price (500 x 1.05)			(525)
Net gain			38.68

Note:

- ❖ Selling price at end of year 7 is Rs.900. Investor buying one share would get 1.2 shares and hence the gross sale proceeds would be Rs.1080. Selling expenses are 5% and hence net selling price is Rs.1,026
- ❖ Dividend of Rs.24 per share has been taken from year 4 as bonus issue is made in fourth year. Alternatively, higher dividend can be considered from fifth year

WN 2: Computation of maximum purchase price:

- ❖ PV of future dividends and sale proceeds = Rs.563.68; Maximum purchase outflow should therefore be Rs.563.68
- ❖ The investor needs to pay 5 percent expenses on purchase of shares
- ❖ **Maximum purchase price = (Rs.563.68/105%) = Rs.536.84**

30. Valuation of share (Nov 2015 RTP)

Two companies X Ltd. and Y Ltd. paid a dividend of Rs. 3.50 per share. Both are anticipating that dividend shall grow @ 8%. The beta of X Ltd. and Y Ltd. are 0.95 and 1.42 respectively. The yield on GOI Bond is 7% and it is expected that market shall increase at an annual rate of 13%.

You are required to determine:

- Value of share of both companies.
- Why there is a difference in the value of shares of two companies.
- If current market price of share of A Ltd. and B Ltd. are Rs. 74 and Rs. 55 respectively. As an investor what course of action should be followed?

Answer:**WN 1: Computation of value of share of both companies:****Note 1: Computation of Cost of Equity:**

- ❖ Cost of Equity (K_e) = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ K_e of X Limited = $7\% + 0.95 (13\% - 7\%) = 12.70\%$
- ❖ K_e of Y Limited = $7\% + 1.42(13\% - 7\%) = 15.52\%$

Note 2: Computation of fair market price:

Value of A Limited	$\frac{D_1}{(K_e - G)}$	$\frac{3.5 + 8\%}{(12.7\% - 8\%)}$	Rs.80.43 per share
Value of B Limited	$\frac{D_1}{(K_e - G)}$	$\frac{3.5 + 8\%}{(15.52\% - 8\%)}$	Rs.50.27 per share

Reason for difference in value of shares of two companies:

- ❖ The valuation of share of B Ltd. is lower because of systematic risk (beta) is higher though both have same growth rate.

Decision on purchase of shares:

- ❖ If the price of share of A Ltd. is Rs. 74, the share is undervalued and it should be bought.
- ❖ If price of share is Rs. 55, it is overvalued and should not be bought.

31. Valuation of share (Nov 2018)

A company has an EPS of Rs.25 for the last year and the DPS of Rs.1. The earnings are expected to grow at 2% a year in long run. Currently it is trading at 7 times its earnings. IF the required rate of return is 14%, compute the following:

- An estimate of the P/E ratio using Gordon growth model
- The Long-term growth rate implied by the current P/E ratio

Answer:**WN 1: Estimation of PE Multiple using Gordon growth model:**

Market Price	$\frac{D1}{(K_e - G)}$	$\frac{1 + 2\%}{(14\% - 2\%)}$	Rs.8.50 per share

$$\text{❖ PE Multiple} = (\text{MPS}/\text{EPS}) = 8.50/2.50 = 3.40 \text{ Times}$$

WN 2: Computation of growth rate:

- ❖ The share is quoting at PE multiple of 7 times. Current market price on EPS of 2.50 and PE Multiple of 7 times would be Rs.17.50 per share

17.50	=	$\frac{1 + G}{(0.14 - G)}$
0.14 - G (17.50)	=	1+G
2.45 - 17.50G	=	1+G
1.45	=	18.50G
Growth rate	=	1.45/18.50
Growth rate	=	7.84%

32. Valuation of share (Nov 2019)

An investor is considering purchasing the equity shares of LX Limited., whose current market price (CMP) is 150. The company is proposing a dividend of Rs.6 for the next year. LX is expected to grow @ 18 percent per annum for the next four years. The growth will decline linearly to 14 percent per annum after first four years. Thereafter it will stabilize at 14 percent per annum infinitely. The required rate of return is 18 percent per annum.

You are required to determine:

- The intrinsic value of one share
- Whether it is worth to purchase the share at this price

Answer:**WN 1: Computation of Dividend till first year of stabilization phase:**

- ❖ Dividends are expected to grow at 18% for 4 years. Then growth will linearly fall to 14%. Linear fall would indicate fall of 1 percent per year and hence it will become 14 percent in year 8
- ❖ Growth stabilizes from 8th year and hence we should calculate dividends till year 8.

Particulars	Dividend
Year 1	6
Year 2 (6 + 18%)	7.08
Year 3 (7.08 + 18%)	8.35
Year 4 (8.35 + 18%)	9.86
Year 5 (9.86 + 17%)	11.54
Year 6 (11.54 + 16%)	13.38
Year 7 (13.38 + 15%)	15.39
Year 8 (15.39 + 14%)	17.54

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from eighth year and hence we should calculate market price at end of year 7

Market Price (P7)	$\frac{D8}{(K_e - G)}$	$\frac{17.54}{(18\% - 4\%)}$	Rs.438.50 per share

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 18%	DCF
1	6	0.847	5.08
2	7.08	0.718	5.08
3	8.35	0.609	5.08
4	9.86	0.516	5.09
5	11.54	0.437	5.04
6	13.38	0.370	4.96
7	453.89 [15.39 + 438.50]	0.314	142.52
Intrinsic value of share			172.85

Since the intrinsic value of share is Rs.172.85 while it is selling at Rs.150, hence it is under-priced and we should acquire it.

33. Valuation of share (Nov 2019 Exam):

The current EPS of M/s VEE Ltd. is Rs. 4. The company has shown an extraordinary growth of 40% in its earnings in the last few year This high growth rate is likely to continue for the next 5 years after which growth rate in earnings will decline from 40% to 10% during the next 5 years and remain stable at 10% thereafter. The decline in the growth rate during the five year transition period will be equal and linear. Currently, the company's pay-out ratio is 10%. It is likely to remain the same for the next five years and from the beginning of the sixth year till the end of the 10th year, the pay-out will linearly increase and stabilize at 50% at the end of the 10th year. The post tax cost of capital is 17%. You are required to calculate the intrinsic value of the company's stock based on expected dividend. If the current market price of the stock is Rs.125, suggest if it is advisable for the investor to invest in the company's stock or not.

Answer:

WN 1: Computation of EPS and DPS till first year of stabilization phase (11th year):

Year	Growth rate	EPS	Payout Ratio	DPS
1	40%	5.60	10%	0.56
2	40%	7.84	10%	0.78
3	40%	10.98	10%	1.10
4	40%	15.37	10%	1.54
5	40%	21.51	10%	2.15
6	34%	28.82	18%	5.19
7	28%	36.89	26%	9.59
8	22%	45.00	34%	15.30
9	16%	52.20	42%	21.92
10	10%	57.42	50%	28.71
11	10%	63.16	50%	31.58

Note:

- Growth rate is 40% for year 5 and the same falls to 10% by year 10. This would mean fall of 30% for 5 years and yearly fall of 6% in growth rate
- Payout ratio is 10% for year 5 and the same increases to 50% by year 10. This would mean increase of 40% for 5 years and yearly increase of 8% in growth rate

WN 2: Valuation of share at the beginning of stabilization phase:

- Growth of company stabilized at the beginning of year 11 and hence we can compute the value of share at end of year 10

$$P_{10} = \frac{D_{11}}{K_e - G}; P_{10} = \frac{31.58}{17\% - 10\%} = \text{Rs. 451.14}$$

WN 3: Valuation of share:

Year	Cash flow	PVF @ 17%	DCF
1	0.56	0.855	0.48
2	0.78	0.731	0.57
3	1.10	0.625	0.69
4	1.54	0.534	0.82
5	2.15	0.456	0.98
6	5.19	0.390	2.02
7	9.59	0.333	3.19
8	15.30	0.285	4.36
9	21.92	0.244	5.35
10	479.85 [28.71 + 451.14]	0.209	100.29
Total			118.75

- Intrinsic value of share = Rs.118.75
- Current market price is Rs.125 whereas fair market price is Rs.118.75. Share is currently overvalued and hence we should not invest in share.

34. Valuation of Share (Nov 2019 Exam):

You are interested in buying some equity stocks of RK Ltd. The company has 3 divisions operating in different industries. Division A captures 10% of its industries sales which is forecasted to be Rs. 50 crore for the industry. Division B and C captures 30% and 2% of their respective industry's sales, which are expected to be Rs. 20 crore and Rs. 8.5 crore respectively. Division A traditionally had a 5% net income margin, whereas divisions B and C had 8% and 10% net income margin respectively. RK Ltd. has 3,00,000 shares of equity stock outstanding, which sell at Rs. 250.

The company has not paid dividend since it started its business 10 years ago. However from the market sources you come to know that RK Ltd. will start paying dividend in 3 years time and the pay-out ratio is 30%. Expecting this dividend, you would like to hold the stock for 5 year. By analysing the past financial statements, you have determined that RK Ltd.'s required rate of return is 18% and that P/E ratio of 10 for the next year and on ending P/E ratio of 20 at the end of the fifth year are appropriate.

Required:

- Would you purchase RK Ltd. equity at this time based on your one year forecast?
- If you expect earnings to grow @ 15% continuously, how much are you willing to pay for the stock of RK Ltd?

Answer:**WN 1: Computation of EPS of RK Limited for Year 0:**

Division	Industry Sales	Market share	Company sales	Margin	Company Profit
A	50,00,00,000	10%	5,00,00,000	5%	25,00,000
B	20,00,00,000	30%	6,00,00,000	8%	48,00,000
C	8,50,00,000	2%	17,00,000	10%	1,70,000
Total Profit					74,70,000
No of shares					3,00,000
EPS (74,70,000/3,00,000)					24.90

Note: It is assumed that EPS of the company will continue to be the same in year 1 as there is no information on growth for part 1 of the question.

WN 2: Computation of price based on one-year forecast:

- Fair price at end of year 1 = EPS of Year 1 x PE Multiple of next year
- Fair price at end of year 1 = 24.90 x 10 Times = Rs.249

$$\text{PV of share price} = \frac{249}{1.18} = 211.01$$

Conclusion:

- Actual market price is Rs.250 whereas fair market price is Rs.211.01. Share is currently overvalued and hence the same is not to be bought

WN 3: Valuation of share based on growth rate of 15%:**Computation of Dividend Per share till first year of stabilization phase**

Year	Growth rate	EPS	Payout Ratio	DPS
1	15%	28.64	-	0
2	15%	32.93	-	0
3	15%	37.87	30%	11.36
4	15%	43.55	30%	13.07

Note:

- Growth rate has been steady at 15 percent for all years. However, the payout has stabilized at 30% in year 4 and hence cash flows have been calculated till year 4

Valuation of share at the beginning of stabilization phase

$$P_3 = \frac{D_4}{K_e - G}; P_3 = \frac{13.07}{18\% - 15\%} = \text{Rs. } 435.67$$

Valuation of share:

Year	Cash flow	PVF @ 18%	DCF
1	0	0.847	0

2	0	0.718	0
3	447.03 [11.36 + 435.67]	0.609	272.24
Fair value of share			272.24

35. Valuation of share (Nov 2019 Exam):

Following information is available for M/s TS Limited:

Particulars	Rs. Crores
PBIT	5.00
Less: Interest on debt (10%)	1.00
PBT	4.00
Less: Tax @ 25%	1.00
PAT	3.00
No of outstanding shares	40 lacs
EPS	7.50
Market price per share	75
PE Ratio	10 Times

TS Ltd. has an undistributed reserves of Rs. 8 crores. The company requires Rs. 3 crores for the purpose of expansion which is expected to earn the same rate of return on capital employed as present. However, if the debt to capital employed ratio is higher than 35%, then P/E ratio is expected to decline to 8 Times and rise in the cost of additional debt to 14%. Given this data which of the following options the company would prefer, and why?

Option (i) : If the required amount is raised through debt, and

Option (ii) : If the required amount is raised through equity and the new shares will be issued at a price of Rs. 25 each.

Answer:**WN 1: Computation of new EBIT:**

Particulars	Existing	Revised
EBIT (A)	5.00	5.6825 (22 cr x 22.73%)
Capital Employed (B)	22.00	25.00
Share capital (40 lacs x 10)	4.00	4.00
Reserves and surplus	8.00	8.00
Borrowing (1 cr/10%)	10.00	10.00
New fund raised		3.00
ROCE (A/B) x 100	22.73%	22.73%

WN 2: Computation of debt to capital employed for both options:

Particulars	Option 1	Option 2
Debt	13	10
Capital Employed	25	25
Debt to capital employed	52%	40%
Applicable PE Multiple	8	8

WN 3: Computation of market price of both options:

Particulars	Option 1	Option 2
EBIT	5.6825	5.6825
Less: Interest	1.4200 (1.00 + 0.42)	1.0000
EBT	4.2625	4.6825
Less: Tax @ 25%	1.0656	1.1706
PAT	3.1969	3.5119
No of shares	40 lacs	52 lacs
EPS	7.99	6.75
PE Multiple	8	8
New share price	63.92	54.00

Note:

- Interest under option 1 = 1 crores + (3 crores × 14%) = Rs.1.42 Crores
- No of shares under option 2 = 40 lacs + (3 crores/25) = 52 lacs

Conclusion:

- We should go ahead with option 1 due to higher Market Price Per Share

Part IV - Valuation of Convertible Instruments**36. Issue of convertible preference shares (May 2017)**

XYZ company has current earnings of Rs.3 per share with 5,00,000 shares outstanding. The company plans to issue 40,000, 7% convertible preference shares of Rs. 50 each at par. The preference shares are convertible into 2 shares for each preference shares held. The equity share has a current market price of Rs. 21 per share.

- What is preference share's conversion value?
- What is conversion premium?
- Assuming that total earnings remain the same, calculate the effect of the issue on the basic earning per share (a) before conversion (b) after conversion.
- If profits after tax increases by Rs. 1 million what will be the basic EPS (a) before conversion and (b) on a fully diluted basis?

Answer:**WN 1: Computation of conversion value and conversion premium:**

Particulars	Calculation	Amount
Conversion value	CMP of share × conversion ratio 21×2	Rs.42
Conversion premium		
Per preference share	$50 - 42$	Rs.8 per preference share
Per equity share	$\frac{8}{2}$	Rs.4 per equity share
% of conversion value	$\frac{8}{42} \times 100$	19.05% of conversion value

Note:

- Conversion premium can be expressed as per convertible instrument/per equity share/as a % of conversion value

WN 2: Computation of EPS if overall earnings remain same:

Particulars	Before conversion	After Conversion
Profit after tax (5,00,000 × 3)	15,00,000	15,00,000
Less: Preference Dividend (20,00,000 × 7%)	(1,40,000)	-
Earnings available to equity shareholders	13,60,000	15,00,000
Number of equity shares	5,00,000	5,80,000 [5,00,000 + 40,000 × 2]
Earnings per share (EAES/No of shares)	2.72	2.59

WN 3: Computation of EPS if overall earnings increase by Rs.10,00,000:

Particulars	Before conversion	After Conversion
Profit after tax [15,00,000 + 10,00,000]	25,00,000	25,00,000
Less: Preference Dividend (20,00,000 × 7%)	(1,40,000)	-
Earnings available to equity shareholders	23,60,000	25,00,000
Number of equity shares	5,00,000	5,80,000 [5,00,000 + 40,000 × 2]
Earnings per share (EAES/No of shares)	4.72	4.31

37. Convertible bond (May 2017 RTP, May 2018)

GHI Ltd., AAA rated company has issued, fully convertible bonds on the following terms, a year ago

Face value of bond	Rs.1000
Coupon (interest rate)	8.5%
Time to maturity (remaining)	3 years

Interest payment	Annual, at the end of year
Principal repayment	At the end of bond maturity
Conversion ratio (Number of shares per bond)	25
Current market price per share	Rs.45
Market price of convertible bond	Rs.1175

AAA rated company can issue plain vanilla bonds without conversion option at an interest rate of 9.5%.

Required:

- Straight value of bond
- Conversion value of the bond
- Conversion premium
- Percentage of downside risk
- Conversion parity price

Answer:**WN 1: Computation of straight value:**

- Straight value refers to the present value of future cash flows of convertible instrument discounted at investor's required rate of return.
- In this case we should discount bond's cash flows at comparable rate of 9.5%

Year	Cash flow	PVF @ 9.5%	DCF
1	85	0.913	77.61
2	85	0.834	70.89
3	1,085	0.762	826.77
			975.27

WN 2: Computation of conversion value and conversion premium:

Particulars	Calculation	Amount
Conversion value	CMP of share x conversion ratio 45 x 25	Rs.1,125
Conversion premium		
Per debenture	1,175 - 1,125	Rs.50 per debenture
Per equity share	$\frac{50}{25}$	Rs.2 per equity share
% of conversion value	$\frac{50}{1,125} \times 100$	4.44% of conversion value

WN 3: Computation of percentage of downside risk:

Particulars	Calculation	Amount
Downside risk in Rs.	CMP - Straight value	1,175 - 975.27 = Rs.199.73
Downside risk (%)		
% of straight value	$\frac{199.73}{975.27} \times 100$	20.48% of straight value
% of CMP	$\frac{199.73}{1,175} \times 100$	17.00% of CMP

WN 4: Computation of conversion parity price:

- Conversion parity price refers to the target price per equity share at which the investor will have no loss on conversion

$$\text{Conversion parity price} = \frac{1,175}{25} = \text{Rs. 47 per share}$$

38. Convertible bond (Nov 2016 RTP)

The following data is related to 8.5% fully convertible (into equity shares) debentures issued by ABC Limited at Rs.1000.

Market Price of Debenture	Rs.900
Conversion Ratio	30
Straight value of Debenture	Rs.700
Market price of equity share	Rs.25
Expected dividend per share	Rs.1

You are required to calculate:

- ❖ Conversion value of debenture
- ❖ Market conversion price
- ❖ Conversion premium per share
- ❖ Ratio of conversion premium
- ❖ Premium over straight value of debenture
- ❖ Favorable income differential per share
- ❖ Premium pay-back period

Answer:

Particulars	Calculation	Amount
Conversion value	$\text{CMP of share} \times \text{conversion ratio}$ 25×30	750
Market conversion price (or) Conversion parity price	$\frac{\text{CMP of bond}}{\text{Conversion ratio}} = \frac{900}{30}$	30
Conversion premium		
Per debenture	$900 - 750$	Rs.150 per debenture
Per equity share	$\frac{150}{30}$	Rs.5 per equity share
Ratio of conversion premium	$\frac{150}{750} \times 100$	20% of conversion value
Premium over straight value:		
Premium over SV (in rupees)	$\text{CMP} - \text{straight value}$ $900 - 700$	Rs.200 per debenture
Premium over SV (in %)	$\frac{200}{700} \times 100$	28.57% of straight value
Favorable income differential:		
Interest income per bond	$1,000 \times 8.5\%$	Rs.85 per debenture
Dividend income per share		Rs.1
Dividend income for 30 shares		Rs.30
Favorable income differential per bond	$\text{Rs.85} - \text{Rs.30}$	Rs.55 per bond
Favorable income differential per share	$\frac{55}{30}$	Rs.1.83 per share
Premium payback period	$\frac{\text{Conversion premium per share}}{\text{Income differential per share}}$	$\frac{5}{1.83} = 2.73 \text{ years}$

39. Conversion parity price and conversion premium (May 2019 RTP)

The data given below relates to a convertible bond:

Face value	Rs.250
Coupon rate	12%
No of shares per bond	20
Market price of share	Rs.12
Straight value of bond	Rs.235
Market price of convertible bond	Rs.265

Calculate:

- i. Stock value of bond
- ii. The percentage of downside risk
- iii. The conversion premium
- iv. The conversion parity price of the stock

Answer:

Particulars	Calculation	Amount
Stock value or conversion value	$20 \text{ shares} \times 12$	Rs.240
Percentage of downside risk		
Downside risk (in Rs.)	$\text{CMP of bond} - \text{straight value}$	Rs.30
Downside risk (in %)		
As % of CMP of bond	$\left(\frac{30}{265} \times 100 \right)$	11.32%

As % of straight value	$\left(\frac{30}{235} \times 100\right)$	12.77%
Conversion Premium		
Conversion premium (in Rs.)	CMP of bond – Conversion value	Rs.25
Conversion premium (in %)	$\left(\frac{25}{240} \times 100\right)$	10.42%
Conversion parity price	$\left(\frac{\text{CMP of bond}}{\text{Conversion ratio}}\right) = \left(\frac{265}{20}\right)$	Rs.13.25

Part V – Bond Valuation

40. Bond valuation (Nov 2019)

Nominal value of 10% bonds issued by a company is Rs.100. The bonds are redeemable at Rs.110 at the end of year 5. Determine the value of the bond if required yield is

- 5%
- 10%

What will be the price of the bond at the end of each of the next five years in case the required yield is 5%?

Answer:

WN 1: Valuation of bond if required yield is 5%:

- Price of bond is present value of future cash flows (Interest + Principal) discounted at investor's required rate of return of 5%

Year	Cash flow	PVF @ 5%	DCF
1 to 5	10	4.330	43.30
5	110	0.784	86.24
Value of bond			129.54

WN 2: Valuation of bond if required yield is 10%:

Year	Cash flow	PVF @ 10%	DCF
1 to 5	10	3.790	37.90
5	110	0.621	68.31
Value of bond			106.21

WN 3: Valuation of bond at end of each of next five years in case required return is 5%:

Particulars	Calculation	Amount
Price on day 0 (P0)		129.54
Price in year 1:		
Day 0 price		129.54
Add: Required return of 5%	$129.54 \times 5\%$	6.48
Target price in year 1		136.02
Less: Interest earned in year 1		(10)
Expected price in year 1		126.02
Price in year 2:		
Year 1 Price		126.02
Add: Required return of 5%	$126.02 \times 5\%$	6.30
Target price in year 2		132.32
Less: Interest earned in year 2		(10)
Expected price in year 2		122.32
Price in year 3:		
Year 2 Price		122.32
Add: Required return of 5%	$122.32 \times 5\%$	6.11
Target price in year 3		128.43
Less: Interest earned in year 3		(10)
Expected price in year 3		118.43
Price in year 4:		
Year 3 Price		118.43
Add: Required return of 5%	$118.43 \times 5\%$	5.92

Target price in year 4		124.35
Less: Interest earned in year 4		(10)
Expected price in year 4		114.35
Price in year 5:		
Year 4 Price		114.35
Add: Required return of 5%	$114.35 \times 5\%$	5.72
Target price in year 5		120.07
Less: Interest earned in year 4		(10)
Redemption value of year 5		110.07#

Redemption value for year 5 should be Rs.100. However, difference of Rs.0.07 is due to rounding-off issues.

41. Bond valuation (May 2016)

M/s Agfa Industries is planning to issue a debenture series on the following terms

Face value	Rs.100
Term of maturity	10 years
Yearly coupon rate	
Years	
1-4	9%
5-8	10%
9-10	14%

The current market rate on similar debentures is 15 percent per annum. The company proposes to price the issue in such a manner that it can yield 16 percent compounded rate of return to the investors. The company also proposes to redeem the debentures at 5 percent premium on maturity. Determine the issue price of the debentures.

Answer:

Computation of issue price of debentures:

- Interest rate on similar debentures is 15%. However, the company proposes to issue the price in such a manner the investor can earn 16 percent return. Hence, we should discount the cash flows at 16 percent to compute the issue price of debentures

Year	Cash flow	PVF@16%	DCF
1	9	0.862	7.76
2	9	0.743	6.69
3	9	0.641	5.77
4	9	0.552	4.97
5	10	0.476	4.76
6	10	0.410	4.10
7	10	0.354	3.54
8	10	0.305	3.05
9	14	0.263	3.68
10	119	0.227	27.01
Issue price of debentures			71.33

42. Calculation of current yield, YTM & Intrinsic value (May 2019 RTP)

Based on the credit rating, Mr. Bond has decided to apply the following discount rates for valuing bonds:

Credit Rating	Discount Rate
AAA	364 day T bill rate + 3% spread
AA	AAA + 2% spread
A	AAA + 3% spread

He is considering investing in AA rated, Rs.1, 000 face value bond currently selling at Rs.1, 025.86. The bond has five years to maturity and the coupon rate on the bond is 15% p.a. payable annually. The next interest payment is due one year from today and the bond is redeemable at par. (The 364 day T-bill rate to be 9%). You are required to calculate the intrinsic value of the bond for Mr. Bond should he invest in the bond? Also calculate the current yield and the Yield to Maturity (YTM) of the bond.

Answer:

WN 1: Computation of intrinsic value:

- Mr. Bond is investing in AA rated bond. Required return for AA rated bond is AAA rated + 2% spread
- Required return for AAA rated bond is 9% + 3% = 12%
- Required return for AA rated bond is 12% + 2% = 14%

Year	Cash flow	PVF @ 14%	DCF
1 to 5	150	3.433	514.95
5	1,000	0.519	519.00
Fair value of bond			1,033.95

Conclusion:

- CMP of bond is Rs.1,025.86 whereas fair value of bond is Rs.1,033.95. Bond is currently undervalued and we should invest in bond

WN 2: Computation of Yield to Maturity:

Year	Cash flow	PVF @ 14%	DCF	PVF@ 15%	DCF
0	-1,025.86	1	-1,025.86	1	-1,025.86
1	150.00	3.433	514.95	3.352	502.80
5	1,000.00	0.519	519.00	0.497	497.00
NPV			8.09		-26.06

$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$					
$IRR = 14 + \frac{8.09}{8.09 - (-26.06)} \times (15 - 14); IRR = 14 + \frac{8.09}{34.15} \times (1); IRR = 14 + 0.24 = 14.24\%$					

- Yield to maturity = 14.24%

WN 3: Computation of current yield:

$$\text{Current yield} = \frac{\text{Interest}}{\text{Current Market Price}} = \frac{150}{1,025.86} \times 100 = 14.62\%$$

43. Calculation of Minimum Price (May 2015 RTP)

Suppose Mr. A is offered a 10% Convertible Bond (par value Rs. 1,000) which either can be redeemed after 4 years at a premium of 5% or get converted into 25 equity shares currently trading at Rs. 33.50 and expected to grow by 5% each year. You are required to determine the minimum price Mr. A shall be ready to pay for bond if his expected rate of return is 11%.

Answer:**Computation of minimum price:**

- Minimum price refers to the present value of bond computed using certain cash flows. Redemption value under certain cash flow is computed by taking principal as redemption value.
- In case of convertible bond, redemption value will be taken as higher of principal value and expected value of shares. However, for minimum price we should only take principal value as redemption value

Year	Cash flow	PVF @ 11%	DCF
1 to 4	100	3.103	310.30
4	1,050	0.659	691.95
Minimum price of bond			1,002.25

44. Bond valuation (Nov 2013)

ABC Ltd. issued 9%, 5 year bonds of Rs. 1,000/- each having a 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 the intrinsic value of bond?

Answer:**Computation of intrinsic value:**

Year	Cash flow	PVF	DCF

1	90	0.893	80.37
2	90	0.803	72.27
3	1,090	0.725	790.25
Intrinsic value of bond			942.89

Note:

$$\text{PVF of year 1} = \left(\frac{1}{1.12} \right) = 0.893$$

$$\text{PVF of year 2} = \left(\frac{\text{PVF of year 1}}{1.1125} \right) = 0.803$$

$$\text{PVF of year 3} = \left(\frac{\text{PVF of year 2}}{1.1075} \right) = 0.725$$

45. Duration and volatility (Nov 2015)

The following data is available for a bond:

Face value	Rs.1,000
Coupon Rate	11%
Years to maturity	6
Redemption value	Rs.1,000
Yield to Maturity	15%

Calculate the following in respect of the bond:

- Current market price
- Duration of the bond
- Volatility of the bond
- Expected market price if increase in required yield is by 100 basis points
- Expected market price if decrease in required yield is by 75 basis points

Answer:

WN 1: Computation of Current Market Price and Duration:

Year	Cash flow	PVF @ 15%	DCF	Weight	Product
1	110	0.870	95.70	0.1128	0.1128
2	110	0.756	83.16	0.0980	0.1960
3	110	0.658	72.38	0.0853	0.2559
4	110	0.572	62.92	0.0742	0.2968
5	110	0.497	54.67	0.0644	0.3220
6	1,110	0.432	479.52	0.5652	3.3912
			848.35		4.5747

- Current market price = Rs.848.35
- Duration = 4.5747 years

WN 2: Computation of volatility:

$$\text{Volatility} = \frac{\text{Duration}}{1 + \text{YTM}} = \frac{4.5747}{1 + 15\%} = 3.97\%$$

WN 3: Computation of expected price if the yield increases by 100 bps:

- Volatility of 3.97% would mean that bond price will change by 3.97% for 1% change in yield
- Yield has increase by 1 percent and hence bond price will fall by 3.97%
- New price = 848.35 - 3.97% = Rs.814.67

WN 4: Computation of expected price if the yield decreases by 75 bps:

- Yield has fallen by 0.75% and hence price will increase by 2.98% (3.97 x 0.75)
- New price = 848.35 + 2.98% = Rs.873.63

46. Computation of Yield to Maturity (Nov 2020 RTP):

Today being 1st January 2019, Ram is considering to purchase an outstanding Corporate Bond having a face value of ` 1,000 that was issued on 1st January 2017 which has 9.5% Annual Coupon and 20 years of original maturity (i.e. maturing on 31st December 2027). Since the bond was issued, the interest rates have been on downside and it is now selling at a premium of ` 125.75 per bond.

Determine the prevailing interest on the similar type of Bonds if it is held till the maturity which shall be at Par.

PV factors of 6% and 8% is to be used for computing prevailing interest rate

Answer:

WN 1: Computation of NPV at 6% and 8%:

Year	Cash flow	PVF @ 6%	DCF	PVF @ 8%	DCF
0	-1,125.75	1	-1,125.75	1	-1,125.75
1 to 9	95.00	6.801	646.10	6.246	593.37
9	1,000.00	0.592	592.00	0.500	500.00
NPV			112.35		-32.38

$$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$$

$$IRR = 6 + \frac{112.35}{112.35 - (-32.38)} \times (8 - 6); IRR = 6 + \frac{112.35}{144.73} \times (2); IRR = 6 + 1.55 = 7.55\%$$

YTM = 7.55% and thus, prevailing interest rate on similar type of Bonds shall be approx. 7.55%

47. Duration (May 2012 RTP)

ABC Ltd. has made an issue of 14 % non-convertible debentures on January 1, 2007. These debentures have a face value of Rs.100 and are currently traded in the market at a price of Rs. 90. Interest on these NCDs will be paid through post-dated cheque dated June 30 and December 31. Interest payments for the first 3 years will be paid in advance through post-dated cheque while for the last 2 years post-dated cheque will be issued at the third year. The bond is redeemable at par on December 31, 2011 at the end of 5 years.

Required:

- Estimate the current yield & the YTM of the bond.
- Calculate the duration of the NCD.
- Assuming that intermediate coupon payments are, not available for reinvestment. Calculate the realized yield on the NCD.

Answer:

WN 1: Computation of current yield:

$$\text{Current Yield} = \frac{\text{Interest}}{\text{Current Market Price}} = \frac{7}{90} \times 100 = 7.78\% \text{ per half year (or) } 15.56\% \text{ per year}$$

WN 2: Computation of Yield to Maturity:

Period	Cash flow	PVF @ 8%	DCF	PVF @ 9%	DCF
0	(90)	1.000	(90.00)	1.000	(90.00)
1 to 10	7	6.710	46.97	6.417	44.92
10	100	0.463	46.30	0.422	42.20
NPV			3.27		-2.88

$$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$$

$$IRR = 8 + \frac{3.27}{3.27 - (-2.88)} \times (9 - 8); IRR = 8 + \frac{3.27}{6.15} \times (1); IRR = 8 + 0.53 = 8.53\%$$

- YTM = 8.53 percent per half year (or) 17.06 percent per year

WN 3: Computation of duration:

Period	Cash flow	PVF @ 8.53%	DCF	Weight	Product
1	7	0.921	6.45	0.0717	0.0717
2	7	0.849	5.94	0.066	0.132
3	7	0.782	5.47	0.0608	0.1824
4	7	0.721	5.05	0.0561	0.2244
5	7	0.664	4.65	0.0517	0.2585
6	7	0.612	4.28	0.0476	0.2856

7	7	0.564	3.95	0.0439	0.3073
8	7	0.52	3.64	0.0405	0.324
9	7	0.479	3.35	0.0372	0.3348
10	107	0.441	47.19	0.5245	5.245
Total			89.97		7.3657

- Duration = 7.3657 half-years (or) 3.6829 years

WN 4: Computation of realized YTM if intermediate cash flows are not available for reinvestment:

- The bond will earn interest of Rs.14 per year and will earn Rs.70 for 5 years. These amounts are not available for reinvestment and hence the value at the end of five years is Rs.70
- We would receive principal of Rs.100 and hence the maturity value at end of five years is Rs.170
- Investment made today is Rs.70
- The life of instrument is five years and hence we cannot take square root and find realized YTM. We will have to do it in the same manner as that of IRR calculation

Period	Cash flow	PVF @ 6%	DCF	PVF @ 7%	Product
0	(90)	1.000	(90.00)	1.000	(90.00)
10	170	0.558	94.86	0.508	86.36
NPV			4.86		(3.64)

$$IRR = L_1 + \frac{NPV \text{ at } L_1}{NPV \text{ at } L_1 - NPV \text{ at } L_2} \times (L_2 - L_1)$$

$$IRR = 6 + \frac{4.86}{4.86 - (-3.64)} \times (7 - 6); IRR = 6 + \frac{4.86}{8.50} \times (1); IRR = 6 + 0.57 = 6.57\%$$

- Realized YTM will be 6.57 percent per half year (or) 13.14 percent per year

48. Portfolio creation based on duration (Nov 2015)

Mr. A will need Rs.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	Rs.1000	Rs.1000
Coupon	7% payable annually	8% payable annually
Years to maturity	1	4
Current price	Rs.972.73	Rs.936.52
Current yield	10%	10%

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 what quantity? Assume that there will not be any call risk or default risk.

Answer:

WN 1: Computation of Duration of Bond X and Bond Y:

- Investor wants money after two years and hence his investment horizon is for two years. We can immunize his portfolio if the weighted duration of Mr.A's portfolio is of 2 years

Duration of Bond X:

- Life of Bond X is of 1 year and hence it will have single cash flow. Consequently, duration of Bond X will be equal to 1 year

Duration of Bond Y:

Year	Cash flow	PVF @ 10%	DCF	Weight	Product
1	80	0.909	72.72	0.078	0.078
2	80	0.826	66.08	0.071	0.142
3	80	0.751	60.08	0.064	0.192
4	1,080	0.683	737.64	0.788	3.152
Total			936.52		3.564

- Current yield given in the question is basically yield to maturity

WN 2: Computation of investment in Bond X and Bond Y:

- Let us assume W1 to be the proportion of investment in Bond X and (1-W1) to be the proportion of investment in Bond Y

Bond	Weight	Duration	Product
X	W1	1	W1
Y	1-W1	3.564	3.564 - 3.564W1
Total	1		W1 + 3.564 - 3.564W1 = 2

$$W1 + 3.564 - 3.564W1 = 2$$

$$-2.564W1 = -1.564$$

$$W1 = \left(\frac{1.564}{2.564} \right) = 0.6099 \sim 0.61$$

Proportion of investment in Security 1 = 0.61

Proportion of investment in Security 2 = 0.39

WN 3: Computation of number of bonds to be purchased:

Particulars	Calculation	Amount
1. Money required after two years		1,00,000
2. Money to be invested today	$\frac{1,00,000}{1.10^2}$	82,600
3. Amount to be invested in Bond X	82,600 × 61%	50,386
4. Amount to be invested in Bond Y	82,600 × 39%	32,214
5. Number of bonds of X to be purchased	$\frac{50,386}{972.73}$	52
6. Number of bonds of Y to be purchased	$\frac{32,214}{936.52}$	34

49. Immunizing portfolio (Nov 2018)

The following data are available for three bonds A, B and C. These bonds are used by a bond portfolio manager to fund an outflow scheduled in 6 years. Current yield is 9%. All bonds have face value of Rs.100 each and will be redeemed at par. Interest is payable annually.

Bond	Maturity (Years)	Coupon Rate
A	10	10%
B	8	11%
C	5	9%

- Calculate the duration of each bond
- The bond portfolio manager has been asked to keep 45% of the portfolio money in Bond A. Calculate the percentage amount to be invested in bonds B and C that need to be purchased to immunize the portfolio
- After the portfolio has been formulated, an interest rate change occurs, increasing the yield to 11%. The new duration of these bonds are: Bond A = 7.15 years, Bond B = 6.03 years and Bond C = 4.27 years. Is the portfolio still immunized? Why or why not?
- Determine the new percentage of B and C bonds that are needed to immunize the portfolio. Bond A remains at 45% of the portfolio.

Answer:

WN 1: Computation of duration of bond:**Computation of Duration of Bond A:**

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	10	0.917	9.17	0.086	0.086
2	10	0.842	8.42	0.079	0.158
3	10	0.772	7.72	0.073	0.219
4	10	0.708	7.08	0.067	0.268
5	10	0.65	6.5	0.061	0.305
6	10	0.596	5.96	0.056	0.336
7	10	0.547	5.47	0.051	0.357
8	10	0.502	5.02	0.047	0.376
9	10	0.46	4.6	0.043	0.387

10	110	0.422	46.42	0.436	4.36
Total			106.36		6.852

- Duration of Bond A = 6.85 years

Computation of Duration of Bond B:

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	11	0.917	10.09	0.091	0.091
2	11	0.842	9.26	0.083	0.166
3	11	0.772	8.49	0.076	0.228
4	11	0.708	7.79	0.07	0.28
5	11	0.65	7.15	0.064	0.32
6	11	0.596	6.56	0.059	0.354
7	11	0.547	6.02	0.054	0.378
8	111	0.502	55.72	0.502	4.016
Total			111.08		5.833

- Duration of Bond B = 5.83 years

Computation of Duration of Bond C:

Year	Cash flow	PVF @ 9%	DCF	Weight	Product
1	9	0.917	8.25	0.083	0.083
2	9	0.842	7.58	0.076	0.152
3	9	0.772	6.95	0.07	0.21
4	9	0.708	6.37	0.064	0.256
5	109	0.65	70.85	0.709	3.545
Total			100		4.246

- Duration of Bond C = 4.25 years

WN 2: Computation of percentage amount to be invested in Bond B and C to immunize the portfolio:

- The portfolio manager has scheduled outflow after 6 years and hence his investment horizon will be of 6 years. We should ensure the weighted duration of portfolio is of 6 years
- Let us assume b to be the proportion of investment in Bond B
- Proportion of investment in Bond C = $1 - 0.45 - b$

Bond	Weight	Duration	Product
A	0.45	6.85	3.0825
B	b	5.83	5.83b
C	$1 - 0.45 - b$	4.25	$4.25 - 1.9125 - 4.25b$
Total			$5.42 - 1.58b = 6$

Investment in Bond B:

$$5.42 - 1.58b = 6; 1.58b = 0.58; b = \frac{0.58}{1.58} = 0.3671$$

- Hence 36.71 percent of investment is to be made in Bond B

Investment in Bond C:

- Investment in Bond C = $100 - 45\% - 36.71\% = 18.29\%$
- Hence 18.29 percent of investment is to be made in Bond C

WN 3: Checking on immunization with revised duration:

Bond	Weight	Duration	Product
A	0.45	7.15	3.2175
B	0.3671	6.03	2.2136
C	0.1829	4.27	0.7810
Total			6.2121

- Portfolio is not immunized as the duration of the portfolio has increased from 6 years to 6.21 years

WN 4: Computation of percentage investment to immunize the portfolio with revised duration of bonds:

- Let us assume b to be the proportion of investment in Bond B

- Proportion of investment in Bond C = $1 - 0.45 - b$

Bond	Weight	Duration	Product
A	0.45	7.15	3.2175
B	b	6.03	6.03b
C	$1 - 0.45 - b$	4.27	$4.27 - 1.9215 - 4.27b$
Total			$5.566 - 1.76b = 6$

Investment in Bond B:

$$5.566 - 1.76b = 6; 1.76b = 0.434; b = \frac{0.434}{1.76} = 0.2466$$

- Hence 24.66 percent of investment is to be made in Bond B

Investment in Bond C:

- Investment in Bond C = $100 - 45\% - 24.66\% = 30.34\%$
- Hence 30.34 percent of investment is to be made in Bond C

50. Bond refunding (Nov 2016 RTP)

ABC Ltd. is contemplating calling Rs. 3 crores of 30 year Rs. 1,000 bond issued 5 years ago with a coupon interest rate of 14 %. The bonds have a call price of Rs. 1,140 and had initially collected proceeds of Rs. 2.91 crores due to a discount of Rs. 30 per bond. The initial floating cost was Rs. 3, 60,000. The Company intends to sell Rs. 3 crores of 12% 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 Rs. 1,000. The estimated floatation cost is Rs. 4, 00,000. The company is paying 40% tax and it's after cost of debt is 8 %. 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?

Answer:**WN 1: Initial Outflow:**

Particulars	Calculation	Amount (in lacs)
Redemption value of old bond	$\left(\frac{300}{1,000}\right) \times 1,140$	(342)
Tax premium on redemption of old bonds	$42 \times 40\%$	16.80
Tax benefit on write-off of discount on old bond	$\frac{9}{30} \times 25 \times 40\%$	3.00
Tax benefit on write-off of floatation cost of old bond	$\frac{3.60}{30} \times 25 \times 40\%$	1.20
Inflow from new bonds	$300 - 4$	296
Overlapping interest (Note 1)	$300 \times 14\% \times \frac{2}{12} \times 60\%$	(4.2)
Initial Outflow		(29.20)

Note:

- Overlapping interest is the extra interest to be paid due to delay in redemption of old bond. During this period, interest would be paid for both old and new bonds. Under bond refunding, the assumption is that we have redeemed the old bond and replaced with new bond. Hence any interest paid on old bond will be called as overlapping interest

WN 2: In-between flows:

(in lacs)

Particulars	Old Bond	New Bond
Interest cost	42 [$300 \times 14\%$]	36 [$300 \times 12\%$]
Tax on interest	(16.80) [$42 \times 40\%$]	(14.40) [$36 \times 40\%$]
Tax on floatation cost	(0.048) [$3.6/30 \times 40\%$]	(0.064) [$4/25 \times 40\%$]
Tax on discount	(0.12) [$9/30 \times 40\%$]	-
Net cash flow	25.032	21.536

- Annual cash flow savings = 25.032 – 21.536 = 3.496 lacs

WN 3: Terminal flow:

(in lacs)

Particulars	Old Bond	New Bond
Redemption value	(300)	(300)

- Net incremental cash flow = 0

WN 4: Computation of NPV:

(in lacs)

Year	Cash flow	PVF @ 8%	DCF
0	(29.20)	1.000	(29.20)
1 to 25	3.496	10.675	37.32
NPV			8.12

- The company should go ahead with bond refunding as it results in positive NPV of Rs.8.12 lacs

51. Bond valuation (May 2015)

On 31st March 2013, the following information about Bonds is available:

Name of Security	Face Value	Maturity Date	Coupon Rate	Coupon Dates
Zero coupon	10,000	31 st March, 2023	N.A.	N.A.
T-Bill	1,00,000	20 th June, 2013	N.A.	N.A.
10.71% GOI 2023	100	31 st March, 2023	10.71	31 st March
10% GOI 2018	100	31 st March, 2018	10.00	31 st March and 31 st October

Calculate:

- If 10 years yield is 7.5 percent p.a. what price the zero coupon bond would fetch on 31st March, 2013?
- What will be the annualized yield if the T-Bill is traded @98500?
- If 10.71% GOI 2023 Bond having yield to maturity is 8%, what price would it fetch on April 1, 2013 (after coupon payment on 31st March)?
- 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)?

Answer:**WN 1: Valuation of Zero-Coupon Bond:**

Year	Cash flow	PVF @ 7.5%	DCF
10	10,000	0.4852	4,852
Value of Bond			4,852

WN 2: Computation of annualized yield of treasury bill:

- Investment of Rs.98,500 today will become Rs.1,00,000 in 81 days

$$\text{Return} = \frac{1,00,000 - 98,500}{98,500} \times \frac{365}{81} \times 100 = 6.86\%$$

WN 3: Valuation of 10.71% GOI 2023 Bond:

Year	Cash flow	PVF @ 8%	DCF
1 to 10	10.71	6.710	71.86
10	100	0.463	46.30
Value of bond			118.16

WN 4: Valuation of 10% GOI 2018 Bond:

Period	Cash flow	PVF @ 4%	DCF
1 to 10	5	8.110	40.55
10	100	0.676	67.60
Value of bond			108.15

Note:

- Bond pays half-yearly interest and hence we should half-yearly discounting. Discount rate is 8% per annum and same would be equal to 4% per half-year

52. Miscellaneous - Calculation of forward rates (Nov 2015 RTP)

Consider the following data for Government Securities:

Face Value	Interest Rate (%)	Maturity (years)	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

Answer:

WN 1: Computation of forward rate of year 1(r₁):

Analysis of 1-year bond

Year	Cash flow	PVF	DCF
0	(91,000)	1.000	(91,000)
1	1,00,000	0.91	91,000
			0

Note:

- Current market price of 1-year bond is Rs.91,000. The bond does not pay any interest and hence on maturity we will receive 1,00,000
- r₁ will be the forward rate for year 1 and should be the discount rate at which the PV of 1,00,000 is Rs.91,000 (Today's value)
- From above calculation we can find that PVF for year 1 is 0.91

$$\frac{1}{1 + r_1} = 0.91; 1 + r_1 = \frac{1}{0.91}; 1 + r_1 = 1.0989; r_1 = 0.0989 \text{ or } 9.89\%$$
- From above calculations we can conclude that forward rate for year 1 is 9.89%

WN 2: Computation of forward rate of year 2(r₂):

Analysis of 2-year bond

Year	Cash flow	PVF	DCF
0	(99,000)	1.000	(99,000)
1	10,500	0.91	9,555
2	1,10,500	0.8095	89,445
Total			0

Note:

- We need to first populate the cash flows of the bond. Year 0 is current market price, year 1 would be interest income & year 2 would be interest + principal redemption
- PVF for year 1 would be 0.91 based on forward rate of 9.89%
- PVF for year 2 is taken as balancing figure. PVF of year 2 = 89,445/1,10,500 = 0.8095; 89,445 is taken as balancing figure to make the total of DCF as 0
- We can now compute r₂ using the below calculation

$$\frac{\text{PVF of year 1}}{1 + r_2} = 0.8095; 1 + r_2 = \frac{0.91}{0.8095}; 1 + r_2 = 1.1242; r_2 = 0.1242 \text{ (or) } 12.42\%$$
- From above calculations we can conclude that forward rate of year 2 is 12.42%

WN 3: Computation of forward rate of year 3 (r₃):

Analysis of 3-year bond:

Year	Cash flow	PVF	DCF
0	(99,500)	1.000	(99,500)
1	11,000	0.91	10,010
2	11,000	0.8095	8,905
3	1,11,000	0.7260	80,585
Total			0

Note:

- PVF for year 1 and year 2 is taken as per WN 2
- PVF for year 3 is taken as balancing figure. PVF of year 3 = 80,585/1,11,000 = 0.7256; 80,585 is taken as balancing figure to make the total of DCF as 0
- We can now compute r₃ using the below calculation

$$\frac{\text{PVF of year 2}}{1 + r_3} = 0.7256; 1 + r_3 = \frac{0.8095}{0.7260}; 1 + r_3 = 1.1150; r_3 = 0.1150 \text{ or } 11.50\%$$

- From above calculations we can conclude that forward rate of year 3 is 11.50%

WN 4: Computation of forward rate of year 4(r₄):**Analysis of 4-year bond:**

Year	Cash flow	PVF	DCF
0	(99,900)	1.000	(99,900)
1	11,500	0.91	10,465
2	11,500	0.8095	9,309
3	11,500	0.7260	8,349
4	1,11,500	0.6437	71,777
Total			0

Note:

- We can now compute r₄ using the below calculation

$$\frac{\text{PVF of year 3}}{1 + r_4} = 0.6437; 1 + r_4 = \frac{0.7260}{0.6437}; 1 + r_4 = 1.1279; r_4 = 0.1279 \text{ (or) } 12.79\%$$
- From above calculations we can conclude that forward rate of year 4 is 12.79%

53. Calculation of forward rates (Nov 2016 RTP)

The following is the yield structure of AAA rated debenture:

❖ 3 Months	:	8.5%
❖ 6 months	:	9.25%
❖ 1 year	:	10.50%
❖ 2 years	:	11.25%
❖ 3 years and above	:	12.00%

Required:

- Based on the expectation theory calculate the implicit one-year forward rates in year 2 and year 3
- If the interest rate increases by 50 basis points, what will be the percentage change in the price of the bond having a maturity of 5 years? Assume that the bond is fairly priced at the moment at Rs. 1,000

Answer:**WN 1: Computation of implicit one-year forward rate in year 2 and year 3:****Forward rate in year 2:**

$$\text{Forward rate in year 2} = \frac{\text{FVF for year 2}}{\text{FVF for year 1}} - 1 = \frac{(1 + 11.25\%)^2}{(1 + 10.50\%)} - 1 = 1.1200 - 1 = 12.00\%$$

Forward rate in year 3:

$$\text{Forward rate in year 3} = \frac{\text{FVF for year 3}}{\text{FVF for year 2}} - 1 = \frac{(1 + 12.00\%)^3}{(1 + 11.25\%)^2} - 1 = 1.1352 - 1 = 13.52\%$$

WN 2: Computation of percentage change in bond prices if interest rate increases by 0.50%:

- 5-year bond has required yield of 12 percent. The bond is fairly priced at Rs.1,000. Bond is quoted at par and hence interest rate on bond should be equal to yield of bond. The required yield of bond increases by 0.50% and the revised yield of bond would be 12.50%

New price of bond:

Year	Cash flow	PVF @ 12.50%	DCF
1 to 5	120	3.561	427.32
5	1,000	0.555	555.00
Revised Price			982.32

$$\% \text{ fall in price} = \frac{1,000 - 982.32}{1,000} \times 100 = 1.77\%$$

Note: The change in price can also be computed with the help of duration and volatility.

54. Impact on interest coverage (Nov 2012)

Tiger Limited is presently working with an EBIT of Rs.90 lacs. Its present borrowings are as follows:

Particulars	Amount in lacs
12% term loan	300

Working capital borrowings	
From bank at 15%	200
Public deposit at 11%	100

The sales of the company are growing and to support this, the company proposes to obtain additional borrowing of Rs.100 lacs expected to cost 16%. The increase in EBIT is expected to be 15%.

Calculate the change in interest coverage ratio after the additional borrowing is effected and comment on the arrangement made.

Answer:

Particulars	Existing	Revised
EBIT (A)	90.00	103.50 [90 + 15%]
Interest expenditure		
12% term loan	36.00	36.00
15% WC borrowing	30.00	30.00
Public deposit	11.00	11.00
16% new borrowing	0.00	16.00
Total interest cost (B)	77.00	93.00
Interest coverage (A/B)	1.169	1.113

Comment:

With the proposed increase in the sales the burden of interest on additional borrowings of Rs.100 lacs will adversely affect the interest coverage ratio which has been reduced from 1.169 times to 1.113 times

55. Bond refunding (May 2013)

M/s. Earth Limited has 11% bond worth of Rs. 2 crores outstanding with 10 years remaining to maturity. The company is contemplating the issue of a Rs. 2 crores 10 year bond carrying the coupon rate of 9% and use the proceeds to liquidate the old bonds. The unamortized portion of issue cost on the old bonds is Rs. 3 lakhs which can be written off no sooner the old bonds are called. The company is paying 30% tax and it's after tax cost of debt is 7%. Should Earth Limited liquidate the old bonds? You may assume that the issue cost of the new bonds will be Rs. 2.5 lakhs and the call premium is 5%

Answer:

WN 1: Computation of initial outflow:

Particulars	Calculation	Amount (in lacs)
Cash flows relating to old bond:		
Value of old bonds redeemed		(200)
Call premium on old bonds	200 x 5%	(10)
Tax benefit on write off of call premium of old bonds	10 x 30%	3
Tax benefit on write off of issue cost of old bonds	3 x 30%	0.9
Cash flows relating to new bond:		
Value of issue of new bond		200
Issue cost of new bond		(2.5)
Net initial outflow		8.6

Note:

- ❖ All items associated with old bond will be written off on day 0 and the company would get tax benefit on the same. Items to be written off are floatation cost and call premium on old bond

WN 2: Computation of in-between cash flows:

Particulars	Old bond	New bond
Interest outflow	22 (200 x 11%)	18 (200 x 9%)
Less: Tax saving on interest	(6.6)	(5.4)
Less: Tax benefit on w/o off floatation cost	0.09 [3 lacs/10 years x 30%]	0.075 [2.5 lacs/10 years x 30%]
Net outflow	15.31	12.525

- ❖ Net annual savings = 15.31 lacs - 12.525 lacs = 2.785 lacs

WN 3: Computation of NPV of refunding decision:

(in lacs)

Year	Cash flow	PVF @ 7%	DCF
0	(8.6)	1	(8.6)
1 to 10	2.785	7.024	19.56
NPV of refunding decision			10.96

Decision: The bond should be refunded as the same generates positive NPV of 10.96 lacs

56. Concept based on duration (May 2014 RTP):

Mr.A is planning for making investment in bonds of one of the two companies X Limited and Y Limited. Duration of bond X is 4.9 years and that of bond Y is 4.63 years. Mr.A considers duration as the basis for decision making, you are required to decide which Bond should Mr.A invest in?

Answer:

- Duration of Bond Y is lower and hence the same will have low volatility. Hence Mr.A should go ahead with Bond Y due to lower duration

57. Convertible bond (Nov 2016)

A Limited has issued convertible bonds, which carries a coupon rate of 14%. Each bond is convertible into 20 equity shares of the company A Limited. The prevailing interest rate for similar credit rating bond is 8%. The convertible bond has 5 years maturity. It is redeemable at par at Rs.100.

You are required to estimate:

- Current market price of the bond, assuming it being equal to its fundamental value
- Minimum market price of equity share at which bond holder should exercise conversion option and
- Duration of the bond

Answer:

WN 1: Computation of current market price and duration

Year	Cash flow	PVF @ 8%	DCF	Weight	Product
1	14	0.926	12.96	0.105	0.105
2	14	0.857	12	0.097	0.194
3	14	0.794	11.12	0.09	0.27
4	14	0.735	10.29	0.083	0.332
5	114	0.681	77.63	0.626	3.13
Market value			124	Duration	4.03 years

Note 1: Computation of redemption value:

- ❖ Redemption value of convertible bond on maturity date would be higher of the following:
 - **Conversion value of bond:** The details on share price is not available and hence this cannot be computed
 - **Redemption as bond:** The bond can be redeemed on maturity date at par value of Rs.100
- ❖ Redemption value in this case would be taken as Rs.100 due to absence of information on conversion value of bond on maturity date.

Minimum market price at which the bond holder should exercise conversion option:

- ❖ Minimum market price is basically the conversion parity price
- ❖ Minimum price = (CMP of bond/Conversion ratio) = (124/20) = Rs.6.20 per share

58. Valuation of debt (Nov 2017 RTP)

Based on the following data, estimate the Net Asset Value (NAV) on 1st July 2016 on per unit basis of a Debt Fund:

Name of security	Face Value	Purchase Price	Maturity Date	No of securities	Coupon Dates	Duration of bonds
10.71% GOI 2028	100	104.78	31 st March 2028	1,00,000	31 st March	7.3494
10% GOI 2023	100	100.00	31 st March, 2023	50,000	31 st March & 30 th September	5.086
9.5% GOI 2021	100	97.93	31 st December 2021	40,000	30 th June & 31 st December	4.3949

8.5% SGL 2025	100	91.36	30 th June 2025	20,000	30 th June	6.5205

Number of units (Rs.10 face value each): 1,00,000

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 Rs.6,72,800 and Rs.2,37,400 respectively.

Answer:

WN 1: Computation of accrued interest:

- ❖ 10.71% GOI 2028 and 10% GOI 2023 would have last paid interest on March 31, 2016 and hence interest for the period April 1, 2016 to June 30, 2016 (3 months) would be accrued interest on NAV valuation date

Bond	Calculation	Amount
10.71% GOI 2028	$1,00,000 \times 100 \times 10.71\% \times (3/12)$	2,67,750
10% GOI 2023	$50,000 \times 100 \times 10\% \times (3/12)$	1,25,000
Total accrued interest		3,92,750

WN 2: Valuation of securities:

Name of security	Purchase Amount	Duration	Volatility (Duration/(1 + YTM%))	% change (Volatility × 0.75%)	Amount of change	Revised value
10.71% GOI 2028	1,04,78,000	7.3494	6.6813 [7.3494/1.10]	-5.0110	-5,25,053	99,52,947
10% GOI 2023	50,00,000	5.086	4.8438 [5.086/1.05]	-3.6329	-1,81,645	48,18,355
9.5% GOI 2021	39,17,200	4.3949	4.1856 [4.3949/1.05]	-3.1392	-1,22,969	37,94,231
8.5% SGL 2025	18,27,200	6.5205	5.9277 [6.5205/1.10]	4.4456	-81,230	17,45,970
Total value of all securities						2,03,11,503

WN 3: Computation of NAV:

Particulars	Amount
Value of securities (WN 2)	2,03,11,503
Accrued interest (WN 1)	3,92,750
Cash in hand	6,72,800
Total Assets (A)	2,13,77,050
Less: Expenditure accrued	(2,37,400)
Net Assets	2,11,39,650
No of units	1,00,000
NAV per unit (2,11,39,650/1,00,000)	Rs.211.40

59. Valuation of bond (Nov 2018 RTP)

Pet feed plc has outstanding, a high yield Bond with following features:

Face value	Rs.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%.

- If an investor expects that interest will be 8%, six years from now then how much he should pay for this bond now
- 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.

Answer:

Part 1:

- ❖ The interest rate in the market is expected to be 8% after six years. The bond is paying interest of 10% and hence the company will not extend the duration. This is because the company can issue new bonds at 8%

Year	Cash flow	PVF @ 8%	DCF
1 to 6	1,000	4.623	4,623
6	10,000	0.630	6,300
Expected price today			10,923

Part 2:

- ❖ The interest rate in the market turns out to be 12% after six years. The bond is paying interest of 10% and hence the company will extend the duration. This is because the company would like to continue with the bond having lower interest rate

Year	Cash flow	PVF @ 12%	DCF
1 to 6	1,000	4.111	4,111
6	10,000	0.507	5,070
Expected price at end of year 6			9,181

Note:

- ❖ The price has been calculated at end of year 6. This is because the company will get to know the interest rate only after 6 years. The bond value has been calculated as present value of future cash flows (**Year 7 to 12**) discounted back to year 6.
- ❖ Potential loss = 10,923 - 9,181 = Rs.1,742

60. Valuation of debt and preference portfolio (May 2017 RTP)

John inherited the following securities on his uncle's death:

Types of security	Nos.	Annual Coupon %	Maturity Years	Yield %
Bond A (Rs.1,000)	10	9	3	12
Bond B (Rs.1,000)	10	10	5	12
Preference shares C (Rs.100)	100	11	*	13*
Preference shares D (Rs.100)	100	12	*	13*

* likelihood of being called at a premium over par.

Compute the current value of his uncle's portfolio.

Answer:

Types of security	Note	Value
Bond A (Rs.1,000)	1	9,282
Bond B (Rs.1,000)	2	9,275
Preference shares C (Rs.100)	3	8,462
Preference shares D (Rs.100)	4	9,231
Total value		36,250

Note 1: Valuation of Bond A:

Year	Cash flow	PVF @ 12%	DCF
1 to 3	90	2.402	216.20
3	1,000	0.712	712.00
Expected price of 1 bond			928.2
Expected price of 10 bonds			9,282

Note 2: Valuation of Bond B:

Year	Cash flow	PVF @ 12%	DCF
1 to 5	100	3.605	360.50
5	1,000	0.567	567.00
Expected price of 1 bond			927.5
Expected price of 10 bonds			9,275

Note 3: Valuation of Preference Shares C:

- ❖ Details on life of preference shares is not given and hence preference shares would be treated like a perpetuity.
- ❖ $PV \text{ of perpetuity} = \left(\frac{\text{Perpetuity Amount}}{\text{Investor Expectation}} \right) = \frac{11}{13\%} = 84.62 \text{ per share}$
- ❖ Value of 100 shares = Rs.8,462

Note 4: Valuation of Preference Shares D:

- ❖ PV of perpetuity = $\left(\frac{\text{Perpetuity Amount}}{\text{Investor Expectation}} \right) = \frac{12}{13\%} = 92.31$ per share
- ❖ Value of 100 shares = Rs.9,231

61. Decision on conversion (May 2018)

Sabanam Limited has issued convertible debentures with coupon rate of 11%. Each debenture has an option to convert to 16 equity shares at any time until the date of maturity. Debentures will be redeemed at Rs.100 on maturity of 5 years. An investor generally requires a rate of return of 8% p.a. on a 5-year security. As an advisor, when will you advise the investor to exercise conversion for given market prices of the equity share of (i) Rs.5, (ii) Rs.6 and (iii) Rs.7.10.

Answer:

WN 1: Computation of current market price of bond

Year	Cash flow	PVF@8%	DCF
1 to 5	11	3.993	43.923
5	100	0.681	68.100
Value of bond			112.023

Note 1: Computation of redemption value:

- ❖ Redemption value of convertible bond on maturity date would be higher of the following:
 - **Conversion value of bond:** The details on share price on maturity date is not available and hence this cannot be computed
 - **Redemption as bond:** The bond can be redeemed on maturity date at par value of Rs.100
- ❖ Redemption value in this case would be taken as Rs.100 due to absence of information on conversion value of bond on maturity date.

WN 2: Decision on conversion of bond:

Market Price	Conversion ratio	Conversion value
Rs.5	16:1	Rs.80
Rs.6	16	Rs.96
Rs.7.10	16	Rs.113.60

Hence, unless the market price is Rs.7.10 conversion should not be exercised.

62. Computation of spread of yield from comparable bond (Nov 2019 RTP)

A hypothetical company ABC Limited issued a 10% debenture (Face value of Rs.1,000) of the duration of 10 years is currently trading at Rs.850 per debenture. The bond is convertible into 50 equity shares being currently quoted at Rs.17 per share. Calculate the spread of yield of the above bond from this comparable bond, if equivalent yield of the same is 11.80%

Answer:

Computation of NPV at 11% and 13%:

Year	Cash flow	PVF@11%	DCF	PVF@13%	DCF
0	(850)	1	(850)	1	(850)
1 to 10	100	5.889	588.90	5.426	542.60
10	1,000	0.352	352.00	0.295	295.00
NPV of Bond			90.90		-12.40

Computation of YTM:

YTM (IRR)	=	$L1 + \left(\frac{\text{NPV at L1}}{\text{NPV at L1} - \text{NPV at L2}} \right) \times (L2 - L1)$
YTM	=	$11 + \frac{90.90}{90.90 - (-12.40)} \times (13 - 11)$
YTM	=	11 + 1.76
YTM	=	12.76%

Spread from comparable bond:

- ❖ Spread from comparable bond = Spread of this bond - yield of comparable bond
- ❖ Spread from comparable bond = 12.76% - 11.80% = 0.96%

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Chapter 5 – Portfolio Management**Theory for solving problems**Notion of Return:

- ❖ Expected return is weighted average of possible returns with probability being the assigned weight
- ❖ It can also be calculated as simple mean of past returns if probability is not given
- ❖ Expected return ignores the concept of time value of money. Hence IRR of compounded annual rate of growth is most appropriate indicator of return
- ❖ Despite its limitations, simple mean is used as indicator of return because of following:
 - It is assumed that each year has equal probability of occurrence
 - Arithmetic mean is used to compute standard deviation which is a measure of risk

How to compute return?

- ❖ Return is a function of dividend and capital appreciation. The one year holding period return is calculated as under:

Return = $\frac{D_1 + (P_1 - P_0)}{P_0}$
D1 = Dividend of next year
P1 = Price of next year
P0 = Current year price

- ❖ If each year's return has a certain probability of occurrence, the expected return will be the weighted average of return with probability of occurrence being the assigned weight
- ❖ Other things (risk) remaining the same, the investment with higher return will be selected

Notion of Risk:

- ❖ Risk refers to volatility of returns and is measured with the help of standard deviation
- ❖ Standard deviation is a measure of risk and is compute with the help of following formula:

$$\text{Standard Deviation} = \sqrt{pd^2}$$

- ❖ Standard deviation can be measured in rupees or in percentages
- ❖ Other things (return) remaining the same, the stock with lower SD will be selected

Note: If probabilities are not given in the question then equal probability is to be assumed for every year.

Format for computing risk and return:

Probability	Return	Product	Deviation	Pd ²

Notion of diversification:

- ❖ Diversification means investing in more than one stock. Investing in more than one stock is called building a portfolio
- ❖ Diversification reduces risk if an “economic factor” affects the company in one way and another company in opposite way
- ❖ **Example:** Summer is good for ice-cream and bad for coffee and investing in both ice-cream and coffee business lead to risk reduction.
- ❖ **Example:** Investing in ice-cream and soft drink business may not lead to risk reduction because summer is good for both businesses and winter is bad for both businesses

Portfolio:

- ❖ The return of a portfolio is the weighted average return of securities which constitute the portfolio
- ❖ The risk of a portfolio is **NOT** the weighted average risk of securities which constitute the portfolio. This is because the risk of a portfolio does not depend only on the securities but also on how the securities **correlate** to each other.

Portfolio Risk = $\sqrt{(\sigma_a w_a)^2 + (\sigma_b w_b)^2 + 2\sigma_a \sigma_b \text{COR}_{ab}}$
COR _{ab} = Correlation between A and B

- ❖ Risk-reduction is set to take place if the risk of a portfolio is less than the weighted average risk of securities which constitute the portfolio

- ❖ The extent of risk reduction can be as under:

Correlation co-efficient	Extent of risk reduction
-1	↓ even to zero
-1 to +1	↓but not up-to zero
+1	Cannot be reduced

Portfolio with minimum risk:

- ❖ Portfolio risk does not depend only on the standard deviation of individual securities but also on how securities are correlated to each other

Optimum weights with 2 securities:

$$\text{Weight of Security 1} = \frac{\text{Variance of Security 2} - \text{Covariance of 1 and 2}}{\text{Variance of security 1} + \text{Variance of Security 2} + 2\text{Covariance of 1 and 2}}$$

$$\text{Weight of security 2} = 1 - \text{weight of security 1}$$

Optimum weights with 3 Securities (Critical line approach):

- ❖ Critical line is calculated to get the weights of the individual securities in the minimum variance portfolio
- ❖ We would need combination of two minimum variance portfolio in order to arrive at the critical line

Weight of security 1 = a + b (weight of security 2)

Form two equations and get values of a and b

The critical line will then be written as Weight of security 1 = a + b (weight of security 2)

Example:

Portfolio 1 = Security A = 50%, Security B = 25% and Security C = 25%

Portfolio 2 = Security A = 70%, Security B = 20% and Security C = 10%

Critical line between A and B:

Weight of Security A = a + b(weight of Security B)

$$0.50 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.70 = a + 0.20b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = -4 and a = 1.5

Critical line: Weight of Security A = 1.50 - 4(Weight of Security B)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security A = 0.70
- ❖ Desired weight of security B = 0.2
- ❖ Balance weight of Security C = 0.1

Critical line between B and C:

Weight of Security B = a + b(weight of Security C)

$$0.25 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.20 = a + 0.10b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = 0.3333 and a = 0.1667

Critical line: Weight of Security B = 0.1667 - 0.3333(Weight of Security C)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security B = 0.20
- ❖ Desired weight of security C = 0.1
- ❖ Balance weight of Security A = 0.7

Critical line between A and C:

Weight of Security A = a + b(weight of Security C)

$$0.50 = a + 0.25b \dots\dots\dots (\text{Equation 1})$$

$$0.70 = a + 0.10b \dots\dots\dots (\text{Equation 2})$$

Solving equations, we get b = -1.3333 and a = 0.8333

Critical line: Weight of Security A = 0.8333 - 1.3333(Weight of Security C)

Creation of portfolio with Security A, B and C:

- ❖ Weight of security A = 0.70
- ❖ Desired weight of security C = 0.1
- ❖ Balance weight of Security B = 0.2

Optimum weight with more than 3 securities (Sharpe's optimal portfolio):

- ❖ **Step 1:** Calculate excess return to Beta (Treynor Ratio) for all securities

Treynor Ratio = $\frac{\text{Expected return} - \text{riskfree return}}{\text{Beta of security}}$	
❖ Step 2:	Arrange the securities in the descending order of the variable computed in step 1
❖ Step 3:	Calculate $[(\text{Excess return} \times \text{Beta}) / \sigma^2 \text{ci}]$ for all securities
Variable for step 3 = $\frac{\text{Excess return} \times \text{Beta}}{\sigma^2 \text{ci}}$	
❖ Step 4:	Calculate cumulative values for the variable identified in step 3
❖ Step 5:	Calculate $[\text{Beta}^2 / \sigma^2 \text{ci}]$ for all securities
Variable for step 5 = $\frac{\text{Beta}^2}{\sigma^2 \text{ci}}$	
❖ Step 6:	Calculate cumulative values for the variable identified in step 5
❖ Step 7:	Calculate cut-off point for all securities:
Cutoff point = $\frac{(\text{Market variance} \times \text{Step 4 value})}{(1 + (\text{Market variance} \times \text{Step 6 value}))}$	
❖ Step 8:	Identify the maximum cut-off point. Securities till the maximum cut-off point will form part of optimum portfolio
❖ Step 9:	Calculate Z-value for securities which have been selected to form part of optimum portfolio
Z value = $\frac{\text{Beta}}{\sigma^2 \text{ci}} \times (\text{Treynor ratio} - \text{Maximum Cutoff Point})$	
❖ Step 10:	Identify the proportion of securities in the final portfolio. The weights of the securities would be in the same proportion as their z-value

How to calculate correlation co-efficient:

- ❖ **Step 1:** Compute the deviation of each security for each observation from their respective mean
- ❖ **Step 2:** Multiply the product of these deviations with the probability of occurrence
- ❖ **Step 3:** The sum of the values of step 2 is the co-variance_{AB}. **Co-variance between two securities can also be calculated as Beta of Security 1 * Beta of Security 2 * Variance of market.**
- ❖ **Step 4:** Correlation co-efficient is computed using the below formula:

$$\text{COR}_{AB} = \frac{\text{Covariance}_{AB}}{\sigma_A \sigma_B}$$

Return and risk of three securities (Markowitz Model):

- ❖ **Return:** Weighted average of the securities which constitute the portfolio
- ❖ **Risk:**

For 3 securities the formula of $(a + b + c)^2$ is to be used
Portfolio Risk = $a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
$a = \sigma_a w_a$; $b = \sigma_b w_b$; $c = \sigma_c w_c$
With 2ab we need to add correlation of a and b; similarly for 2ac we need to add correlation of a and c; for 2bc we need to add correlation of b and c

Notion of Dominance:

- ❖ Security A dominates Security B if
 - Security A has higher return for same or lower risk
 - Security A has same return for a lower risk
- ❖ In that case Security A is said to be a dominating (or efficient) stock. Security B is said to be a dominated (or inefficient) stock
- ❖ Only efficient stocks should form part of a portfolio

Efficiency frontier:

- ❖ Efficiency frontier is a curve which connects all the efficient securities/portfolio
- ❖ The curve should start with minimum SD security/portfolio and all other efficient securities/portfolio are to be plotted on the graph
- ❖ Risk is to be considered on x-axis and return is to be plotted on y-axis

Utility Curve:

- ❖ Efficiency frontier gives a list of various efficient securities/portfolio. However the portfolio to be selected within the list of efficient portfolios would depend upon the risk appetite of the investor

- ❖ Utility of a portfolio is measured with the help of standard deviation and expected return

$$\text{Utility} = \text{Expected return of portfolio} - (0.5 \times \text{aversion factor} \times \text{variance of portfolio})$$

- ❖ Utility curve provides the different combination of risk and return which will give same utility. There can be multiple utility curves which gives enhanced levels of utility to an investor. We can call it as Utility curve 1 (U1) giving the highest levels of utility and then U2 giving a moderate level of utility and U3 giving a lower level of utility and so on.
- ❖ The point of intersection of higher utility curve and efficiency frontier will give the portfolio to be selected by the investor

Portfolio of risk free-asset and efficient portfolio:

- ❖ Risk free-asset provides guaranteed return with zero risk. Addition of risk free asset can help in increasing the return while reducing the standard deviation of the portfolio
- ❖ Efficient frontier gives multiple efficient portfolios. However one of the portfolios will be the best and the same can be identified by following a combination of efficient portfolio and risk free asset

Steps

- ❖ **Step 1:** Identify the target standard deviation
- ❖ **Step 2:** Get the weight of the efficient portfolio and risk free asset
 - Weight of efficient portfolio = Target SD / SD of efficient portfolio
 - Weight of risk free asset = 1 - weight of efficient portfolio
- ❖ **Step 3:** Calculate the weighted average expected return and select the combination of risk free asset and efficient portfolio which gives the highest return

Notion of non-diversifiable risk:

- ❖ Adding more securities to a portfolio reduce risk but the rate of reduction slows down and after a point tapers off.
- ❖ The number of securities at which risk reduction stops is not known
- ❖ Since risk reduction is not possible beyond a point of time, total risk is broken into
 - Diversifiable risk [Non-systematic risk]
 - Non-diversifiable risk [Systematic risk]
- ❖ The portfolio manager should eliminate diversifiable risks through diversification and hold only non-diversifiable risk
- ❖ The stock market rewards only non-diversifiable risk
- ❖ Non-diversifiable risk exists because there are certain events (inflation, recession, outbreak of war) which affects all stocks alike

Systematic risk and non-systematic risk:

Particulars	Components	Standard deviation approach	Variance approach
Systematic risk	Interest rate risk, Purchasing Power risk and Market risk	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \\ \text{(or)} \\ \text{Beta of Security } x \\ \text{SD of Market} \end{array} \right)$	$\left(\begin{array}{c} \text{SD of Security } x \\ \text{Correlation coefficient} \\ \text{(or)} \\ \text{Beta of Security } x \\ \text{SD of Market} \end{array} \right)^2$
Non-systematic risk ($\sigma^2 \epsilon_i$)	Business risk and financial risk	Total risk - Systematic risk	Total risk - Systematic risk

Note:

- ❖ Co-efficient of determination gives the percentage of the variation in the security's return that is explained by the variation of the market return. Variation on account of index is called systematic risk and balance is called unsystematic risk.

$$\text{Co-efficient of determination} = \text{Systematic risk} / \text{Total Risk}$$

- ❖ Total risk (Variance) of portfolio as per Sharpe Index Model = Systematic risk of portfolio + Unsystematic risk of portfolio
 - Systematic risk of portfolio = (Beta of portfolio * SD of market)²
 - Unsystematic risk = (W₁² * Unsystematic risk) + (W₂² * Unsystematic risk) + (W_n² * Unsystematic risk)

Notion of Beta:

- ❖ Beta is a measure of non-diversifiable risk. Beta measures the sensitivity of a stock to a broad-based market index.
- ❖ If the beta of a stock with respect to sensex is 1.5, it means that if sensex changes by 10% then the stock will change by 15%

Nature of Beta	Size	Nature of Investor
Low	<1	Conservative
Unity	=1	Neutral
High	>1	Aggressive

- ❖ Beta is the ratio of **systematic risk** to standard deviation of the market

Formula 1: Beta = $\frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$
N = No. of observations; X = Rate of return of stock; Y = Rate of return of market
Formula 2: Beta = $\frac{\text{SD of Security}}{\text{SD of Market}} \times \text{Correlation coefficient}$
Formula 3: Beta = $\frac{\text{Covariance of Security and Market}}{\text{Variance of Market}}$

Beta of portfolio:

- ❖ Beta of the portfolio is the weighted average of beta of individual securities with the amount invested in each security being the assigned weights
- ❖ An individual stock is not diversified and therefore the risk applicable is total risk or standard deviation
- ❖ A portfolio is normally fully diversified and hence the risk applicable is non-diversifiable risk computed with the help of Beta
- ❖ If a portfolio is not fully diversified then the applicable risk is total risk computed with the help of standard deviation

Format for calculation of Beta

Security	Beta	Weight (Amount invested)	Product

- ❖ **Beta of portfolio = Sum of products/sum of weights**

CAPM and Gearing:

- ❖ Based on the liabilities side, a firm can be classified either as unlevered firm or levered firm
- ❖ Based on the asset side, a firm may have single project or multiple projects
- ❖ Based on the above mentioned 2 points the following situations arise:
 - Unlevered firm & single project
 - Unlevered firm & multiple projects
 - Levered firm & single project
 - Levered firm & multiple projects

Key Principles:

- ❖ Overall beta of assets side = Overall beta of liabilities side
- ❖ If there are several assets, then Beta of assets will be weighted average of beta of various assets
- ❖ If there are several liabilities, then Beta of liabilities will be weighted average of beta of various liabilities
- ❖ The overall beta of a firm is constant irrespective of capital structure. As we introduce more debt in the capital structure the beta of equity will change in such a way that overall beta remains same
- ❖ Two firms operating under same business risk class will have same overall beta irrespective of capital structure. Example: WIPRO and INFOSYS will have same overall Beta
- ❖ The starting beta for overall beta will therefore be beta of the unlevered firm

Proxy Beta:

- ❖ Following organisation will not be able to compute equity beta:
 - Unlisted companies
 - Private companies

- Partnership firms
- ❖ Such companies can take the overall beta of a similar company as their own beta (proxy)

$$\text{Overall Beta} = \text{Debt Beta} \times \frac{\text{Debt}}{\text{Debt} + \text{Equity}} + \text{Equity Beta} \times \frac{\text{Equity}}{\text{Debt} + \text{Equity}}$$

Note:

1. In cases taxes are involved then value of debt is replaced with debt * (1- tax rate) and

Security Market Line:

- ❖ Security Market Line (SML) is the representation of capital asset pricing model.
- ❖ It displays the expected rate of return of an individual security as a function of systematic, non-diversifiable risk (Beta).
- ❖ It is visual of the capital asset pricing model (CAPM) where the x-axis of the chart represent risk in terms of beta, and the y-axis of the chart represents expected return.
- ❖ Return as per security Market Line = $R_f + \text{Beta} \times (R_m - R_f)$

Characteristic line:

- ❖ Security characteristic line plots performance of a particular security or portfolio against that of the market portfolio at every point of time
- ❖ It represents the amount by which an individual share price gives a greater or lower return mandated by CAPM. The excess or lower return is denoted as Alpha.
- ❖ Positive Alpha indicates that the share has outperformed the market and vice versa

$$\text{Characteristic line} = \text{Alpha} + \text{Beta} \times (R_m)$$

Where Alpha = Actual return - Required return

Capital Market Line:

- ❖ Capital market line is used to show the rates of return, which depends on risk-free rates of return and levels of risk for a specific portfolio
- ❖ **CML Versus SML:** This risk in case of CML is measured through standard deviation while the same for SML is measured through Beta
- ❖ It depicts the expected return of a security on Y-axis and the standard deviation is depicted on the X-axis
- ❖ Return as per Capital market line = $R_f + (\text{SD of security} / \text{SD of Market}) \times (R_m - R_f)$

Arbitrage Pricing Theory Model (APT Model)

- ❖ APT is an asset pricing model based on the idea that an asset's returns can be predicted using the relationship between that asset and many common risk factors.
- ❖ CAPM is a single factor model wherein expected return of a security is dependent on a single factor named Beta
- ❖ However, share price can be impacted by multiple factors such as inflation, money supply, interest rate, industrial production among others
- ❖ Expected return under APT model is calculated as under:

$$\text{Expected return} = \text{Risk free return} + (\text{Factor 1 Beta} \times \text{Risk premium of factor 1}) + (\text{Factor 2 Beta} \times \text{Risk premium of factor 2}) + (\text{Factor 3 Beta} \times \text{Risk premium of factor 3}) + (\text{Factor 4 Beta} \times \text{Risk premium of factor 4})$$

Practical Problems**Overview:**

- Part I – Basics of Portfolio Theory
- Part II – Optimum weights for risk reduction
- Part III – Security and Portfolio Beta
- Part IV – Systematic and Unsystematic Risk
- Part V – Characteristic Line, CML and SML
- Part VI – Factory Sensitivity Analysis and Arbitrage Pricing Theory
- Part VII – Beta and Leverage
- Part VIII – Portfolio Strategies

Part I - Basics of Portfolio Theory

1. Calculation of expected return and standard deviation (May 2017)

A stock costing Rs.120 pays no dividends. The possible prices that the stock might sell for at the end of the year with the respective probabilities are:

Price	Probability
115	0.1
120	0.1
125	0.2
130	0.3
135	0.2
140	0.1

Required:

- Calculate the expected return
- Calculate the standard deviation of returns

Answer:

Computation of expected return and standard deviation:

Price	Probability	Return (in Rs.)	Return (in %)	Product	Deviation	Pd ²
115	0.1	-5.00	-4.17	-0.42	-11.25	12.66
120	0.1	0.00	0.00	0.00	-7.08	5.01
125	0.2	5.00	4.17	0.83	-2.91	1.69
130	0.3	10.00	8.33	2.50	1.25	0.47
135	0.2	15.00	12.50	2.50	5.42	5.88
140	0.1	20.00	16.67	1.67	9.59	9.2
				7.08		34.91

Note:

- Return (in Rs.) = Expected price - 120
- Return (in %) = Return in Rs./120
- Product = Probability x Return (in %)
- Deviation = Return in % - Expected return (sum of product)
- Pd² = Probability x Deviation x Deviation

Expected return (%)	7.08%
Standard deviation (%)	$\sqrt{34.91} = 5.91\%$
Expected return (in Rs.)	= Price x Expected return in % = 120 x 7.08% = Rs.8.50
Standard deviation (in Rs.)	= Price x Standard Deviation in % = 120 x 5.91% = Rs.7.09

2. Calculation of Risk and Return (Nov 2017)

The following is the return of two securities for the past five years. Calculate the expected return and risk

Year	Security A	Security B
1	10.6	20.5
2	11.6	-10.9
3	-14	28.4
4	17.6	-2.8
5	10	5.8

Answer:

- Probability is not given in question and hence we are assuming equal probability for all years. This assumption would help us to solve all risk and return questions in same format

Security A

Year	Return	Probability	Product	Deviation	Pd ²
1	10.6	0.2	2.12	3.44	2.37
2	11.6	0.2	2.32	4.44	3.94
3	-14	0.2	-2.80	-21.16	89.55
4	17.6	0.2	3.52	10.44	21.8

5	10	0.2	2.00	2.84	1.61
Total			7.16		119.27

Expected return (%)	7.16%
Standard deviation (%)	$\sqrt{119.27} = 10.92\%$

Security B

Year	Return	Probability	Product	Deviation	Pd ²
1	20.5	0.2	4.10	12.30	30.26
2	-10.9	0.2	-2.18	-19.10	72.96
3	28.4	0.2	5.68	20.20	81.61
4	-2.8	0.2	-0.56	-11.00	24.2
5	5.8	0.2	1.16	-2.40	1.15
Total			8.20		210.18

Expected return (%)	8.20%
Standard deviation (%)	$\sqrt{210.18} = 14.50\%$

3. Calculation of portfolio return and standard deviation (May 2018)

Consider the following information on two stocks, A and B:

Year	Return on A (%)	Return on B (%)
2006	10	12
2007	16	18

You are required to determine:

- ❖ The expected return on a portfolio containing A and B in the proportion of 40% and 60% respectively
- ❖ The standard deviation from each of these two stocks
- ❖ The co-variance of returns from the two stocks
- ❖ Co-relation co-efficient between the returns of the two stocks
- ❖ Standard deviation of the portfolio

Answer:**Base calculation:**

Year	Prob	Security A				Security B				Pd _a d _b
		Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
2006	0.5	10	5	-3	4.5	12	6	-3	4.5	4.5
2007	0.5	16	8	3	4.5	18	9	3	4.5	4.5
Total			13		9		15		9	9

Portfolio return	=	Weight average of individual security return
Portfolio return	=	$(0.4 \times 13\%) + (0.6 \times 15\%) = 14.20\%$
Standard deviation of A	=	$\sqrt{Pd^2} = \sqrt{9} = 3\%$
Standard deviation of B	=	$\sqrt{Pd^2} = \sqrt{9} = 3\%$
Co-variance of stocks	=	Sum of Pd _a d _b = 9%
Co-relation coefficient	=	$\frac{CO - variance_{AB}}{\sigma_A \sigma_B} = \frac{9}{3 \times 3} = 1$
Portfolio Variance	=	$(\sigma_a W_a)^2 + (\sigma_b W_b)^2 + 2\sigma_a W_a \sigma_b W_b COR_{ab}$
Portfolio Variance	=	$(3 \times 0.4)^2 + (3 \times 0.6)^2 + 2(3)(0.4)(3)(0.6)(1)$
Portfolio Variance	=	$1.44 + 3.24 - 4.32 = 9\%$
Portfolio SD	=	$\sqrt{9} = 3\%$

4. Calculation of portfolio return and standard deviation

X Ltd. Invested on 1.4.2009 in certain equity shares as below:

Name of company	No. of shares	Cost
M Limited	1000 (Rs. 100 each)	2, 00,000
N Limited	500 (Rs. 10 each)	1, 50,000

In September 2009, 10% dividend was paid out by M Limited and in October, 2009, 30% dividend paid out by N Limited. On 31.3.2010 market quotations showed a value of Rs. 220 and Rs. 290 per share for M Limited and N Limited respectively.

On 1.4.2010, investment advisors indicate

- ❖ that the dividend from M Limited and N Limited for the year ending 31.3.2011 are likely to be 20% and 35% respectively and
- ❖ that the probabilities of the market quotations on 31.3.2011 are as below:

Probability	Price per share of M Limited	Price per share of N Limited
0.20	220	290
0.50	250	310
0.30	280	330

You are required to:

- Calculate the average return from the portfolio for the year ended 31.3.2010
- Calculate the average expected return from the portfolio for the year 2010-11
- Advise X co. Ltd of the comparative risk in the two investments by calculating the standard deviation in each case.

Answer:

WN 1: Computation of return of portfolio for 2009-10

Return of Security M	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} = \frac{10 + (220 - 200)}{200} \times 100 = 15\%$
Return of Security N	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} = \frac{3 + (290 - 300)}{300} \times 100 = -2.33\%$

Portfolio Return:

Security	Return	Weight	Product
M	15%	2,00,000	30,000
N	-2.33%	1,50,000	-3,500
Portfolio	7.57%	3,50,000	26,500

- **Portfolio return of 2009-10 = 7.57%**

WN 2: Computation of risk and return of Security M for 2010-11

Return of Security M	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} \times 100$
Probability of 0.2	=	$\frac{(20) + (220 - 220)}{220} \times 100 = 9.09\%$
Probability of 0.5	=	$\frac{(20) + (250 - 220)}{220} \times 100 = 22.73\%$
Probability of 0.3	=	$\frac{(20) + (280 - 220)}{220} \times 100 = 36.36\%$

Return and risk calculation:

Return	Probability	Product	Deviation	Pd ²
9.09	0.2	1.82	-15.01	45.06
22.73	0.5	11.37	-1.37	0.94
36.36	0.3	10.91	12.26	45.09
Total		24.10		91.09

Expected return (%)	24.10%
Standard deviation (%)	$\sqrt{91.09} = 9.54\%$

WN 3: Computation of risk and return of Security N for 2010-11

Return of Security N	=	$\frac{(D_1) + (P_1 - P_0)}{P_0} \times 100$

Probability of 0.2	=	$\frac{(3.5) + (290 - 290)}{290} \times 100 = 1.21\%$
Probability of 0.5	=	$\frac{(3.5) + (310 - 290)}{290} \times 100 = 8.10\%$
Probability of 0.3	=	$\frac{(3.5) + (330 - 290)}{290} \times 100 = 15\%$

Return and risk:

Return	Probability	Product	Deviation	Pd ²
1.21	0.2	0.24	-7.58	11.49
8.1	0.5	4.05	-0.69	0.24
15	0.3	4.50	6.21	11.57
		8.79		23.30

Expected return (%)	8.79%
Standard deviation (%)	$\sqrt{23.30} = 4.83\%$

WN 4: Portfolio Return for 2010-11

Security	Return	Weight	Product
M	24.10%	2,20,000 [1,000 x 220]	53,020
N	8.79%	1,45,000 [500 x 290]	12,746
Portfolio	18.02%	3,65,000	65,766

- Portfolio return of 2010-11 = 18.02%

5. Efficient portfolio (Nov 2017 RTP)

Given the following risky portfolio:

Particulars	A	B	C	D	E	F	G	H
Return %	10	12.5	15	16	17	18	18	20
Risk %	23	21	25	29	29	32	35	45

- ❖ Which of the following portfolios are efficient and which are inefficient?
- ❖ Suppose one can tolerate a risk of 25%, what is the maximum return one can achieve if no borrowing or lending is resorted to?
- ❖ Suppose one can tolerate a risk of 25%, what is the maximum return one can achieve if borrowing or lending at a rate of 12% is resorted to?

Answer:**WN 1: Identification of efficient and inefficient securities**

- Security B dominates Security A as it generates higher return with lower risk. Hence Security A is inefficient.
- Security E dominates Security D as it generates higher return with same risk. Hence Security D is inefficient
- Security F dominates Security G as it generates same return with lower risk. Hence Security G is inefficient
- Security B, C, E, F and H are efficient securities

WN 2: Maximum return if risk is limited to 25%

- Security B and C are efficient securities which fulfill the criteria of maximum risk of 25 percent. Investor will prefer Security C and the same can give maximum return of 15%

WN 3: Selection of security with borrowings:

- Investor is willing to borrow/lend money and hence investor will take a portfolio of risky asset and risk-free asset
- Standard deviation = Weight of risky asset x SD of risky asset
- Weight of risky asset = Maximum risk of 25% / SD of risky asset

Security	Risk	Weight of risky asset [Maximum risk/Security Risk]	Weight of risk-free asset	Portfolio return
B	21	119.05%	-19.05%	12.60
C	25	100%	0%	15.00
E	29	86.21%	13.79%	16.31
F	32	78.13%	21.87%	16.69
H	45	55.56%	44.44%	16.44

- Portfolio return = (Weight of risky asset x Security return) + (Weight of risk-free asset x 12%)
- Investor can earn 16.69% return by investing 78.13% in security F and 21.87% in risk-free asset

6. Share buy/Sell decision (May 2016)

An investor is holding 1,000 shares of Asian paints Company. Presently the rate of dividend being paid by the company is Rs.2 per share and the share is being sold at Rs.25 per share in the market. However, several factors are likely to change during the course of the year as indicated below:

	Existing	Revised
Risk free rate	12%	10%
Market risk premium	6%	4%
Beta value	1.4	1.25
Expected growth rate	5%	9%

In view of the above factors whether the investor should buy, hold or sell the shares? And why?

Answer:

Computation of fair market price:

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

Particulars	Existing scenario	Revised scenario
1. Dividend of next year (D1)	2.10 [2 + 5%]	2.18 [2 + 9%]
2. Cost of equity (Rf + Beta x (Rm - Rf))	= 12% + (1.4 x 6%) = 20.40%	= 10% + (1.25 x 4%) = 15%
3. Growth rate	5%	9%
4. Fair market price	13.63	36.33

- Under the existing scenario the share is overvalued. However, with change in expectations fair market price increases to Rs.36.33 per share. Share will be undervalued and we should buy the share

7. Valuation of share and CAPM (Nov 2014, May 2018)

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 firm A was Rs.2.00. The beta of Platinum Ltd equity Stock is 1.2.

- What is the equilibrium price of equity stock of Platinum Limited?
- What is 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's rises to 1.3?

(Consider all 3 changes to happen simultaneously)

Answer:

Computation of fair market price:

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

Particulars	Existing scenario	Revised scenario
1. Dividend of next year (D1)	2.14 [2 + 7%]	2.20 [2 + 10%]
2. Cost of equity (Rf + Beta x (Rm - Rf))	= 9% + 1.2 (13% - 9%) = 13.80%	= 11% + 1.3 (13% - 11%) = 13.60%
3. Growth rate	7%	10%
4. Equilibrium price	31.47	61.11

Notes:

- Inflation premium increases by 2 percent. Inflation forms part of risk-free rate. It is assumed that change will increase Risk free rate from 9 % to 11%. Alternatively, we can also assume risk free rate to increase from 9% to 9.18%
- Similar to inflation assumption, it is assumed that growth rate will change from 7% to 10%
- Market return continues to be 13%. Alternatively, we could have increased market return also by 2 percent so that risk premium continues to be 4%

8. Computation of intrinsic value and required return (May 2016)

XYZ Limited paid a dividend of Rs.2 for the current year. The dividend is expected to grow at 40% for the next 5 years and at 15% per annum thereafter. The return on 182 days T-bills is 11% per annum and the market return is expected to be around 18% with a variance of 24%. The co-variance of XYZ's return with that of the market is 30%. You are required to calculate the required rate of return and intrinsic value of the stock.

Answer:**WN 1: Computation of required rate of return on stock (Ke):****Note 1: Computation of Beta:**

Beta	=	$\frac{\text{Co - variance of security and market}}{\text{Variance of market}}$
Beta	=	$\frac{30}{24}$
Beta	=	1.25 Times

Note 2: Computation of required return:

Ke	=	$R_f + \text{Beta} \times (R_m - R_f)$
Ke	=	$11 + 1.25 \times (18 - 11)$
Ke	=	19.75%

WN 2: Computation of intrinsic value:**Note 1: Computation of Dividend till first year of stabilization phase:**

- ❖ Dividends are expected to grow at 40% for 5 years. Growth will stabilize from sixth year onwards at 15%. Hence, we should calculate Dividends for first six years

Particulars	Dividend
Year 0	2
Year 1	2.80
Year 2	3.92
Year 3	5.49
Year 4	7.68
Year 5	10.76
Year 6	12.37

WN 2: Computation of market price at last year before stabilization phase:

- ❖ Growth stabilizes from sixth year and hence we should calculate market price at end of year 5

Market Price (P ₅)	$\frac{D_6}{(K_e - G)}$	$\frac{12.37}{(19.75\% - 15\%)}$	Rs.260.42

WN 3: Computation of fair market price:

Year	Cash flow	PVF @ 19.75%	DCF
1	2.80	0.825	2.34
2	3.92	0.697	2.73
3	5.49	0.582	3.19
4	7.68	0.486	3.73
5	271.18 [10.76+260.42]	0.406	110.10
Fair market price of share			122.09

9. Computation of systematic/unsystematic/sharpe/treynor (Nov 2016)

Mr. Abhishek is interested in investing Rs.2,00,000 for which he is considering following three alternatives:

- Invest Rs.2,00,000 in Mutual Fund X (MFX)
- Invest Rs.2,00,000 in Mutual Fund Y (MFY)
- Invest Rs.1,20,000 in MFX and Rs.80,000 in 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%

Co-variance of returns of MFX, MFY and market portfolio Mix are as follow:

Particulars	MFX	MFY	MIX
MFX	4.800	4.300	3.370
MFY	4.300	4.250	2.800
MIX	3.370	2.800	3.100

You are required to calculate:

- Variance of return from MFX, MFY and market return
- Portfolio return, beta, portfolio variance and portfolio standard deviation
- Expected return, systematic risk and unsystematic risk and
- Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Answer:

WN 1: Computation of variance of return of MFX, MFY and Market return:

Variance of MFX	=	Co-variance between MFX and MFX	4.800
Variance of MFY	=	Co-variance between MFY and MFY	4.250
Variance of Market	=	Co-variance of MIX and MIX	3.100

Note: In this question we have taken portfolio mix of 60% and 40% as market return

WN 2: Computation of portfolio return, beta, portfolio variance and portfolio standard deviation:

Weight of MFX in portfolio	=	(1,20,000/2,00,000)	60%
Weight of MFY in portfolio	=	(80,000/2,00,000)	40%
Portfolio return	=	$0.60 \times 15\% + 0.40 \times 14\%$	14.60%
Beta of MFX	=	$\frac{\text{Co-variance of MFX and market}}{\text{Variance of market}}$	$\frac{3.370}{3.100} = 1.087$
Beta of MFY	=	$\frac{\text{Co-variance of MFY and market}}{\text{Variance of market}}$	$\frac{2.800}{3.100} = 0.903$
Portfolio Beta	=	$(0.60 \times 1.087) + (0.40 \times 0.903)$	1.013
Portfolio variance	=	$(W_X \times SD_X)^2 + (W_Y \times SD_Y)^2 + 2W_X W_Y \text{COV}_{XY}$	
Portfolio variance	=	$(0.60)^2 \times 4.800 + (0.40)^2 \times 4.250 + 2(0.60)(0.40)(4.300)$	4.472
Portfolio SD	=	$\sqrt{4.472}$	2.115

WN 3: Computation of expected return, systematic risk and unsystematic risk:

Note 1: Calculation of expected return:

Particulars	MIX	MFX	MFY
Expected return ($R_f + \beta \times (R_m - R_f)$)	$10\% + 1.0134(12\% - 10\%)$ =12.03%	$10\% + 1.087(12\% - 10\%)$ =12.17%	$10\% + 0.903(12\% - 10\%)$ =11.81%

Note 2: Calculation of systematic risk and unsystematic risk:

Particulars	MIX	MFX	MFY
Total risk	4.472	4.80	4.250
Systematic risk [$\beta^2 \times \text{variance of market}$]	$(1.013)^2 \times 3.10$ = 3.181	$(1.087)^2 \times 3.10$ = 3.663	$(0.903)^2 \times 3.10$ = 2.528
Unsystematic risk [Total risk - Sys risk]	1.291	1.137	1.722

WN 4: Computation of Sharpe Ratio, Treynor Ratio and Alpha:

Particulars	MIX	MFX	MFY
Sharpe Ratio	$\frac{14.60 - 10}{2.115}$ = 2.175	$\frac{15\% - 10\%}{\sqrt{4.800}}$	$\frac{14\% - 10\%}{\sqrt{4.250}}$

Expected return – Risk free		= 2.282	= 1.94
Standard Deviation			
Treynor Ratio	$\frac{14.60 - 10}{1.0134}$	$\frac{15\% - 10\%}{1.087}$	$\frac{14\% - 10\%}{0.903}$
Expected return – Risk free	= 4.54	= 4.60	= 4.43
Beta			
Alpha	$14.60 - 12.03\%$	$15\% - 12.17\%$	$14\% - 11.81\%$
(Actual return – required return)	= 2.57%	= 2.83%	= 2.19%

10. Computation of security return and SD of market (May 2013 RTP)

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%
Co-efficient of correlation	0.75

You are required to determine the standard Deviation of Market Return and Security Return

Answer:

Note 1: Computation of Risk-free rate

Risk free Rate	=	$\frac{\text{Interest}}{\text{Market Price}}$
Risk free Rate	=	$\frac{7}{140} \times 100 = 5\%$

It is assumed that face value of treasury bond is \$ 100

Note 2: Computation of Beta:

Return as per SML = $R_f + \text{Beta} \times (R_m - R_f)$
Equation for X:
$15\% = 5\% + \text{Beta} \times (15\% - 5\%)$
Solving the equation, we get Beta = 1

Note 3: Computation of standard deviation of market:

Beta	=	$\frac{\text{Co – variance of security and Market}}{\text{Variance of Market}}$
1	=	$\frac{225}{225}$
Variance of Market	=	225
SD of Market	=	15%

Note 4: Computation of standard deviation of security:

Beta	=	$\frac{\text{SD of Security}}{\text{SD of Market}} \times \text{Co – relation coefficient}$
1	=	$\frac{\text{SD of Security}}{15} \times 0.75$
15	=	SD of Security
$\frac{15}{0.75}$	=	
SD of Security	=	20%

Part II – Optimum Weights for Risk Reduction**11. Risk reduction (Nov 2012 RTP)**

An investor has decided to invest Rs.1,00,000 in the shares of two companies, namely, ABC and XYZ. The returns and their probability is given below:

Probability	ABC (%)	XYZ (%)
0.20	12	16
0.25	14	10
0.25	-7	28
0.30	28	-2

- a) Comment on return and risk of investment in individual shares.

- b) Compare the risk and return of these two shares with a Portfolio of these shares in equal proportions.
- c) Find out the proportion of each of the above shares to formulate a minimum risk portfolio.

Answer:

WN 1: Computation of risk and return of individual securities:

Prob	Security ABC				Security XYZ				Pd _{abc} d _{xyz}
	Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
0.20	12	2.4	-0.55	0.06	16	3.2	3.9	3.04	-0.43
0.25	14	3.5	1.45	0.53	10	2.5	-2.1	1.1	-0.76
0.25	-7	-1.75	-19.55	95.55	28	7	15.9	63.2	-77.71
0.30	28	8.4	15.45	71.61	-2	-0.6	-14.1	59.64	-65.35
Total		12.55		167.75		12.1		126.98	-144.25

Return of ABC	=	12.55%
Risk of ABC	$\sqrt{167.75}$	12.95%
Return of XYZ	=	12.10%
Risk of XYZ	$\sqrt{126.98}$	11.27%

Comments:

- Security ABC provides higher return than XYZ. However, the same is offset by higher risk

WN 2: Computation of Portfolio return and Portfolio Risk:

Portfolio return	=	$(0.5 \times 12.55) + (0.5 \times 12.10) = 12.325\%$
Portfolio Variance	=	$(\sigma_a W_a)^2 + (\sigma_x W_x)^2 + 2W_a W_x \text{COV}_{ax}$
Portfolio Variance	=	$(12.95 \times 0.50)^2 + (11.27 \times 0.50)^2 + 2(0.5)(0.5)(-144.25)$
Portfolio Variance	=	$41.93 + 31.75 - 72.13 = 1.55$
Portfolio SD	=	$\sqrt{1.55} = 1.24\%$

WN 3: Computation of weights for minimum risk portfolio:

Weight of security 1	=	$\frac{\text{Variance of Security 2} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$
Weight of security 1	=	$\frac{126.98 + 144.25}{167.75 + 126.98 + 2(144.25)} = \frac{271.23}{583.23} = 0.4650$
Weight of security 2	=	$\frac{\text{Variance of Security 1} - \text{Covariance of 1 \& 2}}{\text{Variance of Security 1} + \text{Variance of Security 2} - 2\text{Covariance of 1 \& 2}}$
Weight of security 2	=	$\frac{167.75 + 144.25}{167.75 + 126.98 + 2(144.25)} = \frac{312.00}{583.23} = 0.5350$

Optimum weights for risk reduction:

- Weight of ABC = 0.465 or 46.50%
- Weight of XYZ = 0.535 or 53.50%

Part III – Security and Portfolio Beta

12. Calculation of Beta

Given below is information of market rates of return and data from two companies A and B:

	Year 2007	Year 2008	Year 2009
Market (%)	12.0	11.0	9.0
Company A (%)	13.0	11.5	9.8
Company B (%)	11.0	10.5	9.5

You are required to calculate Beta of company A and company B

Answer

Probability is not given in question and hence we can use formula 1 to compute Beta

WN 1: Computation of Beta of Company A:

Year	Company A return (X)	Market return (Y)	XY	Y ²
2007	13	12	156	144
2008	11.5	11	126.5	121

2009	9.8	9	88.2	81
Sum	34.3	32	370.7	346
Average	11.43	10.67		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(370.7 - 3(11.43)(10.67))}{346 - 3(10.67^2)} = \frac{4.8257}{4.4533} = 1.0836 \text{ Times}$$

WN 2: Computation of Beta of Company B:

Year	Company B return (X)	Market return (Y)	XY	Y ²
2007	11	12	132	144
2008	10.5	11	115.5	121
2009	9.5	9	85.5	81
Sum	31	32	333	346
Average	10.33	10.67		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(333 - 3(10.33)(10.67))}{346 - 3(10.67^2)} = \frac{2.3367}{4.4533} = 0.5247 \text{ Times}$$

13. Calculation of Beta (Nov 2020 RTP)

The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability	Return of F (%)	Return of P (%)
0.30	30	-10
0.40	20	20
0.30	0	30

You are required to calculate the expected return of security 'F' and the market portfolio 'P', the covariance between the market portfolio and security and beta of the security

Answer:

Computation of expected return of security, market, covariance and Beta:

Prob	Security F			Market P			Pd ²	Pd _i d _p
	Return	Product	Deviation	Return	Product	Deviation		
0.3	30	9	13	-10	-3	-24	172.8	-93.6
0.4	20	8	3	20	8	6	14.4	7.2
0.3	0	0	-17	30	9	16	76.8	-81.6
Total		17			14		264	-168

Return of Security F	=	17%
Return of Market P	=	14%
Covariance of security and market	=	-168
Beta of security	$\frac{\text{Covariance of security and Market}}{\text{Variance of Market}}$	$\frac{-168}{264} = -0.6364$

14. Portfolio Beta (Nov 2012, Nov 2018 RTP)

Mr. Fed-up wants to invest an amount of Rs.520 lakhs and had approached his Portfolio Manager. The Portfolio Manager had advised Mr. Fed-up to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in Rs. Lakhs)	60	80	100	120	160
Beta	0.5	1	0.8	1.2	1.5

You are required to advise Mr. FedUp in regard to the following, using Capital Asset Pricing Methodology:

- Expected return on the portfolio, if the Government Secs are at 8% and NIFTY is yielding 10%.
- Advisability of replacing Security 'Better' with NIFTY.

Answer:

WN 1: Computation of Portfolio Beta and Portfolio Return:

Security	Beta	Weight	Product
Moderate	0.5	60	30
Better	1	80	80
Good	0.8	100	80
Very good	1.2	120	144
Best	1.5	160	240
Total	1.1038	520	574

- Portfolio Beta = 1.038 Times
- Portfolio Return = $8\% + 1.1038 \times (10\% - 8\%) = 8\% + 2.21\% = 10.21\%$

Advise on replacing Security 'Better' with NIFTY:

- Security Better has Beta of 1 Time. We can replace the same with NIFTY as the same will also have Beta of 1 Time

15. Portfolio Beta (May 2014 RTP)

XYZ Limited has substantial cash flow and until the surplus funds are utilized to meet the future capital expenditure, likely to happen after several months are invested in a portfolio of short term equity investments, details for which are given below:

Investment	No. of shares	Beta	MPS	Expected yield
A Ltd	60,000	1.16	4.29	19.5%
B Ltd	80,000	2.28	2.92	24%
C Ltd	1,00,000	0.90	2.17	17.5%
D Ltd	1,25,000	1.50	3.14	26%

The current market return is 19% and the risk free rate is 11%. Required to:

- Calculate the risk of the XYZ Ltd portfolio relative to market.
- Whether XYZ Limited should change the composition of its portfolio.

Answer:

WN 1: Computation of Actual Beta and Actual Return:

Security	Beta	Weight	Product	Return	Product
A Limited	1.16	2,57,400	2,98,584	19.50%	50,193
B Limited	2.28	2,33,600	5,32,608	24.00%	56,064
C Limited	0.90	2,17,000	1,95,300	17.50%	37,975
D Limited	1.50	3,92,500	5,88,750	26.00%	1,02,050
Total	1.4677	11,00,500	16,15,242	22.38%	2,46,282

- Overall beta = Sum of Product (Column 4)/Sum of weights
- Overall return = Sum of Product (Column 6)/Sum of weights

WN 2: Computation of equilibrium (fair) Beta:

$$\begin{aligned} \text{Return} &= R_f + \text{Beta} \times (R_m - R_f) \\ 22.38 &= 11 + \text{Beta} \times (19 - 11) \\ 11.38 &= 8\text{Beta} \\ \text{Fair Beta} &= \frac{11.38}{8} = 1.4225 \text{ Times} \end{aligned}$$

Comment on risk of portfolio:

- Actual Beta of Portfolio is 1.4677 Times whereas fair Beta is 1.4225 Times. This indicates that Portfolio carries more risk than required as actual Beta is higher than Fair Beta. Hence Portfolio is relatively more risky

WN 3: Advise on change in composition of Portfolio:

Security	Beta	CAPM Return [$R_f + \text{Beta} \times (R_m - R_f)$]	Actual Return	Decision
A Ltd	1.16	20.28	19.50	Sell as actual return is lower than CAPM return
B Ltd	2.28	29.24	24.00	Sell as actual return is lower than CAPM return
C Ltd	0.90	18.20	17.50	Sell as actual return is lower than CAPM return

D Ltd	1.50	23.00	26.00	Buy/hold as actual return is higher than CAPM return

16. Modification in portfolio Beta (Nov 2016 RTP)

A portfolio manager has the following four stocks in this portfolio:

Security	No. of shares	Market price per share	Beta
VSL	10,000	50	0.9
CSL	5,000	20	1.0
SML	8,000	25	1.5
APL	2,000	200	1.2

Compute the following:

- Portfolio β
- If the PM seeks to reduce the β to 0.8, how much risk free investment should he bring in?
- If the PM seeks to increase the β to 1.2 how much risk free investment should he bring in?

Answer:

WN 1: Computation of Portfolio Beta:

Security	Beta	Weight	Product
VSL	0.90	5,00,000	4,50,000
CSL	1.00	1,00,000	1,00,000
SML	1.50	2,00,000	3,00,000
APL	1.20	4,00,000	4,80,000
Total	1.1083	12,00,000	13,30,000

- Overall Beta = Sum of Product/Sum of weights = 1.1083 Times

WN 2: Reduction of Beta:**Option 1 - Bringing in fresh risk-free investment without selling shares:**

Let us assume B to be the amount of investment in risk-free asset

Security	Beta	Weight	Product
Risky portfolio	1.1083	12,00,000	13,30,000
Risk free asset	-	B	-
		16,62,500	
Overall	0.8000	[13,00,000/0.80]	13,30,000

- $12,00,000 + B = 16,62,500$; $B = 4,62,500$
- Portfolio manager should bring in risk-free investment of Rs.4,62,500

Option 2- Bringing in fresh risk-free investment by selling shares:

Let us assume A and B to be the amount of investment in risky portfolio and risk-free asset.

Security	Beta	Weight	Product
Risky portfolio	1.1083	A	1.1083A
Risk free asset	-	B	-
Total	0.8000	12,00,000	9,60,000

- $1.1083 A = 9,60,000$; $A = 8,66,191$
- $A + B = 12,00,000$; $8,66,191 + B = 12,00,000$; $B = 3,33,809$
- Portfolio manager should bring in risk-free investment of Rs.3,33,809 by selling shares

WN 3: Increasing the Beta:**Option 1 - Borrowing money and buying more shares:**

Let us assume A and B to be the amount of investment/borrowing in risky portfolio and risk-free asset

Security	Beta	Weight	Product
Risky portfolio	1.1083	A	1.1083A
Risk free asset	-	B	-
Total	1.2000	12,00,000	14,40,000

- $1.1083A = 14,40,000$; $A = 12,99,287$
- $A + B = 12,00,000$; $12,99,287 + B = 12,00,000$; $B = -99,287$

- Portfolio Manager should borrow Rs.99,287 and buy shares

Option 2 – Borrowing money and reducing own investment:

- Let us assume B to be the borrowing in risk-free asset
- Reducing own capital would mean that investor would borrow money but not buy new shares. Hence total of weights will become less than 12,00,000. This is because investor has reduced his own investment in the company

Security	Beta	Weight	Product
Risky portfolio	1.1083	12,00,000	13,30,000
Risk free asset	-	B	-
Total	1.2000	11,08,333 [13,30,000/1.20]	13,30,000

- $12,00,000 + B = 11,08,333$; $B = -91,667$
- Portfolio Manager should borrow Rs.91,667 to increase the Beta to 1.20 times

17. Calculation of Beta

The following information is available for the share of X limited and market index for the past four years:

Years	X Ltd share price	X Limited Dividend Yield	Index of stock exchange	Dividend yield of market	Return from Government
Present year	197.00	10%	2182	16%	15%
1 year ago	164.20	12%	1983	15%	15%
2 year ago	155.00	8%	1665	16%	16%
3 year ago	121.00	10%	1789	10%	14%
4 year ago	95.00	10%	1490	18%	15%

With above information available please calculate:

- Expected return of X limited share
- Expected return on market index
- Risk free rate of return
- Beta of X Limited

Answer:**WN 1: Computation of return of X Limited:**

- This is a tricky question and the prices have been given in the reverse order. Let us change the order and compute the return. It is assumed that present year is 2020

Year	Price	Capital appreciation	Capital appn % (Column 3/ Price of last year)	Dividend %	Return of X
2016	95	NA	NA	10	NA
2017	121	26	27.37	10	37.37
2018	155	34	28.1	8	36.1
2019	164.2	9.2	5.94	12	17.94
2020	197	32.8	19.98	10	29.98
Expected return on X Limited share (Average)					30.35%

- Capital appreciation of 2017 = $26/95 = 27.37\%$
- Capital appreciation of 2018 = $34/121 = 28.10\%$
- Return of X = Capital appreciation % + Dividend %

WN 2: Computation of return of Market Index:

Year	Price	Capital appreciation	Capital appn %	Dividend %	Return of market
2016	1490	NA	NA	18	NA
2017	1789	299	20.07	10	30.07
2018	1665	-124	-6.93	16	9.07
2019	1983	318	19.1	15	34.1
2020	2182	199	10.04	16	26.04
Expected return on Market Index (Average)					24.82%

WN 3: Computation of risk-free rate of return:

$$\text{Risk free rate of return} = \frac{15 + 15 + 16 + 14 + 15}{5} = 15\%$$

WN 4: Computation of Beta:

Year	Company X return (X)	Market return (Y)	XY	Y ²
2017	37.37	30.07	1123.72	904.2
2018	36.1	9.07	327.43	82.26
2019	17.94	34.1	611.75	1162.81
2020	29.98	26.04	780.68	678.08
Sum	121.39	99.28	2843.58	2827.35
Average	30.35	24.82		

$$\text{Beta} = \frac{(\sum XY - n(\text{Mean of X})(\text{Mean of Y}))}{\sum Y^2 - n(\text{Mean of Y})^2}$$

$$\text{Beta} = \frac{(2843.58 - 4(30.35)(24.82))}{2827.35 - 4(24.82^2)} = \frac{-169.57}{363.22} = -0.4669 \text{ Times}$$

18. Return for portfolio using CAPM (May 2015, May 2018)

Your client is holding the following securities:

Securities	Cost Rs.	Dividends/ Interest Rs.	Market price Rs.	Beta
Equity Shares:				
Gold Ltd.	10,000	1,725	9,800	0.6
Silver Ltd.	15,000	1,000	16,200	0.8
Bronze Ltd.	14,000	700	20,000	0.6
PSU Bonds	36,000	3,600	34,500	0.01

Average return on the portfolio is 15.7%. Calculate

(i) Expected rate of return in each, using the Capital Asset Pricing Model (CAPM)

(ii) Risk free rate of return

Author's Note:

- This question lacks accuracy and we will be making lots of contradictory assumption. However, this is frequently tested in exam and hence students should not ignore this problem

WN 1: Computation of Return of Market:

- Let us assume market comprises of 1 share of Gold Limited, Silver Limited, Bronze Limited and 1 PSU Bonds

Security	Cost	Market price	Capital appreciation	Dividends	Total return
Gold Ltd	10,000	9,800	-200	1,725	1,525
Silver Ltd	15,000	16,200	1,200	1,000	2,200
Bronze Ltd	14,000	20,000	6,000	700	6,700
PSU Bonds	36,000	34,500	-1,500	3,600	2,100
Total	75,000				12,525

$$\text{Return of market} = \frac{12,525}{75,000} \times 100 = 16.70\%$$

WN 2: Computation of Risk-free rate:

- Let us now consider the given portfolio as our portfolio and compute average Beta (Average is taken as simple average; weighted average can also be done)

$$\text{Beta of Portfolio} = \frac{0.6 + 0.8 + 0.6 + 0.01}{4} = 0.50 \text{ Times}$$

$$\text{Return of Portfolio} = R_f + \text{Beta} \times (R_m - R_f)$$

$$15.70 = R_f + 0.50 \times (16.70 - R_f)$$

$$15.70 = R_f + 8.35 - 0.5R_f$$

$$7.35 = 0.50R_f; R_f = \frac{7.35}{0.50} = 14.70\%$$

WN 3: Computation of expected rate of return for each security:

Particulars	Calculation	Amount
1. Gold Limited	$R_f + \text{Beta} \times (R_m - R_f)$ $14.70 + 0.6 \times (16.70 - 14.70)$	15.90%
2. Silver Limited	$14.70 + 0.8 \times (16.70 - 14.70)$	16.30%
3. Bronze Limited	$14.70 + 0.6 \times (16.70 - 14.70)$	15.90%
4. PSU Bonds	$14.70 + 0.01 \times (16.70 - 14.70)$	14.72%

19. Return for portfolio using CAPM

A holds the following portfolio:

Share/Bond	Beta	Initial Price	Dividends	Market price at the end of year
Epsilon Ltd	0.8	25	2	50
Sigma Ltd	0.7	35	2	60
Omega Ltd	0.5	45	2	135
GOI Bonds	0.01	1,000	140	1,005

Calculate:

- ❖ The expected return on his portfolio using capital asset pricing method
- ❖ The average return on his portfolio

Risk free return is 14%

Answer:

Author's Note:

- This question also lacks accuracy. Again, we are doing this in ICAI manner as the same is frequently tested in exam
- I do not find any difference in expected return and average return. However both are asked and are done differently in suggested answers

WN 1: Computation of Market return/expected return of portfolio:

- Let us assume market comprises of one share of Epsilon Limited, Sigma Limited, Omega Limited and one GOI Bonds

Security	Cost	Market price	Capital appreciation	Dividends	Total return
Epsilon Limited	25	50	25	2	27
Sigma Limited	35	60	25	2	27
Omega Limited	45	135	90	2	92
GOI Bonds	1,000	1,005	5	140	145
Total	1,105				291

$$\text{Return of market} = \frac{291}{1,105} \times 100 = 26.33\%$$

Expected return of portfolio = 26.33%

WN 2: Computation of average return of portfolio:

Particulars	Calculation	Amount
1. Epsilon Limited	$R_f + \text{Beta} \times (R_m - R_f)$ $14 + 0.80 \times (26.33 - 14.00)$	23.86%
2. Sigma Limited	$14 + 0.70 \times (26.33 - 14.00)$	22.63%
3. Omega Limited	$14 + 0.80 \times (26.33 - 14.00)$	20.17%
4. GOI Bonds	$14 + 0.01 \times (26.33 - 14.00)$	14.12%
Average return of portfolio		20.20%

20. Share buy/sell decision (Nov 2015 RTP)

An investor holds two stocks A and B. The probability distribution of the returns is:

Economic scenario	Probability	Conditional returns %		
		A	B	Market

Growth	0.40	25	20	18
Stagnation	0.30	10	15	13
Recession	0.30	-5	-8	-3

The risk free rate during the next year is expected to be around 11%. Determine whether the investor should liquidate his holdings in stocks A and B or on the contrary make fresh investments in them.

Answer:

- We are required to decide whether company can make fresh investments/liquidate its holdings. This can be done by computing Beta of A and B
- Beta combined with CAPM would give the required return of security. The same would be then compared with actual return to decide on fresh investments

WN 1: Computation of Beta of Company A:

Prob	Security A			Market				$Pd_a d_m$
	Return	Product	Deviation	Return	Product	Deviation	Pd^2	
0.4	25	10	13.5	18	7.2	7.8	24.34	42.12
0.3	10	3	-1.5	13	3.9	2.8	2.35	-1.26
0.3	-5	-1.5	-16.5	-3	-0.9	-13.2	52.27	65.34
Total		11.5			10.2		78.96	106.2

$$\text{Beta of Company A} = \frac{\text{Covariance of A and Market}}{\text{Variance of Market}} = \frac{106.20}{78.96} = 1.3450 \text{ Times}$$

WN 2: Computation of Beta of Company B:

Prob	Security B			Market				$Pd_b d_m$
	Return	Product	Deviation	Return	Product	Deviation	Pd^2	
0.4	20	8	9.9	18	7.2	7.8	24.34	30.89
0.3	15	4.5	4.9	13	3.9	2.8	2.35	4.12
0.3	-8	-2.4	-18.1	-3	-0.9	-13.2	52.27	71.68
Total		10.1			10.2		78.96	106.69

$$\text{Beta of Company B} = \frac{\text{Covariance of B and Market}}{\text{Variance of Market}} = \frac{106.69}{78.96} = 1.3512 \text{ Times}$$

WN 3: Decision on investment/redemption:

Particulars	Security A	Security B
1. Beta	1.3450	1.3512
2. Required return	9.9240 [11 + 1.3450 × [10.20 - 11]]	9.9190 [11 + 1.3512 × [10.20 - 11]]
3. Actual Return	11.50	10.10

Conclusion:

- Security A and B generates higher return than expected return. Hence both are under-valued and we should make additional investment in company A and B

21. Computation of expected return using CAPM (Nov 2013, May 2018)

Mr. Ram is holding the following securities:

Security	Cost	Dividends	Market Price	Beta
Equity shares:				
Gold Limited	11,000	1,800	12,000	0.6
Silver Limited	16,000	1,000	17,200	0.8
Bronze Limited	12,000	800	18,000	0.6
GOI Bonds	40,000	4,000	37,500	1.0

Calculate:

- Expected rate of return in each case, using the capital asset pricing model
- Average rate of return, if risk free rate of return is 14%

Answer:**WN 1: Computation of market return**

Let us assume that market portfolio consists of 1 unit of Gold Limited, Silver Limited, Bronze Limited and GOI Bonds

Security	Investment	Dividends	Capital gains

Gold Limited	11,000	1,800	1,000
Silver Limited	16,000	1,000	1,200
Bronze Limited	12,000	800	6,000
GOI Bonds	40,000	4,000	-2,500
Total	79,000	7,600	5,700

$$\diamond \text{ Expected return of market portfolio} = \frac{7,600 + 5,700}{79,000} = 16.84\%$$

WN 2: Computation of expected return of each security:

Return	=	Rf + beta x (Rm - Rf)	
Gold Limited	=	14 + 0.6 (16.84 - 14)	15.70%
Silver Limited	=	14 + 0.8 (16.84 - 14)	16.27%
Bronze Limited	=	14 + 0.6 (16.84 - 14)	15.70%
GOI Bonds	=	14 + 1.0 (16.84 - 14)	16.84%

WN 3: Computation of average rate of return:

Average Return	=	$\frac{15.70 + 16.27 + 15.70 + 16.84}{4}$	16.13%

22. Computation of Beta (May 2017)

The following information are available with respect of Krishna Limited:

Year	Krishna Limited Average Price	Dividend Per Share	Average Market Index	Dividend Yield	Return on Govt bonds
2012	245	20	2013	4%	7%
2013	253	22	2130	5%	6%
2014	310	25	2350	6%	6%
2015	330	30	2580	7%	6%

Compute Beta Value of the Krishna Limited at the end of 2015 and state your observation.

Answer:

WN 1: Computation of return of security 2013, 2014 and 2015:

Year	Krishna Limited Average Price	Capital Appreciation	Dividend Per Share	Total return	Return in % [Total return/Last year price]
2012	245	NA	20	NA	NA
2013	253	8	22	30	12.24% [30/245]
2014	310	57	25	82	32.41% [82/253]
2015	330	20	30	50	16.13% [50/310]

WN 2: Computation of return of market for 2013, 2014 and 2015:

Year	Average Market Index	Capital appreciation	Capital appreciation %	Dividend Yield	Total return %
2012	2013	NA	NA	4%	NA
2013	2130	117	5.81% [117/2130]	5%	10.81%
2014	2350	220	10.33% [220/2130]	6%	16.33%
2015	2580	230	9.79% [230/2350]	7%	16.79%

WN 3: Computation of Beta:

Year	Security return [X]	Market Index [Y]	XY	Y ²
2012-13	12.24	10.81	132.31	116.86
2013-14	32.41	16.33	529.25	266.67

2014-15	16.13	16.79	270.82	281.90
Total	60.78	43.93	932.38	665.43
Average	20.26	14.64		

$$\text{Beta} = \frac{(\sum XY - n\bar{X}\bar{Y})}{\sum Y^2 - n(\bar{Y})^2} = \frac{932.38 - 3 \times 20.26 \times 14.64}{665.43 - 3 \times 14.64^2} = 1.897$$

Observation:

Year	Expected return	Actual Return	Action
2012-13	6% + 1.897(10.81% - 6%) = 15.12%	12.24%	Sell
2013-14	6% + 1.897(16.33% - 6%) = 25.60%	32.41%	Buy
2014-15	6% + 1.897(16.79% - 6%) = 26.47%	16.13%	Sell

23. Computation of portfolio return and beta

Mr. Tempest has the following portfolio of four shares:

Name	Beta	Investment in lacs
Oxy Rin Limited	0.45	0.80
Boxed Limited	0.35	1.50
Square Limited	1.15	2.25
Ellipse Limited	1.85	4.50

The risk-free rate of return is 7% and the market rate of return is 14%.

Required:

- Determine the portfolio return
- Calculate the portfolio Beta

Answer:**WN 1: Computation of Portfolio Beta:**

Security	Beta	Weight	Product
Oxy Rin Limited	0.45	0.80	0.36
Boxed Limited	0.35	1.50	0.525
Square Limited	1.15	2.25	2.5875
Ellipse Limited	1.85	4.50	8.325
Total		9.05	11.7975

$$\text{Portfolio Beta} = \frac{\text{Sum of product}}{\text{Sum of weights}} = \frac{11.7975}{9.05} = 1.3036 \text{ Times}$$

WN 2: Computation of Portfolio Return:

$$\text{Portfolio Return} = R_f + \text{Beta} \times (R_m - R_f) = 7 + 1.3036 \times (14 - 7) = 16.13\%$$

24. Impact of diversification (Nov 2012 RTP)

Suppose that economy A is growing rapidly and you are managing a global equity fund and so far, you have invested only in developed-country stocks only. Now you have decided to add stocks of economy A to your portfolio. The table below shows that expected rates of return, standard deviations, and correlation coefficients (all estimates are in aggregate stock market of developed countries and stock market of Economy A).

Particulars	Developed country stocks	Stocks of Economy A
Expected rate of return (%)	10	15
Risk (Standard deviation)	16	30
Correlation coefficient	0.30	

Assuming the risk-free interest rate to be 3%, you are required to determine:

- What percentage of your portfolio should you allocate to stocks of Economy A and if you want to increase the expected rate of return on your portfolio by 0.5%?
- What will be the standard deviation of your portfolio assuming that stocks of Economy A are included in the portfolio as calculated above?
- Also show how well the Fund will be compensated for the risk undertaken due to inclusion of stocks of Economy A in the portfolio

Answer:**WN 1: Computation of efficient portfolio which gives return of 7.5%**

Let us assume X to be the proportion of investment in developed country and (1-X) to be the proportion of investment in Economy A

Security	Return	Weight	Product
Developed Country	10	X	10X
Economy A	15	1-X	15 - 15X
Total	10.5	1	10.5

- ❖ The investor wants overall return of 10.5% and hence overall return in above table is 10.5. Based on weight of 1 product total should add to 10.5
- ❖ $10X + 15 - 15X = 10.5$
- ❖ $5X = 4.5$; $X = 90\%$
- ❖ Hence investor should invest 90% in developed country and 10% in Economy A

WN 2: Computation of risk of above portfolio:

Risk of portfolio	=	$(W_1SD_1)^2 + (W_2SD_2)^2 + 2W_1W_2SD_1SD_2COR_{12}$
Variance of Portfolio	=	$(0.90 \times 16)^2 + (0.10 \times 30)^2 + (2 \times 0.90 \times 0.10 \times 16 \times 30 \times 0.30)$
Variance of Portfolio	=	242.28
SD of portfolio	=	15.57% or 15.60%

WN 3: Computation of how well the fund have been compensated for the risk undertaken:

- ❖ We can compute Sharpe Ratio to understand how fund has been compensated for the risk undertaken

Sharpe Ratio	=	$\left(\frac{\text{Actual Return} - \text{Risk Free Return}}{\text{Standard Deviation}} \right)$
Sharpe Ratio of Developed Economy	=	$\frac{10 - 3}{16} = 0.437$
Sharpe Ratio of revised portfolio	=	$\frac{10.5 - 3}{15.60} = 0.481$

Sharpe Ratio has improved by 0.04 times due to addition of Economy A in revised portfolio.

Part IV - Systematic and Unsystematic Risk

25. Systematic and unsystematic risk (Nov 2015 RTP)

A study by a Mutual fund has revealed the following data in respect of three securities:

Security	S.D. (%)	Correlation with index
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%.

- a) What is the sensitivity of returns of each stock with respect to the market?
- b) What is the covariance among the various stocks?
- c) What would be the risk of portfolio consisting of all the three stocks equally?
- d) What is the beta of the portfolio consisting of equal investment in each stock?
- e) What is the total, systematic and unsystematic risk of the portfolio in (d)?

Answer:

WN 1: Computation of Beta:

- Sensitivity of returns with respect to market is known as Beta

Beta of security	=	$\frac{\sigma_s}{\sigma_m} \times COR_{sm}$
Beta of A	=	$\frac{20}{15} \times 0.60 = 0.80$ Times
Beta of B	=	$\frac{18}{15} \times 0.95 = 1.14$ Times
Beta of C	=	$\frac{12}{15} \times 0.75 = 0.60$ Times

WN 2: Computation of co-variance between stocks:

Co-variance between 1 and 2	=	Beta of 1 x Beta of 2 x variance of Market
Co-variance between 1 and 2	=	$0.80 \times 1.14 \times 225 = 205.20$

Co-variance between 1 and 3	=	Beta of 1 x Beta of 3 x Variance of Market
Co-variance between 1 and 3	=	$0.80 \times 0.60 \times 225 = 108$
Co-variance between 2 and 3	=	Beta of 2 x Beta of 3 x Variance of Market
Co-variance between 2 and 3	=	$1.14 \times 0.60 \times 225 = 153.90$

WN 3: Computation of Portfolio risk with equal investment in all three stocks:

Portfolio Variance	=	$(SD_a \times W_a)^2 + (SD_b \times W_b)^2 + (SD_c \times W_c)^2 + 2(W_a)(W_b)(COV_{ab}) + 2(W_a)(W_c)(COV_{ac}) + 2(W_b)(W_c)(COV_{bc})$
Portfolio variance	=	$(20 \times 0.3333)^2 + (18 \times 0.3333)^2 + (12 \times 0.3333)^2 + 2(0.3333)(0.3333)(205.20) + 2(0.3333)(0.3333)(108) + 2(0.3333)(0.3333)(153.90)$
Portfolio variance	=	$44.44 + 36 + 16 + 45.59 + 24 + 34.19 = 200.22$
Portfolio SD	=	14.15

WN 4: Computation of Beta of Portfolio consisting of all stocks equally:

$$\text{Portfolio Beta} = \frac{0.60 + 0.80 + 1.14}{3} = 0.8467 \text{ Times}$$

WN 5: Computation of total risk, systematic risk and unsystematic risk:

- Systematic and unsystematic risk can be computed under variance as well as SD approach. Variance approach is preferred if the problem is silent.

Particulars	Variance Approach	SD approach
1. Total risk	200.22	14.15
2. Systematic risk (SD of Market x Beta of Portfolio)	161.29 $(0.8467 \times 15)^2$	12.70 (0.8467×15)
3. Unsystematic risk (bal figure)	38.93	1.45

26. Systematic and unsystematic risk (May 2016 RTP)

The following details are given for X and Y companies' stocks and the Bombay Sensex for a period of one year. Calculate the systematic and unsystematic risk for the companies' stocks. What would be the portfolio risk if equal amount of money is allocated between these stocks?

	X Stock	Y Stock	Sensex
Average return	0.15	0.25	0.06
Variance of return	6.30	5.86	2.25
Beta	?	0.685	
Co-efficient of determination (r^2)	0.18	?	

Answer:**WN 1: Analysis of systematic and unsystematic risk:**

- Coefficient of determination (r^2) is given in the question. This would mean coefficient of determination under variance approach. If the same was mentioned as r then the same would be under SD approach

Particulars	Stock X	Stock Y
1. Total risk	6.30	5.86
2. Systematic risk	1.134 $[6.30 \times 0.18]$	1.056 $[0.685 \times 0.685 \times 2.25]$
3. Unsystematic risk	5.166	4.804
4. Co-efficient of determination (r^2)	0.18	0.18 $[1.056/5.86]$
5. Beta $\left(\sqrt{\frac{\text{Systematic risk}}{\text{Variance of Market}}}\right)$	0.7099 $\sqrt{\frac{1.134}{2.25}}$	0.685

WN 2: Computation of Portfolio risk:**Markowitz Approach:**

Portfolio Variance	=	$(\sigma_x W_x)^2 + (\sigma_y W_y)^2 + 2W_x W_y COV_{xy}$

Portfolio Variance	=	$(6.30 \times 0.5 \times 0.5) + (5.86 \times 0.5 \times 0.5) + 2(0.5)(0.5)(1.09)$
Portfolio variance	=	$1.58 + 1.47 + 0.55 = 3.60$
Portfolio SD	=	$\sqrt{3.60} = 1.90$

Computation of co-variance of X and Y:

Co-variance between X and Y = Beta of X x Beta of Y x Variance of Market

Co-variance between X and Y = $(0.7099) \times (0.6850) \times 2.25 = 1.09$

Sharpe Approach:

Particulars	Portfolio variance
1. Systematic risk (Note 1)	1.09
2. Unsystematic risk (Note 2)	2.49
3. Total Risk	3.58
4. Portfolio SD	1.89

Note 1: Computation of systematic risk:

Systematic risk = $(0.6975 \times 0.6975 \times 2.25) = 1.09$

Note 2: Computation of unsystematic risk:

Unsystematic risk = $(5.166 \times 0.5^2) + (4.804 \times 0.5^2) = 2.49$

27. Portfolio Beta (May 2015)

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 is 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:

- ❖ The Portfolio Beta
- ❖ Residual variance of each of the three shares
- ❖ Portfolio variance using Sharpe Index Model
- ❖ Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

Answer:**WN 1: Computation of Portfolio Beta:**

Portfolio Beta = $(0.20 \times 0.40) + (0.50 \times 0.50) + (0.30 \times 1.10) = 0.66$

WN 2: Computation of residual variances:

Particulars	Share A	Share B	Share C
1. Total risk (variance)	0.0150	0.0250	0.1000
2. Systematic risk (Beta x Beta x variance of market)	0.0016	0.0025	0.0121
3. Unsystematic risk (Residual variance)	0.0134	0.0225	0.0879

WN 3: Computation of Portfolio variance as per Sharpe Index Model:

Particulars	Portfolio variance
1. Systematic risk (Note 1)	0.004356
2. Unsystematic risk (Note 2)	0.014072
3. Total Risk	0.018428

Note 1: Computation of systematic risk:

Systematic risk = $(0.66 \times 0.66 \times 0.1 \times 0.1) = 0.004356$

Note 2: Computation of unsystematic risk:

$$\text{Unsystematic risk} = (0.0134 \times 0.2^2) + (0.0225 \times 0.5^2) + (0.0879 \times 0.3^2) = 0.014072$$

WN 4: Computation of Portfolio Variance as per Markowitz approach:

Portfolio Variance	=	$(SD_a \times W_a)^2 + (SD_b \times W_b)^2 + (SD_c \times W_c)^2 + 2(W_a)(W_b)(COV_{ab}) + 2(W_a)(W_c)(COV_{ac}) + 2(W_b)(W_c)(COV_{bc})$
Portfolio variance	=	$(0.015 \times 0.20 \times 0.20) + (0.025 \times 0.50 \times 0.50) + (0.100 \times 0.30 \times 0.30) + 2(0.20)(0.50)(0.030) + 2(0.20)(0.30)(0.020) + 2(0.50)(0.30)(0.040)$
Portfolio variance	=	$0.0006 + 0.005625 + 0.009 + 0.006 + 0.0024 + 0.012$
Portfolio variance	=	0.035625

28. Portfolio standard deviation (Nov 2016 RTP)

A portfolio has been constructed with the following features:

Security	B	Random Error, $\sigma\epsilon_i$	Weight
A	1.50	6	.3
B	1.10	10	.2
C	1.30	4	.2
D	0.80	12	.2
E	0.90	7	.1

Find out the risk of the portfolio given that the standard deviation of the market index is 20%.

Answer:

WN 1: Computation of Portfolio Beta and Portfolio Unsystematic risk:

Security	Beta	Weight	Product	Random error (SD)	Product
A	1.5	0.3	0.45	6	3.24
B	1.1	0.2	0.22	10	4
C	1.3	0.2	0.26	4	0.64
D	0.8	0.2	0.16	12	5.76
E	0.9	0.1	0.09	7	0.49
Total			1.18		14.13

- Random error is basically unsystematic risk (SD based unsystematic risk as the value is not squared)
- Product for column 6 = Random error x Random error x Weight x weight
- Beta of Portfolio = 1.18 Times
- Unsystematic risk of portfolio = 14.13 (weighted average of individual unsystematic risk; Random error is equal to unsystematic risk)

WN 2: Computation of Portfolio risk:

Particulars	Amount
1. Systematic risk $(1.18 \times 1.18 \times 20 \times 20)$	556.96
2. Unsystematic risk (Note 2)	14.13
3. Total Risk (Portfolio Variance)	571.09
4. Portfolio SD	$\sqrt{571.09} = 23.90$

29. Systematic and Unsystematic Risk (Nov 2019 Exam):

Following are risk and return estimates for two stocks

Stock	Expected Return (%)	Beta	Specific SD of Expected Return (%)
A	14	0.8	35
B	18	1.2	45

The market index has a Standard Deviation (SD) of 25% and risk free rate on Treasury Bills is 6%.

You are required to calculate:

- The standard deviation of expected returns on A and B.
- Suppose a portfolio is to be constructed with the proportions of 25%, 40% and 35% in stock A, B and Treasury Bills respectively, what would be the expected return, standard deviation of expected return of the portfolio?

Answer:

WN 1: Computation of standard deviation of A and B:

- Specific SD of expected return refers to Unsystematic Risk

Particulars	A	B
Systematic risk (Beta x SD of Market) ²	400 (0.8 x 25) ²	900 (1.2 x 25) ²
Unsystematic risk	1225 (35) ²	2025 (45) ²
Total Risk (Variance)	1625	2925
Standard Deviation	40.31%	54.08%

WN 2: Computation of expected return and standard deviation of portfolio:

- Expected Return of portfolio = $(14 \times 0.25) + (18 \times 0.40) + (6 \times 0.35) = 12.80\%$
- Beta of Portfolio = $(0.80 \times 0.25) + (1.20 \times 0.40) + (0 \times 0.35) = 0.68$ Times
- Systematic risk of portfolio = $(0.68 \times 25)^2 = 289$
- Unsystematic risk of portfolio = $(35 \times 0.25)^2 + (45 \times 0.40)^2 + (0 \times 0.35)^2 = 400.56$
- Total risk of portfolio = $289 + 400.56 = 689.56$
- SD of portfolio = $\text{SQRT}(689.56) = 26.26\%$

Part V - Characteristic Line, CML and SML**30. Characteristic line (Nov 2016)**

The returns on stock A and market portfolio for a period of 6 years are as follows:

Year	Return on A (%)	Return on market portfolio (%)
1	12	8
2	15	12
3	11	11
4	2	-4
5	10	9.5
6	-12	-2

You are required to determine:

- Characteristic line for stock A
- The systematic and unsystematic risk of stock A.

Answer:**WN 1: Characteristic line:****Computation table for Beta:**

- Probability is not given in the question and hence we are assuming equal probability. Beta can also be computed under formula 1. However we need total risk of security for solving systematic and unsystematic risk

Prob	Security A				Market				Pd _a d _m
	Return	Product	Deviation	Pd ²	Return	Product	Deviation	Pd ²	
0.1667	12	2.00	5.67	5.36	8	1.33	2.26	0.85	2.14
0.1667	15	2.50	8.67	12.53	12	2.00	6.26	6.53	9.05
0.1667	11	1.83	4.67	3.64	11	1.83	5.26	4.61	4.09
0.1667	2	0.33	-4.33	3.13	-4	-0.67	-9.74	15.8	7.03
0.1667	10	1.67	3.67	2.25	9.5	1.58	3.76	2.36	2.3
0.1667	-12	-2.00	-18.33	56.01	-2	-0.33	-7.74	9.99	23.65
Total		6.33		82.92		5.74		40.15	48.26

Particulars	Calculation	Amount
1. Beta of Security (Covariance of security and Market/Variance of Market)	$\frac{48.26}{40.15}$	1.20
2. Required return (Beta x R _m)	(1.20×5.74)	6.89
3. Actual return		6.33
4. Alpha (Actual return - required return)		-0.56
5. Characteristic line (Alpha + (Beta x R _m))		-0.56 + 1.20 R _m

WN 2: Computation of systematic risk and unsystematic risk:

Particulars	Variance Approach	SD Approach
1. Total Risk	82.92	9.11
2. Systematic risk (Beta x SD of Market)	57.82	7.60
3. Unsystematic risk (balancing figure)	25.10	1.51

31. Characteristic line (May 2015 RTP)

The rates of return on the security of company X and market portfolio for 10 periods are

Year	Return on X (%)	Return on market portfolio (%)
1	20	22
2	22	20
3	25	18
4	21	16
5	18	20
6	-5	8
7	17	-6
8	19	5
9	-7	6
10	20	11

- What is the beta of security X?
- What is the characteristic line for security X?

Answer:

WN 1: Computation of Beta:

Year	Return of X	Return of Market (Y)	XY	Y ²
1	20	22	440	484
2	22	20	440	400
3	25	18	450	324
4	21	16	336	256
5	18	20	360	400
6	-5	8	-40	64
7	17	-6	-102	36
8	19	5	95	25
9	-7	6	-42	36
10	20	11	220	121
Total/Average	15	12	2157	2146

$$\text{Beta} = \frac{\sum XY - n(\text{Mean of X})(\text{Mean of Y})}{\sum Y^2 - n(\text{Mean of Y})^2} = \frac{2157 - 10(15)(12)}{2146 - 10(12)(12)} = \frac{357}{706} = 0.5057 \text{ Times}$$

WN 2: Characteristic line:

Particulars	Calculation	Amount
1. Required return (Beta x R _m)	(0.5057 x 12)	6.07
2. Actual return		15
3. Alpha		8.93
4. Characteristic line (Alpha + (Beta x R _m))		8.93 + 0.5057R _m

32. Security market line & capital market line (May 2014 RTP, May 2019 RTP)

Expected return on two stocks for particular market returns are given in the following table:

Market Return	Aggressive	Defensive
7%	4%	9%
25%	40%	18%

You are required to calculate:

- The Betas of the two stocks
- Expected return of each stock, if the market return is equally likely to be 7% or 25%
- The Security Market Line (SML), if the risk free rate is 7.5% and market return is likely to be 7% or 25%
- The Alphas of the two stocks
- Capital market line

Answer:**WN 1: Computation table for Beta:****Security A:**

Prob	Aggressive				Market				$Pd_a d_m$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	
0.5	4	2	-18	162	7	3.5	-9	40.5	81
0.5	40	20	18	162	25	12.5	9	40.5	81
Total		22		324		16		81	162

Security B:

Prob	Aggressive				Market				$Pd_b d_m$
	Return	Product	Deviation	Pd^2	Return	Product	Deviation	Pd^2	
0.5	4	2	-18	162	7	3.5	-9	40.5	20.25
0.5	40	20	18	162	25	12.5	9	40.5	20.25
Total		22		324		16		81	40.5

WN 2: Beta, Expected return and SML:

Particulars	Calculation	Amount
1. Beta of Aggressive	(162/81)	2 Times
2. Beta of Defensive	(40.50/81)	0.50 Times
3. Expected return of Aggressive	WN 1	22%
4. Expected return of defensive	WN 1	13.50%
5. Security Market Line	$R_f + \text{Beta} \times (R_m - R_f)$ $7.5 + \text{Beta} \times (16 - 7.5)$	$7.5 + 8.50 \text{ Beta}$

WN 3: Computation of Alpha:**Computation of Alpha:**

Particulars	Characteristic Line Approach	CAPM Approach
Security Aggressive		
1. Required return	32% [Beta x R_m]	24.50% $R_f + \text{Beta} \times (R_m - R_f)$
2. Actual Return	22%	22%
3. Alpha	-10%	-2.50%
Security Defensive		
1. Required return	8% [0.5 x 16]	11.75% [7.5 + 0.5 x 8.5]
2. Actual Return	13.50%	13.50%
3. Alpha	5.50%	1.75%

WN 4: Capital Market Line:

$$\text{Capital Market Line} = R_f + \frac{\text{SD of Security}}{\text{SD of Market}} \times (R_m - R_f) = 7.50\% + \left(\frac{\text{SD of Security}}{9} \right) \times 8.50\%$$

Part VI - Factor Sensitivity Analysis and Arbitrage Pricing Theory

33. Miscellaneous - Factor sensitivity analysis (Nov 2018)

Mr. X own a portfolio with the following characteristics:

Particulars	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.

- a) If Mr. X has Rs. 1, 00,000 to invest and sells short Rs. 50,000 of security B and purchases Rs. 1, 50,000 of security A what 'is the sensitivity of Mr. X's portfolio to the two factors?

- b) If Mr. X borrows Rs. 1, 00,000 at the risk free rate and invests the amount he borrows along with the original amount of Rs. 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?
- c) What is the expected return premium of part 2?

Answer:

WN 1: Computation of sensitivity of Portfolio to Factor 1 and Factor 2:

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	1,50,000	0.80	1,20,000	0.60	90,000
Security B	-50,000	1.50	-75,000	1.20	-60,000
Total	1,00,000	0.45	45,000	0.30	30,000

- Factor 1 sensitivity of Portfolio = $45,000/1,00,000 = 0.45$ Times
- Factor 2 sensitivity of Portfolio = $30,000/1,00,000 = 0.30$ Times

WN 2: Computation of sensitivity of Portfolio to Factor 1 and Factor 2:

Security	Weight	Factor 1 Beta	Product	Factor 2 Beta	Product
Security A	3,00,000	0.80	2,40,000	0.60	1,80,000
Security B	-1,00,000	1.50	-1,50,000	1.20	-1,20,000
Risk-free security	-1,00,000	0.00	0	0.00	0
Total	1,00,000	0.90	90,000	0.60	60,000

- Factor 1 sensitivity of Portfolio = $90,000/1,00,000 = 0.90$ Times
- Factor 2 sensitivity of Portfolio = $60,000/1,00,000 = 0.60$ Times

WN 3: Computation of return premium:

Return = $R_f + (\text{Beta}_1 \times \text{RP}_1) + (\text{Beta}_2 \times \text{RP}_2)$
$15 = 10 + 0.80 \text{ RP}_1 + 0.60 \text{ RP}_2$ Equation 1
$20 = 10 + 1.50 \text{ RP}_1 + 1.20 \text{ RP}_2$ Equation 2
Equation 1 x 2
$30 = 20 + 1.60 \text{ RP}_1 + 1.20 \text{ RP}_2$
Subtracting equation 2 from above equation
$10 = 10 + 0.10 \text{ RP}_1$; $\text{RP}_1 = 0$
Substituting RP 1 in equation 1
$15 = 10 + 0 + 0.60 \text{ RP}_2$
$\text{RP}_2 = 5/0.60 = 8.33\%$
Return Premium of Factor 1 = 0%
Return Premium of Factor 2 = 8.33%
Return Premium for Part 2:
Return Premium = $(0.90 \times 0) + (0.60 \times 8.33) = 5\%$

34. Arbitrage pricing theory (May 2013 RTP)

Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected Value %	Actual Value %
GNP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00
Interest rate	1.30	7.75	9.00
Stock market index	1.70	10.00	12.00
Industrial production	1.00	7.00	7.50

If the risk free rate of interest be 9.25%, how much is the return of the share under Arbitrage Pricing Theory?

Answer:

Return under APT = Risk free rate + (Factor 1 Beta x Change in Factor 1) + (Factor 2 Beta x Change in Factor 2) + (Factor 3 Beta x Change in Factor 3) + (Factor 4 Beta x Change in Factor 4) + (Factor 5 Beta x Change in Factor 5)

$$\text{Return under APT} = 9.25 + (1.20 \times 0) + (1.75 \times 1.50) + (1.30 \times 1.25) + (1.70 \times 2.00) + (1 \times 0.50)$$

$$\text{Return under APT} = 17.40\%$$

35. Arbitrage Pricing Theory (Nov 2019 RTP)

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

- Small cap growth stocks
- Small cap value stocks
- Large cap growth stocks
- Large cap value stocks

Mr. Nirmal Kumar also estimated the weights of the above categories of stocks in the market index. Furthermore, the sensitivity of returns on these categories of stocks to the three important factor are estimated to be:

Category of stocks	Weight in the market index	Factor I (Beta)	Factor II (Price Book)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk premium		6.85%	-3.5%	0.65%

The rate of return on treasury bonds is 4.5%.

Required:

- Using arbitrage pricing theory, determine the expected return on the market index
- Using CAPM, determine the expected return on the market index
- Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks. If the target beta for the desired portfolio is 1, determine the composition of his portfolio.

Answer:**WN 1: Computation of Market index return using APT:**

Return under APT = $R_f + (\text{Factor 1 Beta} \times \text{RP}_1) + (\text{Factor 2 Beta} \times \text{RP}_2) + (\text{Factor 3 Beta} \times \text{RP}_3)$
Small cap growth = $4.5 + (0.80 \times 6.85) + (1.39 \times -3.50) + (1.35 \times 0.65) = 5.9925\%$
Small cap value = $4.5 + (0.90 \times 6.85) + (0.75 \times -3.50) + (1.25 \times 0.65) = 8.8525\%$
Large cap growth = $4.5 + (1.165 \times 6.85) + (2.75 \times -3.50) + (8.65 \times 0.65) = 8.4778\%$
Large cap value = $4.5 + (0.85 \times 6.85) + (2.05 \times -3.50) + (6.75 \times 0.65) = 7.535\%$
Return of Market Index = $(5.9925 \times 0.25) + (8.8525 \times 0.10) + (8.4778 \times 0.50) + (7.535 \times 0.15) = 7.7525\%$

WN 2: Computation of Market Index return using CAPM:

Return under APT = $R_f + (\text{Beta} \times \text{RP})$
Small cap growth = $4.5 + (0.80 \times 6.85) = 9.98\%$
Small cap value = $4.5 + (0.90 \times 6.85) = 10.665\%$
Large cap growth = $4.5 + (1.165 \times 6.85) = 12.4803\%$
Large cap value = $4.5 + (0.85 \times 6.85) = 10.3225\%$
Return of Market Index = $(9.98 \times 0.25) + (10.665 \times 0.10) + (12.4803 \times 0.50) + (10.3225 \times 0.15) = 11.35\%$

WN 3: Computation of portfolio weights for Beta of 1 Time:

Let us assume W_1 to be the weight of small cap value and $(1 - W_1)$ to be the weight of large cap Growth

Security	Beta	Weight	Product
Small cap value	0.90	W_1	$0.90W_1$
Large cap Growth	1.165	$1 - W_1$	$1.165 - 1.165W_1$
Total		1	$1.165 - 0.265W_1 = 1$

$$\text{Weight of Small cap value} = \frac{0.165}{0.265} = 62.26\%$$

$$\text{Weight of Large cap growth} = 100 - 62.26\% = 37.74\%$$

Part VII - Beta and Leverages

36. Beta calculation (May 2015 RTP)

The total market value of the equity share of O.R.E. company is Rs.60,00,000 and the total value of the debt is Rs.40,00,000. The treasurer estimate that the beta of the stock is currently 1.5 and the expected risk premium on the market is 10 percent. The treasury bill rate is 8 percent.

Required:

- ❖ What is the Beta of company's existing portfolio of assets?
- ❖ Estimate the company's cost of capital and the discount rate to be used for expansion of the company's present business?

Answer:

- Beta of Assets side will be equal to Beta of liabilities side

Source	Beta	Weight	Product
Equity	1.50	60,00,000	90,00,000
Debt	0.00	40,00,000	0
Overall	0.90	1,00,00,000	90,00,000

- Beta of company's existing assets = 0.90 Times
- Cost of capital = $R_f + \text{Beta} \times (R_m - R_f) = 8 + 0.90 \times 10 = 17\%$
- The company should use discount rate of 17% for expansion

37. Beta calculation through Proxy (Nov 2017 RTP)

ABC Limited manufactures Car Air Conditioners (ACs), Window ACs and Split ACs constituting 60%, 25% and 15% of total market value. The stand-alone standard deviation and coefficient of correlation with market return of Car AC and Window AC is as follows:

	Standard Deviation	Coefficient of Correlation
Car AC	0.30	0.6
Window AC	0.35	0.7

No data for stand-alone SD and Coefficient of Correlation of Split AC is available. However a company who derives its half value from Split AC and half from Window AC has a SD of 0.50 and Coefficient of correlation with market return is 0.85. Index has a return of 10% and has SD of 0.20. Further the risk-free rate of return is 4%.

You are required to determine:

- ❖ Beta of ABC Limited
- ❖ Cost of Equity of ABC Limited

Assuming that ABC Limited wants to raise debt of an amount equal to half of its market value then determine equity Beta, if yield of debt is 5%.

Answer:**WN 1: Computation of Beta of Car AC, Window AC and Proxy Company:**

Beta	=	$\frac{\sigma_s}{\sigma_m} \times \text{COR}_{sm}$
Beta of car AC	=	$\frac{0.30}{0.20} \times 0.60 = 0.90 \text{ Times}$
Beta of window AC	=	$\frac{0.35}{0.20} \times 0.70 = 1.225 \text{ Times}$
Beta of Proxy company	=	$\frac{0.50}{0.20} \times 0.85 = 2.125 \text{ Times}$

WN 2: Computation of Beta of Split AC Business:

Let us assume Beta of Split AC business to be A

Source	Beta	Weight	Product
Split AC	A	0.50	0.50A
Window AC	1.225	0.50	0.6125
Overall	2.125	1.00	2.125

- $0.50A + 0.6125 = 2.125$
- $0.50A = 1.5125$
- $A = 1.5125/0.50 = 3.025 \text{ Times}$
- **Beta of Split AC business = 3.025 Times**

WN 3: Computation of Beta of ABC Limited (Assets side):

Source	Beta	Weight	Product
Car AC	0.90	0.60	0.5400
Split AC	3.025	0.15	0.45375
Window AC	1.225	0.25	0.30625
Overall	1.30	1	1.30

- Beta of ABC Limited = 1.30 Times

WN 4: Computation of equity Beta of ABC Limited:

Let us assume equity beta of ABC Limited to be A

Source	Beta	Weight	Product
Equity	A	0.50	0.50A
Debt	0.1667	0.50	0.0833
Total	1.30	1.00	1.30

- $0.50A + 0.033 = 1.30$
- $A = 1.2167/0.50 = 2.4333$
- **Equity Beta of ABC Limited = 2.4333 Times**

Note 1: Computation of Debt Beta:

$$\text{Return} = R_f + B \times (R_m - R_f)$$

$$5 = 4 + \text{Beta} \times (10 - 4)$$

$$1 = 6 \text{ Beta}$$

$$\text{Debt Beta} = \frac{1}{6} = 0.1667 \text{ Times}$$

WN 5: Computation of cost of equity:

$$\text{Cost of equity} = R_f + \text{Beta} \times (R_m - R_f)$$

$$\text{Cost of equity} = 4 + 2.4333 \times (10 - 4)$$

$$\text{Cost of equity} = 4 + 14.60 = 18.60\%$$

38. Computation of Beta (Nov 2019)

Equity of KGF Limited (KGFL) is Rs.410 crores, its debt, is worth Rs.170 Crores. Printer Division segments value is attributable to 74%, which has an Asset Beta of 1.45, balance value is applied to spares and consumables Division, which has an Asset beta of 1.20. KGFL Debt beta is 0.24.

You are required to calculate:

- Equity beta
- Ascertain Equity Beta, if KGF Limited decides to change its Debt Equity position by raising further debt and buying back of equity to have its Debt Equity Ratio at 1.90. Assume that the present Debt Beta is 0.35 and any further funds raised by way of Debt will have a Beta of 0.40
- Whether the new Equity Beta justifies increase in the value of equity on account of leverage?

Answer:**WN 1: Computation of Asset Beta of KGF Limited**

Source	Beta	Weight	Product
Printer	1.45	0.74	1.073
Spares	1.20	0.26	0.312
Total	1.385	1.00	1.385

- Asset Beta of KGF Limited = 1.385 Times

WN 2: Computation of equity Beta of KGF Limited

Let us assume equity Beta of KGF Limited to be A

Source	Beta	Weight	Product
Equity	A	410	410A
Debt	0.24	170	40.80
Total	1.385	580	803.30

- $410A + 40.80 = 803.30$
- $410A = 762.50$
- **Equity Beta = 1.8596 Times (762.50/410)**

WN 3: Computation of equity Beta post buy-back:

Let us assume equity Beta to be A

Source	Beta	Weight	Product
Equity	A	200	200A
Old Debt	0.35	170	59.50

New Debt	0.40	210	84.00
Total	1.385	580	803.30

- $200A + 59.50 + 84.00 = 803.30$
- $200A = 659.80$
- Equity Beta = 3.299 Times ($659.80/200$)

Note: Computation of debt raised

- Total capital of company (existing) = $410 + 170 = 580$ Crores
- Target debt equity ratio = 1.90 Times
- Debt = 1.90 Equity
- Debt + Equity = 580; $1.90\text{Equity} + \text{Equity} = 580$; $2.90\text{Equity} = 580$; Equity = 200 Crores
- Debt = 380 crores
 - Old debt = 170 Crores
 - New debt = 210 Crores

Conclusion:

- Increase in equity Beta is justified due to higher leverage. Equity Beta has increased from 1.8596 Times to 3.299 Times

Part VIII - Portfolio Strategies**39. Portfolio re-balancing (May 2012)**

Indira has a fund of Rs.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. The present NIFTY is 5326. The minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

- ❖ Immediately to start with.
- ❖ 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.
- ❖ 10 days further from the above date if the NIFTY touches 5539.04.

For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk free securities in which she is going to invest will have no Beta.

Answer:**WN 1: Computation of investment in equity on day 0**

Particulars	Calculation	Amount
Maximum decline in NIFTY	$\frac{5,326 - 4,793.40}{5,326}$	10%
Floor value	$3,00,00 - 10\%$	2,70,000
Investment in equity	$2 \times [3,00,000 - 2,70,000]$	60,000

WN 2: Rebalancing of portfolio:

Particulars	Equity	Bond	Total
Day 0	60,000	2,40,000	3,00,000
Day 10:			
Before rebalancing	57,713	2,40,000	2,97,713
After rebalancing	55,426	2,42,287	2,97,713
Day 20:			
Before rebalancing	59,927	2,42,287	3,02,214
After rebalancing	64,428	2,37,786	3,02,214

Note:**Day 10:**

- Value of equity on day 10 = $60,000 \times \frac{5,122.96}{5,326} = 57,713$
- Value of portfolio will be Rs.2,97,713. We need to rebalance the same as per CPPI
- Investment in equity = $2 \times [2,97,713 - 2,70,000] = 55,426$

Day 20:

- Value of equity on day 20 = $55,426 \times \frac{5,539.04}{5,122.96} = 59,927$
- Value of portfolio will be Rs.3,02,214. We need to rebalance the same as per CPPI
- Investment in equity = $2 \times [3,02,214 - 2,70,000] = 64,428$

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Chapter 7 - Mutual Funds

Theory to solve problems

Net Asset Value:

- ❖ Net asset value (NAV) is value per unit of a mutual fund on a specific date. It is the amount which a unit holder would receive if the mutual fund were wound up
- ❖ NAV per unit is computed once per day based on the closing market prices of the securities in the fund's portfolio
- ❖ $\text{NAV per unit} = (\text{Value of assets} - \text{value of liabilities}) / \text{Number of units}$

Holding Period Return:

- ❖ The total return received from holding an asset or portfolio of assets over a period of time, generally expressed as a percentage.
- ❖ Holding period return/yield is calculated on the basis of total returns from the asset or portfolio - i.e. income plus changes in value. It is particularly useful for comparing returns between investments held for different periods of time.
- ❖ $\text{Holding Period Return} = \frac{\text{Income} + (\text{End of Period Value} - \text{Initial Value})}{\text{Initial Value}}$

Expense ratio:

- ❖ Expense ratio is a measure of what it costs an investment company to operate a mutual fund
- ❖ An expense ratio is determined through an annual calculation, where a fund's operating expenses are divided by the average assets under management (AUM)
- ❖ Operating expenses are paid out of fund's earnings and hence high expense ratio will lead to lower return for unitholders
- ❖ $\text{Expense ratio} = \text{Operating expenses per unit} / \text{Average of opening and closing NAV}$

Evaluation of MF Performance:

Measure	Description
Sharpe Index [Reward to Variability]	❖ Measures the risk premium per unit of total risk ❖ $\text{Sharpe Index} = [\text{Return from MF} - \text{Risk free return}] / \text{SD of MF}$ ❖ Suitable for undiversified portfolio
Treynor Index [Reward to Volatility]	❖ Measures the risk premium per unit of non-diversifiable risk ❖ $\text{Treynor Index} = [\text{Return from MF} - \text{Risk free return}] / \text{Beta of MF}$ ❖ Suitable for diversified portfolio
Jensen's Alpha	❖ Return in excess of what has been mandated by CAPM ❖ $\text{Jensen's Alpha} = \text{Return from MF} - \text{Required return as per CAPM}$

Practical Problems

Overview:

- Part I - MF Return
- Part II - Calculation of NAV
- Part III - Mutual Funds - Performance Evaluation

Part I - MF Return

1. Calculation of return (May 2013 RTP)

Mr. A can earn a return of 16 percent by investing in equity shares on his own. Now he is considering a recently announced equity based mutual fund scheme in which initial expenses are 5.5 percent and annual recurring expense are 1.5 percent.

- ❖ How much should the fund earn to provide Mr. A return of 16 percent?
- ❖ Ascertain the target expense ratio in case the Mutual Fund earn 18%?
- ❖ Ascertain the initial expense ratio in case the MF can earn 19%?

Answer:**WN 1: Computation of MF return to earn individual return of 16 percent:**

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$\text{MF return} = \frac{16\%}{1 - 0.055} + 1.5\% = 16.93\% + 1.5\% = 18.43\%$$

WN 2: Computation of target expense ratio if MF can earn 18%:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$18\% = \frac{16\%}{1 - 0.055} + \text{Annual expense ratio}$$

$$18\% = 16.93\% + \text{Annual expense ratio}$$

$$\text{Target Annual expense ratio} = 1.07\%$$

WN 3: Computation of initial expense ratio if MF can earn 19%:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$19\% = \frac{16\%}{1 - \text{Initial expense ratio}} + 1.5\%$$

$$17.5\% = \frac{16\%}{1 - \text{Initial expense ratio}}$$

$$1 - \text{Initial expense ratio} = \frac{16\%}{17.5\%} = 0.9143$$

$$\text{Initial expense ratio} = 1 - 0.9143 = 0.0857 \text{ (or) } 8.57\%$$

2. Calculation of return (May 2016 RTP)

Mr. X, an investor purchased 300 units of ABC Mutual Fund at rate of Rs.12.25 per unit, one year ago. Over the year Mr.X received Rs.1.25 as dividend and had received a capital gains distribution of Rs.1.00 per unit. You are required to find out:

- Mr.X's holding period return assuming that this no load fund has a NAV of Rs.13.00 as on today
- Mr.X's holding period return, assuming all the dividends and capital gains distributions are reinvested into additional units as at average price of Rs.12.50 per unit.

Answer:**WN 1: Computation of return with dividend payout option:**

$$\text{Return} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times 100$$

$$\text{Return} = \frac{(13.00 - 12.25) + 1.25 + 1.00}{12.25} \times 100 = 24.49\% \text{ per annum}$$

Note:

- Return can be computed using the above formula for a single unit. Return percentage would remain same irrespective of the number of units purchased by the investor

WN 2: Computation of return with dividend re-investment option:

Particulars	Calculation	Amount
Dividend per unit		2.25
No of opening units		300
Dividend in rupees	300 x 2.25	675
Re-investment NAV		12.50
Units received due to dividend reinvestment	$\frac{675}{12.50}$	54
Closing units	300 + 54	354
Closing NAV		13.00
Closing value	354 x 13	Rs.4,602

$$\text{Return} = \frac{\text{Closing value} - \text{Opening investment}}{\text{Opening investment}} \times 100$$

$$\text{Return} = \frac{4,602 - (300 \times 12.25)}{(300 \times 12.25)} \times 100 = \frac{927}{3,675} \times 100 = 25.22\%$$

3. Computation of amount of investment (Nov 2018):

During the year 2017 an investor invested in a mutual fund. The capital gain and dividend for the year was Rs. 3.00 per unit, which were re-invested at the year end NAV of Rs. 23.75. The investor had total units of

26,750 as at the end of the year. The NAV had appreciated by 18.75% during the year and there was an entry load of Rs. 0.05 at the time when the investment was made.

The investor lost his records and wants to find out the amount of investment made and the entry load in the mutual fund.

Answer:

Opening NAV	$\frac{23.75}{118.75\%}$	Rs.20
No of units at beginning		X
Amount of dividend		3X
Dividend in units		$\frac{3X}{23.75}$
Closing units	Opening units + Dividend	26,750
Computation of opening units:	$X + \frac{3X}{23.75} = 26,750$ $\frac{23.75X + 3X}{23.75} = 26,750$ $\frac{26.75X}{23.75} = 26,750$ $X = \frac{26,750 \times 23.75}{26.75}$	23,750 units
Opening investment	$23,750 \times (20 + 0.05)$	Rs.4,76,187.50
Amount of investment	$23,750 \times 0.05$	Rs.1,187.50

4. Calculation of return

Sun Moon Mutual Fund sponsored open-ended equity oriented scheme "Chanakya 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 1.4.1999, Mr. Anand, Mr. Bacchan & Mrs. Charu, three investors invested Rs.1,00,000 each & chosen 'B', 'C' & 'A' Plan respectively. The history of the fund is as follows:

Date	Dividend %	Bonus Ratio	Net Asset Value per unit (FV of Rs.10)		
			Plan A	Plan B	Plan C
28.07.2003	20		30.70	31.40	33.42
31.03.2004	70	5:4	58.42	31.05	70.05
31.10.2007	40		42.18	25.02	56.15
15.03.2008	25		46.45	29.10	64.28
31.03.2008		1:3	42.18	20.05	60.12
24.03.2009	40	1:4	48.10	19.95	72.40
31.07.2009			53.75	22.98	82.07

On 31st July all three investors redeemed all balance units. Calculate annual rate of return to each of the investors.

Consider:

- ❖ Long-term capital gain is exempt from Income tax
- ❖ Short-term capital gain is subject to 10% Income tax
- ❖ Security Transaction Tax 0.2 percent only on sale/redemption of units
- ❖ Ignore education cess

Answer:

WN 1: Computation of return of Mr. Anand (Plan B):

Calculation of units on maturity:

Particulars	Opening Balance	Bonus Allotment	Closing units
Bonus on 31.03.2004	10,000	12,500	22,500
Bonus on 31.03.2008	22,500	7,500	30,000
Bonus on 24.03.2009	30,000	7,500	37,500

Calculation of Annual Return:

Particulars	Calculation	Amount

Value of units sold	(37,500 * 22.98)	8,61,750
Less: STT	(value of units sold * 0.2%)	1,724
Less: Cost of acquisition		1,00,000
Less: Tax on STCG	(7,500 * {(22.98 - 19.95) x 10%}	2,273
Net returns from investment		7,57,753
Holding Period		124 months
Annual Return	$\left(\frac{7,57,753}{1,00,000}\right) \times \left(\frac{12}{124}\right) \times 100$	73.33%

Note:

- Cost of acquisition for bonus units has been taken as NAV on date of allotment

WN 2: Computation of returns of Mr. Bachhan (Growth Plan):

Particulars	Calculation	Amount
Value of units sold	(10,000 * 82.07)	8,20,700
Less: STT	(value of units sold * 0.2%)	(1641)
Less: Cost of acquisition		(1,00,000)
Net returns from investment		7,19,059
Holding Period		124 months
Annual Return	$\left(\frac{7,19,059}{1,00,000}\right) \times \left(\frac{12}{124}\right) \times 100$	69.59%

WN 3: Computation of return of Mrs. Charu (Dividend Reinvestment Plan):**Calculation of units on maturity:**

Date	Opening Balance	Amount of dividend	Units allotted	Closing Balance
01.04.1999	10,000.00	-	0	10000
28.07.2003	10,000.00	20,000	651.47	10651.47
31.03.2004	10,651.47	74,560	1,276.28	11927.75
31.10.2007	11,927.75	47,711	1,131.13	13058.88
15.03.2008	13,058.88	32,647	702.85	13761.73
24.03.2009	13,761.72	55,047	1,144.43	14906.16

Note:

- Amount of dividend = Opening balance x Dividend % x Face value (Rs.10)
- Units allotted = Amount of dividend / NAV on dividend date
- Closing balance = Opening balance + Units allotted

Computation of return:

Particulars	Calculation	Amount
Value of units sold	(14,906.16 x 53.75)	8,01,206
Less: STT	(8,01,206 x 0.2%)	(1,602)
Less: Cost of acquisition		(1,00,000)
Less: Tax on STCG	(1,144.43 x 53.75 - 48.10) x 10%	(647)
Net returns from investment		6,98,958
Holding Period		124 months
Annual Return	$\left(\frac{6,98,958}{1,00,000}\right) \times \left(\frac{12}{124}\right) \times 100$	67.64%

5. MF Return (May 2019)

A mutual fund company introduces two schemes i.e. Dividend Plan (Plan-D) and Bonus Plan (Plan-B). The face value of the unit is Rs.10. On 1-4-2005 Mr.K invested Rs.2,00,000 each in Plan-D and Plan-B when the NAV was Rs.38.20 and Rs.35.60. Both the plans matured on 31-3-2010.

Particulars of dividend and bonus declared over the period are as follows:

Date	Dividend %	Bonus Ratio	NAV of Plan D	NAV of Plan B
30-09-2005	10		39.10	35.60
30-06-2006		1:5	41.15	36.25
31-03-2007	15		44.20	33.10
15-09-2008	13		45.05	37.25
30-10-2008		1:8	42.70	38.30
27-03-2009	16		44.80	39.10
11-04-2009		1:10	40.25	38.90
31-03-2010			40.40	39.70

What is the effective yield per annum in respect of the above two plans?

Answer:

WN 1: Computation of return of Plan-D:

Note 1: Computation of units on maturity:

Date	Unit held	Dividend		Reinvestment rate	New units	Total units
		%	Amount			
01.04.2005	5235.60					5235.60
30.09.2005	5235.60	10	5235.6	39.1	133.90	5369.50
31.03.2007	5369.50	15	8054.25	44.2	182.22	5551.72
15.09.2008	5551.72	13	7217.24	45.05	160.21	5711.93
27.03.2009	5711.93	16	9139.09	44.8	204.00	5915.93

Note 2: Computation of return:

Particulars	Calculation	Amount
Amount received on maturity	5,915.93 x 40.40	2,39,003
Less: Amount invested		(2,00,000)
Return in Rs. for 5 years		39,003
Return per year	39,003/5	7,800.60
Return in %	$\left(\frac{7800.60}{2,00,000} \times 100 \right)$	3.90%

Note 3: Computation of effective yield using IRR method:

Year	Cash flow	PVF@3%	DCF	PVF@4%	DCF
0	-2,00,000	1	(2,00,000)	1	(2,00,000)
5	2,39,003	0.863	2,06,260	0.822	1,96,461
NPV			6,260		(3,539)

IRR	=	$L1 + \left(\frac{NPV \text{ at } L1}{NPV \text{ at } L1 - NPV \text{ at } L2} \right) \times (L2 - L1)$
IRR	=	$3 + \frac{6,260}{6,260 - (-3,539)} \times (4 - 3)$
IRR	=	3 + 0.64
IRR	=	3.64%

WN 2: Computation of return of Plan-B:

Note 1: Computation of units on maturity:

Date	Unit held	Bonus ratio	Bonus units	Total units
01.04.2005	5617.98			5617.98
30.06.2006	5617.98	1:5	1123.60	6741.58
30.10.2008	6741.58	1:8	842.70	7584.28
11.04.2009	7584.28	1:10	758.43	8342.71

Note 2: Computation of return:

Particulars	Calculation	Amount
Amount received on maturity	8,342.71 x 39.70	3,31,206
Less: Amount invested		(2,00,000)
Return in Rs. for 5 years		1,31,206
Return per year	1,31,206/5	26,241.20
Return in %	$\left(\frac{26,241.20}{2,00,000} \times 100 \right)$	13.12%

Note 3: Computation of effective yield using IRR method:

Year	Cash flow	PVF@10%	DCF	PVF@13%	DCF
0	-2,00,000	1	(2,00,000)	1	(2,00,000)
5	3,31,206	0.621	2,05,679	0.543	1,79,845
NPV			5,679		(20,155)

IRR	=	$L1 + \left(\frac{NPV \text{ at } L1}{NPV \text{ at } L1 - NPV \text{ at } L2} \right) \times (L2 - L1)$
IRR	=	$10 + \frac{5,679}{5,679 - (-20,155)} \times (13 - 10)$
IRR	=	10 + 0.66
IRR	=	10.66%

6. MF charges (Nov 2019 RTP)

ANP Plan, a hedge fund currently has assets of Rs. 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 ago was Rs. 21 crores. You are required to 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%

Answer:**WN 1: Calculation of fee payable if return is 29%**

Particulars	Amount
Opening hedge fund	20 Cr
Add: Return earned (20 cr x 29%)	5.8 Cr
Closing value	25.8 Cr
Return in excess of 21 Cr	4.8 Cr
Variable incentive fee (2% x 4.8 Cr)	9,60,000
Fixed incentive fee (0.1% x 20 Cr)	2,00,000
Total incentive	11,60,000

WN 2: Calculation of fee payable if return is 4.5%

Particulars	Amount
Opening hedge fund	20 Cr
Add: Return earned (20 cr x 4.5%)	0.9 cr
Closing value	20.9 Cr
Return in excess of 21 Cr	0
Variable incentive fee	-
Fixed incentive fee (0.1% x 20 Cr)	2,00,000
Total incentive	2,00,000

WN 3: Calculation of fee payable if return is -1.8%

Return is negative and only fixed incentive fee of Rs.2,00,000 will be paid.

7. Front-end loan and back-end load (May 2018)

The unit price of Equity Linked Savings Scheme (ELSS) of a mutual fund is Rs.10. The public offer price (POP) of the unit is Rs.10.204 and the redemption price is Rs.9.80.

Calculate:

- (i) Front-end Load
- (ii) Back-end Load

Answer:

Computation of front-end load:

$$\text{Public offer price} = \frac{\text{NAV}}{1 - \text{Front end Load}}$$

$$10.204 = \frac{10}{1 - \text{Front end Load}}; \text{Front end Load} = 0.0199 \text{ or } 2\%$$

Computation of Back-end Load:

$$\text{Redemption price} = \frac{\text{NAV}}{1 - \text{Back end Load}}$$

$$9.80 = \frac{10}{1 - \text{Back end Load}}; \text{Back end Load} = 0.0204 \text{ or } 2.04\%$$

Alternative answer:

$$\text{Front End load} = \frac{10.204 - 10.00}{10.00} = 0.0204 \text{ or } 2.04\%$$

$$\text{Back End load} = \frac{10.00 - 9.80}{10.00} = 0.02 \text{ or } 2.00\%$$

8. MF Return Versus Own Return (Nov 2019 Exam):

Mr. Alex, a practicing Chartered Accountant, can earn a return of 15 percent by investing in equity shares on his own. He is considering a recently announced equity based mutual fund scheme in which initial expenses are 6 percent and annual recurring expenses are 2 percent.

- (i) How much should the mutual fund earn to provide Mr. Alex a return of 15 percent per annum?
- (ii) Mr. Alex's current Annual Professional Income is Rs. 40 Lakhs. His portfolio value is Rs. 50 Lakhs and now he is spending 10% of his time to manage his portfolio. If he spends this time on profession, his professional income will go up in same proportion. He is thinking to invest his entire portfolio into a Multicap Fund, assuming the fund's NAV will grow at 13% per annum (including dividend). You are requested to advise Mr. Alex, whether he can invest the portfolio into Multicap Funds? If so, what is the net financial benefit?

Answer:

WN 1: Computation of MF return to earn individual return of 15 percent:

$$\text{MF return} = \frac{\text{Own return}}{1 - \text{Initial expense ratio}} + \text{Annual expense ratio}$$

$$\text{MF return} = \frac{15\%}{1 - 0.06} + 2\% = 15.96\% + 2.0\% = 17.96\%$$

WN 2: Computation of net financial benefit of investing in Multicap Fund:

Particulars	Calculation	Amount
Benefits:		
Income from Mutual Fund	50,00,000 x 13%	6,50,000
Additional income due to usage of 10% time in profession	$\frac{40,00,000}{90\%} \times 10\%$	4,44,444
Total Benefits		10,94,444
Opportunity cost:		
Loss of 15 percent income due to shifting to MF	50,00,000 x 15%	7,50,000
Net financial benefit of investing in Multicap Fund	10,94,444 - 7,50,000	3,44,444

9. Effective yield - reverse working: (May 2018)

Mr. Y has invested in the three mutual funds (MF) as per the following details:

Particulars	MF 'X'	MF 'Y'	MF 'Z'
Amount of investment	2,00,000	4,00,000	2,00,000
NAV at the time of purchase	10.30	10.10	10
Dividend received upto 31.03.2008	6,000	0	5,000

NAV as on 31.03.2008	10.25	10	10.20
Effective yield per annum	9.66	-11.66	24.15

Assume 1 Year = 365 days

Mr. Y has misplaced the documents of his investment. Help him in finding the date of his original investment after ascertaining the following:

- Number of units in each scheme;
- Total NAV;
- Total Yield; and
- Number of days investment held

Answer:

WN 1: Computation of number of units and Total NAV in each scheme:

Particulars	Calculation	Amount	NAV as on 31.03.2008	Total NAV as on 31.03.2008 [units x NAV as on 31.03.2008]
MF 'X'	$\frac{2,00,000}{10.25}$	19,417.48	10.25	1,99,029.17
MF 'Y'	$\frac{4,00,000}{10.10}$	39,603.96	10	3,96,039.60
MF 'Z'	$\frac{2,00,000}{10.00}$	20,000.00	10.20	2,04,000.00
Total				7,99,068.77

WN 3: Computation of total Yield:

$$\text{Total Yield} = \frac{\text{Capital gain} + \text{Dividend}}{\text{Investment}} \times 100$$

$$\text{Total Yield} = \frac{(7,99,068.77 - 8,00,000) + 11,000}{8,00,000} \times 100 = 1.2586\%$$

WN 4: Computation of no of days investment is held:

Particulars	MF 'X'	MF 'Y'	MF 'Z'
Let no of days be	X	Y	Z
Initial investment	2,00,000	4,00,000	2,00,000
Capital gain	(970.83)	(3,960.40)	4,000
Dividends	6,000	-	5,000
Total return	5,029.17	-3,960.40	9,000
Holding period return (%)	2.5146	-0.9901	4.50
[Total return/investment] x 100			
Annual Yield	9.66	-11.66	24.15
Period of holding (days)	$\left(\frac{2.5146}{9.66}\right) \times 365$ = 95 Days	$\left(\frac{-0.9901}{-11.66}\right) \times 365$ = 31 Days	$\left(\frac{4.5}{24.15}\right) \times 365$ = 68 Days
Date of original investment	26.12.17	28.02.18	22.01.18

Part II - Calculation of NAV

10. NAV calculation (Nov 2013 RTP, May 2018)

On 1st April 2009, ABC MF has the following assets and prices at 4:00 PM

Shares	No of shares	Market Price Per share
A Limited	10000	19.70
B Limited	50000	482.60
C Limited	10000	264.40
D Limited	100000	674.90
E Limited	30000	25.90
No of units of fund		8,00,000

Calculate the following:

- NAV of the Fund
- Assuming Mr. X, send a cheque of Rs.50,00,000 to the fund and Fund manager purchases 18000 shares of C Limited and the balance is held in bank. Then what will be the position of the fund
- Calculate the New NAV if on 2nd April 2009 at 4:00 PM, the market price of share is as follows:
 - A Limited Rs.20.30

- b. B Limited Rs.513.70
 c. C Limited Rs.290.80
 d. D Limited Rs.671.90
 e. E Limited Rs.44.20

Answer:

WN 1: Computation of NAV of the Fund:

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	19.70	1.97
B Limited	50,000	482.60	241.30
C Limited	10,000	264.40	26.44
D Limited	1,00,000	674.90	674.90
E Limited	30,000	25.90	7.77
Total value of assets			952.38
No of units			8.00
NAV/unit (952.38/8.00)			119.0475

WN 2: Position of fund post purchase by Mr.X:

- Mr. X gives a cheque for Rs.50 lacs. It is assumed that the fund manager buys 18,000 shares of C Limited at closing price of Rs.264.40. This will involve investment of Rs.47,59,200 (18,000 × 264.40) and the balance Rs.2,40,800 (50,00,000 – 47,59,200) is held in the bank account
- Mr. X will get fresh units allotted at NAV of RS.119.0475 and he would get 42,000 units [50,00,000/119.0475]

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	19.70	1.9700
B Limited	50,000	482.60	241.3000
C Limited	28,000	264.40	74.0320
D Limited	1,00,000	674.90	674.9000
E Limited	30,000	25.90	7.7700
Cash (50 lacs - value of C purchased)			2.4080
Total value of assets			1,002.3800
No of units (8 lacs + (50 lacs/119.05))			8.4200
NAV/unit			119.0475

WN 3: Computation of New NAV as on April 2, 2019:

Shares	No of shares	Market Price Per share	Market value of shares (in lacs)
A Limited	10,000	20.30	2.0300
B Limited	50,000	513.70	256.8500
C Limited	28,000	290.80	81.4240
D Limited	1,00,000	671.90	671.9000
E Limited	30,000	44.20	13.2600
Cash (50 lacs - value of C purchased)			2.4080
Total value of assets			1,027.8720
No of units (8 lacs + (50 lacs/119.05))			8.4200
NAV/unit			122.0751

11. Return calculation (Nov 2012 RTP)

Mr. Sinha has invested in three mutual fund schemes as per details below:

Particulars	Scheme X	Scheme Y	Scheme Z

Date of investment	01.12.2011	01.01.2012	01.03.2012
Amount of investment	Rs.5,00,000	Rs.1,00,000	Rs.50,000
NAV at entry date	Rs.10.50	Rs.10.00	Rs.10.00
Dividend received upto 31.03.2012	Rs.9,500	Rs.1,500	Nil
NAV at 31.03.2012	Rs.10.40	Rs.10.10	Rs.9.80

You are required to calculate the effective yield on per annum basis in respect of each of the three schemes to Mr. Sinha upto 31.03.2012?

Answer:

Computation of effective yield:

Particulars	Scheme X	Scheme Y	Scheme Z
1. Amount invested	5,00,000	1,00,000	50,000
2. NAV at entry date	10.50	10.00	10.00
3. No of units purchased (1/2)	47,619.05	10,000.00	5,000.00
4. Closing NAV	10.40	10.10	9.80
5. Value as on 31.03.2012 (3 x 4)	4,95,238.12	1,01,000	49,000
6. Capital appreciation (5 - 1)	(4,761.88)	1,000	(1,000)
7. Dividend income	9,500	1,500	-
8. Return (in rupees) (6 + 7)	4,738.12	2,500.00	-1,000.00
9. Holding Period Return (8/1) x 100	0.95%	2.50%	-2.00%
10. No of days of investment	122	91	31
11. Annual Yield (HPR x 366/No of days)	2.84%	10.05%	(23.61%)

Note:

- Holding period return does not consider the time period of investment and it just calculates return as income earned/amount invested
- For Annualized yield, we need to consider the time period of investment and then calculate the return. For computing no. of days of investment, we have considered February to have 29 days and the overall days to be 366.
- Annualized yield can also be calculated by multiplying holding period return with 12/no. of months of investment. ICAI has calculated return with no. of days in this question

12. Missing NAV (Nov 2015, May 2019 RTP)

Mr. X on 1.7.2007, during the initial offer of some mutual fund invested in 10,000 units having face value of Rs.10 for each unit. On 31.03.2008, the dividend operated by the MF was 10% and Mr.X found that his annualized yield was 153.33%. On 31.12.2009 20% dividend was given. On 31.03.2010, Mr.X redeemed all his balance of 11,296.11 units when his annualized yield was 73.52%. What are the NAVs as on 31.03.2008, 31.12.2009 and 31.3.2010?

Answer:

WN 1: Computation of NAV as on 31.03.2008

- The investor has earned an annualized yield of 153.33% for 1.7.2007 to 31.3.2008
- He has invested for a period of 9 months. The holding period return for 9 months is calculated below:

$$\text{Holding Period Return} = \text{Annual Return} \times \left(\frac{9}{12}\right)$$

$$\text{Holding Period Return} = 153.33\% \times \left(\frac{9}{12}\right) = 115\%$$

Particulars	Calculation	Amount
1. Amount of investment		1,00,000
2. Holding period return (in %)		115%
3. Holding period return (in Rs.)	1,00,000 x 115%	1,15,000
4. Value of investment as on 31.03.2008		2,15,000
5. No of units	$\frac{1,00,000}{10}$	10,000
6. NAV per unit before dividend payment	$\frac{2,15,000}{10}$	21.50
7. Less: Dividend	10 x 10%	1.00
8. NAV per unit post dividend payment	21.50 - 1.00	20.50

WN 2: Calculation of NAV as on 31.12.2009:

Particulars	Calculation	Amount
1. Dividend paid on 31.03.2008	$10,000 \times 1$	10,000
2. Units allotted	$\left(\frac{10,000}{20.50}\right)$	487.80
3. Total units post dividend re-investment		10,487.80
4. Dividend as on 31.12.2009	$10,487.80 \times 10 \times 20\%$	20,975.60
5. Units allotted as on 31.12.2009 (Note 1)	$11,296.11 - 10,487.80$	808.31
6. NAV/unit as on 31.12.2009	$\left(\frac{20,975.60}{808.31}\right)$	25.95

Note 1:

- The company has redeemed 11,296.11 units as on 31.03.2010. However, it had 10,487.80 units as on 31.03.2008. Hence extra units would have been allotted on 31.12.2009 due to dividend re-investment

WN 3: Computation of NAV as on 31.03.2010:

- Mr. X has earned an annualized yield of 73.52%. He has invested from 1.7.2007 to 31.3.2010 and the investment period is 33 months
- Holding period return for 33 months is calculated below:

$$\text{Holding Period Return} = \text{Annual Return} \times \left(\frac{9}{12}\right)$$

$$\text{Holding Period Return} = 73.52\% \times \left(\frac{33}{12}\right) = 202.18\%$$

Particulars	Calculation	Amount
1. Amount of investment		1,00,000
2. Holding period return (in %)		202.18%
3. Holding period return (in Rs.)	$1,00,000 \times 202.18\%$	2,02,180
4. Value of investment as on 31.03.2010		3,02,180
5. No of units		11,296.11
6. NAV as on 31.03.2010	$\frac{3,02,180}{11,296.11}$	26.75

13. Calculation of NAV (May 2017 RTP)

A mutual fund made and issue of 10,00,000 units of Rs.10 each on January 01, 2008. No entry load was charged. It made the following investments:

Particulars	Amount
50,000 equity shares of Rs.100 each @ 160	80,00,000
7% Government securities	8,00,000
9% Debentures (unlisted)	5,00,000
10% Debentures (Listed)	5,00,000
Total	98,00,000

During the year, dividends of Rs.12,00,000 were received on equity shares. Interest on all types of debt securities was received as and when due. At the end of the year equity shares and 10% debentures are quoted at 175 per share and 90% respectively. Other investments are at par. Find out the Net Asset Value (NAV) per unit given that operating expenses paid during the year amounted to Rs.5,00,000. Also find out the NAV, if the mutual fund distributed a dividend of Rs.0.80 per unit during the year to the unit holders.

Answer:**WN 1: Calculation of cash balance as on December 31, 2008:**

Particulars	Calculation	Amount (in lacs)
1. Inflow from unit holders	$10,00,000 \times 10$	100.00
2. Purchase of investments		(98.00)
3. Dividends received		12.00
4. Interest on 7% security	$8 \text{ lacs} \times 7\%$	0.56
5. Interest on 9% debt	$5 \text{ lacs} \times 9\%$	0.45
6. Interest on 10% debt	$5 \text{ lacs} \times 10\%$	0.50
7. Operating expenses		(5.00)

8. Closing cash balance	10.51

WN 2: Computation of NAV as on 31.12.2008:

Particulars	Calculation	Amount (in lacs)
Assets:		
Equity shares	50,000 x 175	87.50
7% Securities		8.00
9% debentures		5.00
10% debentures		4.50
Cash balance		10.51
Total Assets (A)		115.51
Liabilities (B)		0
Net assets (A - B)		115.51
No of units		10
NAV/unit	$\left(\frac{115.51}{10}\right)$	11.551

- NAV/unit before declaration of dividend = Rs.11.551
- NAV/units after declaration of dividend = 11.551 - 0.80 = Rs.10.751/units

14. Calculation of NAV (Nov 2016 RTP, Nov 2018 RTP)

Based on the following data, estimate the Net Asset Value (NAV) on per unit basis of a Regular Income Scheme of a mutual fund on 31.03.2016

Particulars	Amount (in lakhs)
Listed equity shares at cost (ex-dividend)	40.00
Cash in hand (As on 01.04.2015)	5.00
Bonds & debentures at cost	8.96
Of these, Bonds not listed and not quoted	2.50
Other fixed interest securities at cost	9.75
Dividend accrued	1.95
Amount payable on shares	13.54
Expenditure accrued	1.76

Current realizable value of fixed income securities of face value Rs.100 is Rs.96.50. Number of units (Rs.10 face value) = 2,75,000

All the listed equity shares were purchased at a time when the market portfolio index was 12,500. On the NAV date market portfolio index was 19,975. There has been a diminution of 15% in unlisted bonds and debentures valuation. Listed bonds and debentures carry a market value of Rs.7.5 lakhs, on NAV date. Operating expenses paid during the year amounted to Rs.2.24 lakhs.

Answer:

Computation of NAV:

Particulars	Calculation	Amount
Assets:		
Listed equity shares	$40 \times \left(\frac{19,975}{12,500}\right)$	63,92,000
Cash in hand	5,00,000 - 2,24,000	2,76,000
Listed bonds and debentures		7,50,000
Unlisted bonds and debentures	2,50,000 - 15%	2,12,500
Other fixed interest securities	$9,75,000 \times \left(\frac{96.5}{100}\right)$	9,40,875
Accrued dividends (assumed to be receivable)		1,95,000
Total Assets (A)		87,66,375
Liabilities:		
Amount payable on shares		13,54,000
Expenditure accrued		1,76,000
Total Liabilities (B)		15,30,000
Net Assets (A - B)		72,36,375
No of units		2,75,000

NAV/unit	$\frac{72,36,375}{2,75,000}$	26.3141

15. Calculation of NAV and repurchase price (Nov 2015, Nov 2018 RTP)

On 1st April an open ended scheme of mutual fund had 300 Lakh units outstanding with Net Assets Value (NAV) of Rs.18.75. At the end of April, it issued 6 lakhs 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.

	Rs (In lakhs)
Portfolio value appreciation	425.47
Income of April	22.950
Income of May	34.425
Income for June	45.450

You are required to calculate

- Income available for distribution;
- Issue price at the end of April;
- Repurchase price at the end May; and
- Net asset value (NAV) as on 30th June.

Answer:

WN 1: Computation of income available for distribution:

Particulars	No of units (lacs)	Per unit	Amount (in lacs)
Income of April	300	0.0765 [22.95/300]	22.95
Add: Inflow from April MF buyers	6	0.0765	0.459
Total income till April	306	0.0765	23.409
Income of May	306	0.1125 [34.425/306]	34.425
Total income till May	306	0.189	57.834
Less: Redemption in May	3	0.189	0.567
Revised income till May	303	0.189	57.267
Income of June	303	0.15 [45.45/303]	45.45
Income available for distribution	303	0.339	102.717

Note:

- MF is earning income every month. In practice, NAV is calculated every day. However here we are not doing it.
- Hence NAV will get adjusted by dividend equalization. New unit holders will have to pay extra amount towards dividend equalization.
- In case of unit redemptions, unit holders will get extra amount as part of dividend equalization

WN 2: Computation of issue price for April:

- Issue price = (Opening NAV + 2%) + Dividend equalization of April
- Issue price = (18.75 + 2%) + 0.0765 = Rs. 19.2015

WN 3: Computation of Repurchase price at end of May:

- Repurchase price = (Opening NAV - 2%) + Dividend equalization for April and May
- Repurchase price = (18.75 - 2%) + 0.1890 = Rs.18.564

WN 4: Computation of NAV as on June 30:

Particulars	Calculation	Amount (in lacs)
Net assets on April 1	300 x 18.75	5,625.000
Add: Income of April	Given	22.950
Add: Inflow from unit buyers	6 x 19.2015	115.209
Add: Income of May	Given	34.425

Less: Payment to unit sellers	3 x 18.564	(55.692)
Add: Income of June	Given	45.450
Add: Portfolio appreciation	Given	425.470
Less: Dividends paid	70% x 102.717	(71.902)
Net Assets as on June 30		6,140.91
No of units		303
NAV per unit	$\left(\frac{6,140.91}{303}\right)$	20.2670

16. Calculation of NAV (Nov 2014 RTP)

On 1-4-2012 ABC Mutual Fund issued 20 lakh units at Rs.10 per unit. Relevant initial expenses involved were Rs.12 lakhs. It invested the fund so raised in capital market instruments to build a portfolio of Rs.185 lakhs. During the month of April, 2012 it disposed of some of the instruments costing Rs.60 lakhs for Rs.63 lakhs and used the proceeds in purchasing securities for Rs.56 lakhs. Fund management expenses for the month of April, 2012 was Rs.8 lakhs of which 10% in arrears. In April, 2012 the fund earned dividends amounting to Rs.2 lakhs and it distributed 80% of the realized earnings. On 30-04-2012 the market value of the portfolio was Rs.198 lakhs. Mr.Akash, an investor, subscribed to 100 units on 1-4-2012 and disposed of the same at closing NAV on 30-04-2012. What was his annual rate of earning?

Answer:

WN 1: Computation of closing cash balance:

Particulars	Calculation	Amount (in lacs)
Inflow from unit holders	20 lacs x 10	200
Less: Initial expenses		(12)
Less: Purchase of investments		(185)
Add: sale of shares		63
Less: Purchase of investments		(56)
Less: Fund management expenses		(7.2)
Add: Receipt of dividends		2
Less: Payment of dividends	Note 1	(4)
Closing cash balance		0.80

Note 1:

- The company has paid 80% of realized earnings as dividends. Realized earnings = Capital gain of Rs.3 lacs + Dividends of Rs.2 lacs. Dividends paid = 80% x 5 lacs = Rs.4 lacs

WN 2: Computation of NAV:

Particulars	Calculation	Amount (in lacs)
Assets:		
Market value of portfolio		198
Cash balance	WN 1	0.80
Total Assets (A)		198.80
Less: Liabilities		(0.80)
Net Assets		198
No of units		20
NAV per unit	198/20	9.90

WN 3: Computation of annual rate of earning:

$$\text{Annual rate of earning} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

$$\text{Annual rate of earning} = \frac{(9.90 - 10.00) + \left(\frac{4}{20}\right)}{10.00} \times \frac{12}{1} \times 100$$

$$\text{Annual rate of earning} = \frac{0.10}{10.00} \times \frac{12}{1} \times 100 = 12\% \text{ per annum}$$

17. NAV computation and expense ratio (May 2019)

The following particulars relating to Vishnu Fund Schemes:

Particulars	Value in Crores
Investment in shares (at cost)	

Pharmaceutical companies	79
Construction industries	31
Service sector companies	56
IT Companies	34
Real Estate Companies	10
Investment in Bonds (Fixed Income)	
Listed Bonds (8000, 14% Bonds of Rs.15,000 each)	12
Unlisted Bonds	7
No of units outstanding (crores)	4.2
Expenses payable	3.5
Cash and Cash equivalents	1.5
Market expectations on listed Bonds	8.842%

Particulars relating to each sector are as follows:

Sector	Index on purchase date	Index on valuation date
Pharmaceutical companies	260	465
Construction Industries	210	450
Service sector companies	275	480
IT Companies	240	495
Real Estate Companies	255	410

The funds has incurred the following expenses:

- Consultancy and management fees Rs.480 lacs
- Office expenses Rs.150 lacs
- Advertisement expenses Rs.38 lacs

You are required to calculate the following:

- Net Asset Value of the fund
- Net Asset Value per unit
- If the period of consideration is 2 years, and the fund has distributed Rs.3 per unit per year as cash dividend, ascertain the net return (annualized)
- Ascertain the expense ratio

Answer:

WN 1: Computation of Net Asset value of the fund and Net Asset Value per unit:

Particulars	Calculation	Amount (in Cr)
Assets:		
Pharma Companies	$79 \times \left(\frac{465}{260}\right)$	141.2885
Construction	$31 \times \left(\frac{450}{210}\right)$	66.4286
Service sector	$56 \times \left(\frac{480}{275}\right)$	97.7455
IT Companies	$34 \times \left(\frac{495}{240}\right)$	70.1250
Real estate	$10 \times \left(\frac{410}{255}\right)$	16.0784
Listed bonds	$8,000 \times \left(\frac{2,100}{8.842\%}\right)$	19.0002
Unlisted bonds		7.0000
Cash		1.5000
Total Assets (A)		419.1662
Less: Liabilities		
Expenses payable		(3.5000)
Net Asset Value of Fund		415.6662
No of units		4.2000
NAV per unit	$\frac{415.6662}{4.2000}$	98.9681

WN 2: Computation of Return:

$$\text{Annual rate of earning} = \frac{(\text{NAV}_1 - \text{NAV}_0) + D_1 + \text{CG}_1}{\text{NAV}_0} \times \frac{12}{m} \times 100$$

$$\text{Annual rate of earning} = \frac{(98.9681 - 54.5238) + 6}{54.5238} \times \frac{12}{24} \times 100$$

$$\text{Annual rate of earning} = \frac{50.4443}{54.5238} \times \frac{12}{24} \times 100 = 46.26\% \text{ per annum}$$

Note:

Computation of opening NAV:

Particulars	Calculation	Amount (in Cr)
Assets:		
Pharma Companies		79.00
Construction		31.00
Service sector		56.00
IT Companies		34.00
Real estate		10.00
Listed bonds		12.00
Unlisted bonds		7.00
Cash		-
Total Assets (A)		229.00
Less: Liabilities		
Expenses payable		-
Net Asset Value of Fund		229.00
No of units		4.2000
NAV per unit	$\frac{229.00}{4.2000}$	54.5238

WN 3: Computation of expense ratio:

Particulars	Calculation	Amount
1. Expenses for two years (assumed) (in crores)	4.80 + 1.50 + 0.38	6.68
2. Expenses for one year (in crores)	$\frac{6.68}{2}$	3.34
3. No of units (in crores)		4.2
4. Annual expense per unit	$\frac{3.34}{4.2}$	0.7952
5. Annual expense ratio (on closing NAV)	$\frac{0.7952}{98.9681} \times 100$	0.80%
6. Annual expense ratio (on opening NAV)	$\frac{0.7952}{54.5238} \times 100$	1.46%
7. Annual expense ratio (on average NAV)	$\frac{0.7952}{76.7460} \times 100$	1.04%

Part III - Mutual Funds - Performance Evaluation

18. Sharpe & Treynor ratio (May 2016, Nov 2018 RTP, May 2019 RTP)

The following are the data on five mutual funds

Fund	Return	Standard Deviation	Beta
A	15	7	1.25
B	18	10	0.75
C	14	5	1.40
D	12	6	0.98
E	16	9	1.50

You are required to compute reward to variability and reward to volatility ratio and rank the portfolio. Assume risk free rate as 6%

Answer:

WN 1: Computation of reward to variability (Sharpe Ratio) and ranking:

$$\text{Sharpe Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{SD of security}}$$

Fund	Return	Excess return (Return - Risk free)	SD	Reward to variability (Col 3/Col 4)	Rank
A	15	9	7	1.29	2
B	18	12	10	1.2	3
C	14	8	5	1.6	1
D	12	6	6	1	5
E	16	10	9	1.11	4

WN 2: Computation of reward to volatility (Treynor Ratio) and ranking:

$$\text{Treynor Ratio} = \frac{\text{Return of security} - \text{Risk-free return}}{\text{Beta of security}}$$

Fund	Return	Excess return (Return - Risk free)	Beta	Reward to Volatility (Col 3/Col 4)	Rank
A	15	9	1.25	7.2	2
B	18	12	0.75	16	1
C	14	8	1.4	5.71	5
D	12	6	0.98	6.12	4
E	16	10	1.5	6.67	3

19. Calculation of Expected NAV (May 2015)

There are two Mutual Funds, D Mutual Fund Limited and K Mutual Fund Limited, each having close ended equity schemes. NAV as on 31-12-2014 of equity schemes of D Mutual Fund Limited is Rs.70.71 (consisting 99% equity and remaining cash balance) and that of K Mutual Fund Limited is Rs.62.50 (consisting 96% equity and balance in cash).

Following is the other information:

Particulars	Equity Schemes	
	D Mutual Fund Limited	K Mutual Fund Limited
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 Rs.3 per unit for the schemes of both the mutual funds. If share market goes down by 5 percent 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.

Answer:

WN 1: Computation of Beta of D Mutual Fund and K Mutual Fund:

Particulars	D Mutual Fund	K Mutual Fund
1. Sharpe Ratio	2	3.3
2. Standard deviation	11.25	5
3. Excess return (Return - Risk free) [1 x 2]	22.50	16.50
4. Treynor Ratio	15	15
5. Beta (3/4)	1.50	1.10

- Beta of 1.50 times would mean that if market falls by 1%, mf will fall by 1.50%. In this question, the market has fallen by 5%
- Equity component of D Mutual Fund and K Mutual Fund will fall by 7.5% (5 x 1.5) & 5.5% (5 x 1.1) respectively

WN 2: Computation of NAV:

Particulars	D Mutual Fund	K Mutual Fund
1. Opening NAV	70.71	62.50
Represented by equity	70.00	60.00
	[70.71 x 99%]	[62.50 x 96%]

Represented by cash	0.71 [70.71 × 1%]	2.50 [62.50 × 4%]
2. Closing NAV	65.21 [64.75 + 0.46]	58.95 [56.70 + 2.25]
Represented by equity	64.75 [70 – 7.5%]	56.70 [60 – 5.5%]
Represented by cash	0.46 [0.71 – 0.25]	2.25 [2.5 – 0.25]

- Equity component of NAV has been reduced by 7.5% and 5.5%
- Annual expense is Rs.3 per unit. Monthly expense will be Rs.0.25 per unit and hence cash component has been reduced by Rs.0.25 per unit

20. Computation of Jensen's Alpha (May 2017)

The five portfolios of a mutual fund experienced following result during last 10 years:

Portfolio	Average Annual Return %	Standard Deviation	Correlation with the market return
A	20.0	2.3	0.8869
B	17.0	1.8	0.6667
C	18.0	1.6	0.600
D	16.0	1.8	0.867
E	13.5	1.9	0.5437

- ❖ Market risk : 1.2
- ❖ Market rate of return : 14.3%
- ❖ Risk free rate : 10.1%

Beta may be calculated only upto two decimal. Rank the portfolio using JENSEN's ALPHA Method.

Answer:

WN 1: Computation of Beta:

$$\text{Beta} = \frac{\text{Standard deviation of portfolio}}{\text{Standard deviation of market}} \times \text{Correlation coefficient}$$

Portfolio	Standard Deviation	Correlation with the market return	Beta
A	2.3	0.8869	1.70
B	1.8	0.6667	1.00
C	1.6	0.600	0.80
D	1.8	0.867	1.30
E	1.9	0.5437	0.86

WN 2: Computation of Jensen's Alpha:

Portfolio	Beta	Expected return $R_f + \text{beta} \times (R_m - R_f)$	Actual Return	Jensen's Alpha	Rank
A	1.70	17.24	20.0	2.76	II
B	1.00	14.30	17.0	2.70	III
C	0.80	13.46	18.0	4.54	I
D	1.30	15.56	16.0	0.44	IV
E	0.86	13.71	13.5	-0.21	V

21. Mutual Funds – Performance Evaluation (Nov 2019 Exam):

The returns of a Portfolio A and market portfolio for the last 12 months are indicated as follows:

Month	Portfolio A	Market Portfolio
January	-0.52	0.82
February	2.20	0.04
March	2.17	2.80
April	4.17	1.72
May	2.04	0.27
June	3.00	0.39
July	1.99	1.95
August	4.00	0.64
September	-1.38	1.53
October	2.67	2.70

November	3.99	2.52
December	1.86	2.09
Standard Deviation	1.6223	0.9498

- (i) You are required to find out the monthly returns attributable to the sheer skill of the Portfolio Manager.
(ii) What part of the monthly return is attributable to the higher risk assumed by the Portfolio Manager?
Assume that the risk-free rate of return is 12% per annum and the portfolio is fully diversified.

Answer:**WN 1: Computation of Average Portfolio and Market Return:**

Month	Portfolio A	Market Portfolio
Total return for 12 months	26.19	17.47
No of months	12	12
Return per month	2.1825	1.4558

WN 2: Computation of monthly return attributable to sheer skill of portfolio manager:

- Portfolio is fully diversified and hence we should compute the required return of portfolio as per CAPM
- The same should be compared with actual return and the excess return (Alpha) is considered as the return attributable to sheer skill of portfolio manager

Part 1: Beta of Portfolio:

- Portfolio is fully diversified and hence it will not carry any unsystematic risk. The standard deviation of the portfolio would be equal to its systematic risk

Systematic Risk = Beta of Security x SD of Market

$$1.6223 = \text{Beta of Security} \times 0.9498$$

$$\text{Beta of Security} = \frac{1.6223}{0.9498} = 1.7080 \text{ Times}$$

Part 2: Computation of required return as per CAPM:

$$\text{CAPM return} = R_f + \text{Beta} \times (R_m - R_f)$$

$$\text{CAPM return} = 1 + 1.7080 \times (1.4558 - 1)$$

$$\text{CAPM return} = 1.7785\%$$

Part 3: Excess return (Alpha) due to brilliance of portfolio Manager:

Particulars	Amount
Actual Return per month	2.1825%
CAPM required return per month	1.7785%
Excess return (Alpha) per month	0.4040%

WN 3: Computation of return attributable to higher risk of portfolio manager:

- Security A has Beta of 1.7080 Times as compared to market Beta of 1 Time. This would mean that portfolio manager is taking higher risk as compared to market
- Return of market is 1.4558% for Beta of 1 Time. Required return of Security A is 1.7785% for Beta of 1.7080 Times
- Excess return due to higher risk = $1.7785 - 1.4558 = 0.3227\%$ per month

Chapter 8 – Derivatives Analysis and Valuation**Theory to Solve Problems****Basics of derivatives:**

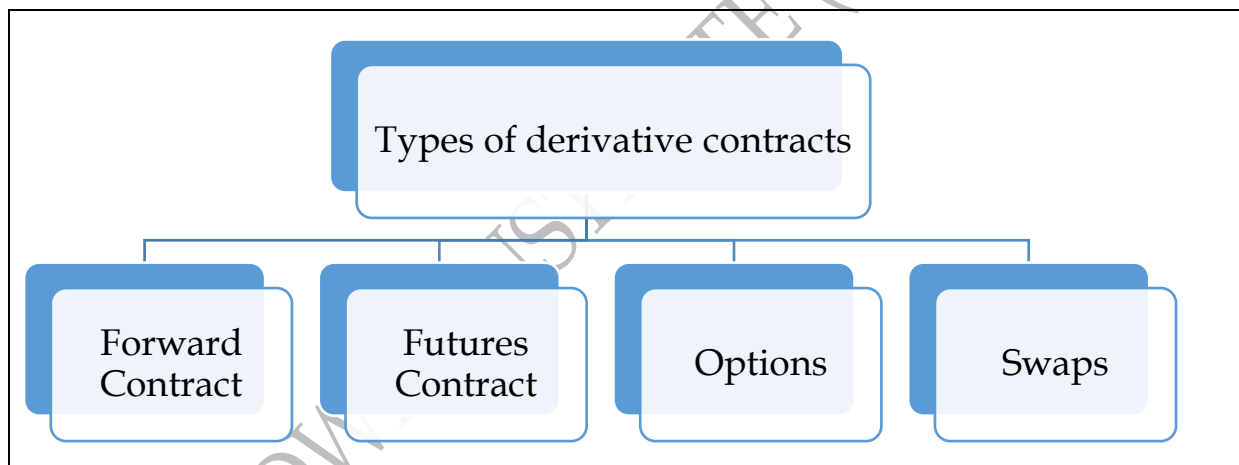
- ❖ A derivative contract is a financial instrument whose payoff structure is derived from the value of the underlying asset

Example: Ticket Price of IPL match is Rs.1,000 but the same is fully sold out. A reference letter is given to buy 3 tickets by paying the price of the ticket

- ❖ The letter is a derivative instrument. It gives you the right to buy the tickets
- ❖ The underlying asset is the ticket
- ❖ The letter does not constitute ownership
- ❖ It is a promise to convey ownership
- ❖ The value of the letter changes with the value of the ticket

What can be an underlying asset?

- ❖ Stock (Equity)
- ❖ Commodity (Cotton)
- ❖ Precious metals (Gold)
- ❖ Foreign currency (\$)
- ❖ Interest rate
- ❖ Market index (Sensex/Nifty)

Types of derivative contracts:**Forward contract:**

Meaning: A forward contract is an agreement entered today under which one party agrees to buy and the other party agrees to sell an asset on a specified future date at an agreed price	Features: ❖ Unique – No transfer can be made ❖ Performance obligation – Both parties obliged to perform ❖ Price risk is eliminated ❖ No margins ❖ Default risk ~ There is no guarantee of performance ❖ Illiquid – FC cannot be traded

Futures contract:

Meaning: A futures contract is a standardized contract between two parties where one of the parties commits to sell and the other permits to buy a specified quantity of a specified asset at an agreed price on a given date in the future	Features: ❖ Standardized quantity ❖ Deal with clearing house ❖ Market to Market

Options Contract:

Meaning: A contract between two parties under which the “buyer of the option” buys on payment of a price (premium) the right and not the obligation to sell (put option) , a standardized quantity (contract size) of a financial instrument (underlying asset) at or before a pre-determined date (expiry date) at a predetermined price (exercise price or strike price).	Features: ❖ Standardized quantity ❖ Deal with clearing house ❖ Market to market

Why derivative instruments:

- ❖ A derivative market is a market for derivative instruments. We need a derivative market because they perform three useful economic functions.

1. Different Players and different objectives: Each player in the market has different objectives. Following are the objectives of the different players: ❖ Hedger – To protect against the adverse price changes ❖ Arbitrageur – Looks for prospects in 2 different markets for riskless gains ❖ Speculator – Take risk in order to make profit during adverse market movement	2. Price Discovery: ❖ Low transaction cost ❖ High return ❖ Price changes are first reflected in this market	3. Risk transfer: ❖ Like an insurance company ❖ Redistributes the risk to market players ❖ Premium is the protection against adverse price movement

Futures:**Key concepts:**

1. Continuous compounding:

- ❖ 12% rate of interest has a different effective annual rate if it is compounded at different frequencies as show below:

Compounding frequency	Effective rate
Annually	12.00%
Half-yearly	12.36%
Quarterly	12.55%
Monthly	12.68%
Continuous compounding	12.75%

- ❖ As the frequency of compounding increases the effective annual rate goes up
- ❖ The effective rate is maximum when compounding is continuous
- ❖ The future value of continuous compounding is got from e^x table and the present value of continuous discounting is got from e^{-x} table
- ❖ Future value of X can also be computed using the below formula

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

2. Arbitrage through futures:

- ❖ Compute fair futures price
- ❖ Compare fair futures price with actual futures price to take decision

Relationship	Valuation	Futures	Spot
AFP > FFP	Over-valued	Sell	Buy
FFP < AFP	Under-valued	Buy	Sell

Computation of fair futures price:**Situation 1: Non-dividend paying stock:**

- ❖ The underlying asset (stock) does not generate any income for the investor.

Fair futures price = Spot rate $\times e^x$
 Where $X = r \times t$; r = rate per annum; t = time in years

Situation 2: Dividend in rupees:

- ❖ This refers to assets (stock) which generate income or dividend during the period of the futures contract
- ❖ In this case the spot price should be adjusted with the present value of the income

Fair futures price = Adjusted Spot rate $\times e^x$
 Where Adjusted spot rate = Spot rate - PV of dividend income

Situation 3: Dividend in percentage

- ❖ At times the income is expressed as a % of spot price. This is called yield
- ❖ Since this is a %, it must be deducted from r

Fair futures price = Spot rate $\times e^{(r-y)t}$
 Where r = risk free rate; y = known yield; t = time in years

Situation 4: Storage costs in rupees

- ❖ In respect of physical assets like Gold there is no intervening income. There are only intervening costs namely storage costs

Fair futures price = Adjusted Spot rate $\times e^x$
 Where Adjusted spot rate = Spot rate + PV of storage costs

Situation 5: Storage cost in percentage:

- ❖ At times the cost is expressed as a % of spot price.
- ❖ Since this is a %, it must be added to r

Fair futures price = Spot rate $\times e^{(r+s)t}$
 Where r = risk free rate; s = storage cost; t = time in years

Convenience yield:

- ❖ It is an implied return on holding inventories. It is an adjustment to the cost of carry in the non-arbitrage pricing formula for forward prices.
- ❖ This is the amount of benefit that is associated with physically owning a particular good
- ❖ **Fair Futures Price = Spot Price + Cost to Carry - Convenience yield**
- ❖ **Cost to carry = FFP as per formula - Spot price**
- ❖ **Convenience yield will be computed in case actual futures price and fair futures price (as per formula) does not match. However, question says that given actual futures price is fair and then we need to use above formula to compute convenience yield**

Contango/Backwardation:

- Contango and backwardation are terms used to define the structure of the forward curve.
- When a market is in contango, the forward price of a futures contract is higher than the spot price.
- Conversely, when a market is in backwardation, the forward price of the futures contract is lower than the spot price
- Contango and backwardation is determined with the help of basis
- **Basis = Spot price - futures prices**
- If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation.

Hedging with futures:

- ❖ To hedge (protect against price risk) we must take a position in the futures market, which is opposite of the position taken in the spot market
 - If we are long in the spot market, we must go short in the futures market
 - If we are short in the spot market, we must go long in the futures market
- ❖ If we seek only partial protection, the value of the position to be taken in the futures market is as under:

Value of futures position = Spot position $\times$ Protection needed (%)
- ❖ If the stock for which hedging is required is not traded in the futures market, we can create a cross hedge by taking a position in index futures. Position to be taken is as under:

	Value of futures position = Spot position x Protection needed (%) * Beta	

Impact of hedging:

- ❖ If we are long in one market and price goes up we gain
- ❖ If we are short in one market and price goes up we lose
- ❖ If we are long in one market and price falls we lose
- ❖ If we are short in one market and price falls we gain

Position	Price	Impact
Long	Up	Gain
Long	Down	Lose
Short	Up	Lose
Short	Down	Gain

How to compute Hedge ratio (Beta)

- ❖ Beta measures the sensitivity of a stock to a broad-based index. Beta of 2 times would indicate that a 1 percent change in index will lead to a 2 percent change in stock price (concept of Beta is explained in detail in portfolio management)

$\text{Beta} = \frac{\text{Change in spot prices}}{\text{Change in future prices}} \times \text{Correlation coefficient}$

How to alter risk in portfolio:

Situation 1: Reducing risk Method 1: Sell portfolio and buy risk free investment ❖ Step 1: Let weight of the stock in the new portfolio is W1. So weight of risk free investment is 1 - W1 ❖ Step 2: Compute weighted average of step 1 and equate the same to the new desired beta ❖ Step 3: The proportion of (1-W1) of old portfolio will be sold and be replaced with risk free investment ❖ Step 4: All stocks in the portfolio will be sold for the value identified in step 3 in the proportion in which they were held in the original portfolio Method 2: Keep portfolio intact, sell stock index futures • Use weighted average format of computation and assume X to be the amount of index futures • Solve X and find the number of contracts to be taken up for hedging $\text{Number of contracts} = \frac{\text{Amount to be hedged}}{\text{Value of one contract}}$	Situation 2: Increasing risk Method 1: Borrow money and buy securities ❖ Step 1: Let weight of the stock in the new portfolio is W1. So weight of borrowings is 1 - W1 ❖ Step 2: Compute weighted average of step 1 and equate the same to the new desired beta ❖ Step 3: The proportion of (1-W1) of old portfolio will be borrowed to buy additional stocks ❖ Step 4: The same old stocks will be bought in the proportion in which they were originally held Method 2: Keep portfolio intact, buy stock index futures • Use weighted average format of computation and assume X to be the amount of index futures • Solve X and find the number of contracts to be taken up for hedging $\text{Number of contracts} = \frac{\text{Amount to be hedged}}{\text{Value of one contract}}$

Concept of Mark to Market and margin account:

- ❖ The stock exchange wants the derivative players to maintain the margin accounts to safeguard against the risk of default
- ❖ **The initial margin to be maintained is equal to average daily absolute change + 3 (Standard deviation)**
- ❖ The margin balance will change with daily profits/losses being credited/recovered from the margin account. This concept is also known as mark to market wherein the company's derivatives are valued daily at the closing price

- ❖ The margin balance cannot fall below a specified limit which is also known as maintenance margin. In case the margin account drops below the maintenance margin then the derivative player is required to replenish the account to the level of initial margin
- ❖ The derivative player can withdraw the balance from the margin account in case the balance is above initial margin. However the maximum withdrawal will be up to the point of initial margin

Open Interest:

- ❖ Open interest is the total number of open or outstanding (not closed or delivered) options and/or futures contract that exist on a given day
- ❖ Open interest is commonly associated with futures and options markets, where the number of existing contracts changes from day to day unlike the stock market wherein the number of shares remain constant unless new issues are made
- ❖ Open interest is a measure of flow of money into a futures or options market. Increasing open interest represents new or additional money coming into the market, while decreasing open interest indicates money flowing out of the market
- ❖ An increase in open interest is typically interpreted as a bullish signal while decreasing open interest is interpreted as a bearish signal

Basics of option contract:

Term	Meaning
Holder	Buyer of the "Right to buy" or "Right to sell"
Writer	Person who sells the "Right to buy" or "Right to sell"
Exercise price / strike price	Price at which the underlying asset will be bought or sold
Expiry date	The date by which the option has to be exercised
Call option	This gives the buyer the right to buy
Put option	This gives the buyer the right to sell
Underlying asset	Asset against which the derivative instrument option is traded
American option	Right can be exercised at any time before the expiry date
European option	Right can be exercised only at the expiry date

When to exercise an option:

Relationship	Call option	Put option
Exercise price > Market price	Lapse	Exercise
Exercise price = Market price	Lapse	Lapse
Exercise price < Market price	Exercise	Lapse

Note:

- ❖ Only buyer can exercise an option
- ❖ Option premium is irrelevant because the same is a sunk cost

In the money (ITM) / Out the money (OTM) and At the money (ATM):

- ❖ An option is in the money if exercising the option at that point would give a gain
- ❖ An option is out the money if exercising the option at that point would lead to a loss
- ❖ An option is at the money if exercising the option at that point would lead to neither profits nor losses
- ❖ In all the above cases, the option premium being a sunk cost is irrelevant

Relationship	Status for call	Status for Put
Exercise price > Market price	OTM	ITM
Exercise price = Market price	ATM	ATM
Exercise price < Market price	ITM	OTM

- ❖ The phrase ITM, OTM and ATM are used in relation to the buyer. Therefore while in the money is good for the buyer, it is bad for the writer
- ❖ Similarly OTM is bad for the buyer it is good for the writer

Taking stance:

- ❖ Whether a derivative player wants to be a buyer (holder) or a writer would depend on his ability to take risk
 - Maximum risk = Writer

- Minimum risk = Holder
- ❖ A buyer would prefer that option which lead to him an exercise on the maturity date
- ❖ A writer would prefer that option which would lead to lapse on the maturity date
- ❖ In order to take a stance we need to compare the exercise price with expected market price

Bullish and Bearish Market:

- ❖ A bullish market is one where the expected MP is greater than the exercise price
- ❖ A bearish market is one where the expected MP is lesser than the exercise price

Party	EMP > EP	EMP < EP
Call Buyer	Favourable	Adverse
Call Writer	Adverse	Favourable
Put Buyer	Adverse	Favourable
Put Writer	Favourable	Adverse

Note:

- ❖ Favourable means making money and adverse means losing money. For a buyer the position is favourable if it is exercisable and for a writer the position is favourable if it lapses

Intrinsic value and time value:

- ❖ Intrinsic value is the extent to which the option is in the money if it ITM
- ❖ Time value is the difference between option premium and intrinsic value

Payoff table and Payoff graph:

- ❖ The payoff table captures the net profit at various expected MP on expiry date
- ❖ Such tables are drawn for call buyer, call writer, put buyer and put writer
- ❖ When an option is exercised, the buyer gains and the writer lose at gross payoff level
- ❖ Gain or loss at the net payoff level will depend on the extent of premium
- ❖ When an option in lapsed, neither the holder nor the writer gain or lose at the gross payoff level
- ❖ A payoff graph is a graphical representation of the payoff table with market price on X-axis and net payoff on Y-axis

Which option what premium?

- ❖ The option with the lowest exercise price is called E_1 . The one with the higher EP is called E_2
- ❖ Example: EP of 90, 110 & 98. Then $E_1 = 90$, $E_2 = 98$ & $E_3 = 110$
- ❖ The call with a lower EP has a greater probability of being exercised and therefore command a higher premium
- ❖ A put with a higher exercise price has a greater probability of being exercised and therefore command a higher premium

Steps in Payoff Table and Payoff Graph:**Step 1: Prepare relationship table**

- ❖ If there are "n" options then there will be "n+1" relationships
- ❖ The various columns in table and their computation is as follows

Column reference	Column Name	Explanation
1	Relationship	Refer point above
2	E_1	Identify action on expiry date and calculation gross payoff
3	E_2	Same as above
4	GPO	Column 2 + Column 3
5	Premium	Income (+) for writer and expense (-) for buyer
6	NPO	$GPO \pm \text{Premium}$
7	BEP	Equate NPO to zero

Step 2: Breakeven table:

The breakeven table summarizes the outcome of the relationship table with reference to the net pay off column

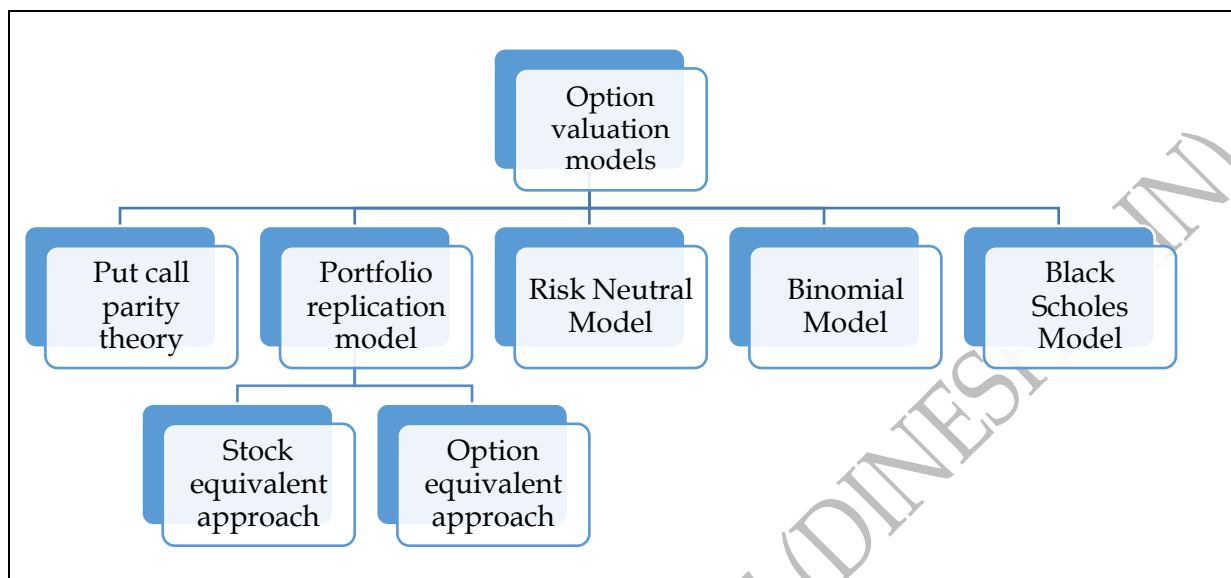
- ❖ If a relationship has no BEP then it will have only one class interval
- ❖ If a relationship has BEP then it will have 3 columns. One before, one at and one after BEP

Step 3: Draw Payoff graph:

- ❖ Payoff graph convert the BEP table into graph. Draw break even table on a graph with expected MP on x-axis and net payoff on y-axis

Pricing options:

- ❖ Valuation of options means finding out the fair option price

**Model 1: Put call parity theory (PCPT)**

Share + Put = Call + Present value of exercise price
The formula indicate that the payoff from the following two strategies will always be identical
❖ Buying a share and buying a put ❖ Buying a call & making an investment equal to present value of exercise price
The above formula can be spun around as follows:
❖ Put = Call + Present value of exercise price - Share ❖ Call = Share + Put - Present value of exercise price ❖ Share = Call + Present value of exercise price - Put
Note: (+) would indicate buy/invest & (-) would indicate sell/borrow

Note:

- ❖ For all option valuation models the share price will get replaced with adjusted share price in case dividends are expected to be paid during tenor of option.
- ❖ Adjusted spot price = Spot Price - PV of dividend income

Model 2: Portfolio Replication Model**Assumptions:**

- ❖ The investor can make only two judgements of market prices on expiry date
- ❖ He cannot make judgements of "MP before expiry date"
- ❖ That only 2 judgements of MP are made doesn't mean that their probabilities are 50/50

Stock equivalent approach:	Option equivalent approach:
❖ Compute intrinsic value at two judgement prices ❖ Compute no. of calls to be bought using $\text{No of calls} = \frac{\text{Spread in Stock Price}}{\text{Spread in IV}}$ ❖ Compute risk free investment = Present value of (Lower JP - IV at JP 1) ❖ Compute value of calls using ○ $S_0 = C_0 * \text{No of calls} + R_f \text{ investment}$ ❖ Compute value of put using PCPT	❖ Compute intrinsic value at two judgement prices ❖ Compute the no. of shares to be bought using $\text{No of Shares} = \frac{\text{Spread in IV}}{\text{Spread in Stock Price}}$ ❖ Compute amount of borrowing using the following formula ○ Borrowing = PV of [(No. of shares * Lower JP) - IV at JP₁]

- ❖ Compute value of call using
 - Call = share value bought – borrowing
- ❖ Compute value of put using PCPT

Model 3: Risk Neutral Model:**Assumptions:**

- ❖ Investors are indifferent to risk
- ❖ Investors can make only two judgement prices “MP of stock on expiry date”
- ❖ It is possible to make an estimate of probabilities of upside price & downside price

Steps:

- ❖ **Step 1:** Compute the intrinsic value at 2 judgement prices
- ❖ **Step 2:** Compute upside probability and downside probability by equating the weighted average return with the return from the risk-free asset
- ❖ **Step 3:** Expected value of call on expiry date is the weighted average of the values in step 1 with probability computed in step 2 being the assigned weights
- ❖ **Step 4:** Compute the PV of expected value of step 3 by discounting at risk free rate. This gives the value of call
- ❖ **Step 5:** Use PCPT model to value the put

Formula to calculate Probability:

$$\text{Upside Probability} = \frac{e^{rt} - d}{u - d}$$

Where

r = rate of interest per annum; t = time period in years

$$d = \frac{JP_1}{\text{Current Price}}$$

$$u = \frac{JP_2}{\text{Current Price}}$$

Model 4: Binomial model:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** Taking into account the previous probabilities roll back the IV to the base. This is the fair value of the option
- ❖ **Step 5:** Discount the value of step 4 to identify the fair value of option on day 0

Binomial model and American Option:

- ❖ **Step 1:** Draw decision diagram
- ❖ **Step 2:** Identify market price on expiry dates
- ❖ **Step 3:** Write intrinsic value at various judgement price on expiry date
- ❖ **Step 4:** The value of each previous node is higher of the following
 - Value of immediate exercise
 - Value of later exercise
- ❖ **Step 5:** Roll back to get the option value at base node
- ❖ **Step 6:** Discount the value of step 4 to identify the fair value of option on day 0

Model 5: Black – Scholes Model:**Assumptions:**

- ❖ Applicable only for European options
- ❖ Risk free rate of return is known and is constant over the life of the option
- ❖ The volatility of the underlying asset is known and is constant over the life of the option
- ❖ The underlying asset's CCRFI is known and follows normal distribution pattern
- ❖ The prices of underlying assets cannot be negative
- ❖ No transaction charges & tax

$$\text{Value of Call} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$
$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$
(or) $d_2 = d_1 - \sigma\sqrt{t}$
S_0 =CMP; r =risk free rate per year; t =time in years and E =Exercise Price
Value of Put can be calculated using Put Call Parity Theory

Delta of an option:

- ❖ Delta is a ratio comparing the change in the price of an asset to the corresponding change in the price of the derivative instrument.
- ❖ It is similar to beta of a stock which measures the percentage change in share price for a corresponding change in market
- ❖ **Example:** A stock option having beta of 0.7 would mean that if price of share increased by 1 rupee then the price of the option will increase by Rs.0.7
- ❖ Delta values can be positive or negative depending on the type of option. Call option will have positive delta values as the increase in share price will lead to increase in call value. However put option will have negative delta values as the increase in share price will lead to decrease in put value
- ❖ Call option can have delta closer to 1 for deep in the money options whereas it will have delta value closer to 0 for deep out of the money options

$$\text{Delta} = \frac{\text{Change in option Price}}{\text{Change in stock price}}$$

(or)

Delta of call option = $N(D_1)$ of Black Scholes Model

Delta of put option = Call delta -1

Delta values with dividend:

- ❖ In case the dividend is given in rupees then the current market price of the share is to be replaced with CMP - PV of dividend income
- ❖ In case the dividend is given as % then delta is as under
 - Call delta = $N(d_1) * e^{-yt}$
 - Put delta = Call delta - 1

Where y = Annualized dividend yield in %; Also additionally r is to be replaced with $r-y$ while calculating d_1

Delta Hedging:

- ❖ Creating a riskless hedge using options and underlying stock is called as Delta Hedging
- ❖ The investor should aim to make the delta adjusted value of the portfolio as zero to have a delta neutral portfolio

Practical Problems

Overview:

- Part I – Valuation of Futures
- Part II – Hedging with Futures
- Part III – Maintenance Margin and Open Interest
- Part IV – Basics of Option
- Part V – Payoff table and Payoff graph
- Part VI – Option Valuation
- Part VII – Delta Hedging

Part I – Valuation of Futures

1. Pricing future (November 2018 RTP)

The following data relate to Anand Ltd.'s share price:

Current price per share	Rs.1800
6 months future's price/share	Rs.1950

Assuming it is possible to borrow money in the market for transactions in securities at 12% per annum, you are expected:

- ❖ To calculate the theoretical minimum price of a 6-months forward purchase and
- ❖ To explain arbitrage opportunity

Answer:

WN 1: Computation of Fair Futures Price:

Base data:

Spot price	Rs.1,800
Time period	6 months (or) 1 half year (or) 0.5 year
Rate of interest	12% per annum (or) 6% per half year
Dividend	0
Storage cost	0
Type of compounding	Half-yearly (Note)

Note:

- Compounding frequency is normally continuous. However, in case e^x values /CCRFI is not mentioned in the question then we can follow normal compounding. Normal compounding frequency would be equal to period of the contract (half-year) and hence frequency is half-yearly

Fair Futures Price:

Futures Price = Spot Price $\times (1 + r)^n$
Futures Price = $1,800 \times (1 + 6\%)^1$
Futures Price = 1,908

- Theoretical minimum price for 6-months forward contract = Rs.1,908

WN 2: Arbitrage mechanism:

- Fair futures price is Rs.1,908 whereas actual futures price is Rs.1,950. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- **Arbitrage gain = Difference between FFP and AFP = Rs.42**

Arbitrage steps:

Particulars	Amount
Day 0:	
• Take a loan for 6 months @ 12% per annum	1,800
• Buy share in spot market with proceeds from loan	1,800
• Enter into futures contract to sell share at Rs.1,950 after 6 months	1,950
Month 6:	
• Sell share in futures market at agreed price of Rs.1,950	1,950
• Repay loan along with interest ($1,800 + \text{Interest of } 6\%$)	(1,908)
• Arbitrage gain	42

2. Pricing future (May 2012 RTP)

On 31-8-2011, the value of stock index was Rs.2,200. The risk-free rate of return has been 8% per annum. The dividend yield on this stock index is as under:

Month	Dividend Paid p.a.
January	3%
February	4%
March	3%
April	3%
May	4%
June	3%
July	3%
August	4%
September	3%
October	4%
November	3%

December	3%

Assuming that interest is compounded daily, find out the future price of contract deliverable on 31-12-2011.
Given $e^{0.01583} = 1.01593$

Answer:

Computation of Fair Futures Price:

Base data:

Spot price	Rs.2,200
Time period	4 months (or) 0.33 years
Rate of interest	8% per annum
Dividend	$3.25\% \frac{[3\% + 4\% + 3\% + 3\%]}{4}$
Storage cost	0
Type of compounding	Daily or continuous

Note:

- Dividend yield has been considered for four months of September to December. It has been taken as average of 3.25% per annum which is average of these four months

Fair Futures Price:

$$\begin{aligned}\text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,200 \times e^{(0.08-0.0325) \times 0.3333} \\ \text{Fair Futures Price} &= 2,200 \times e^{0.01583} \\ \text{Fair Futures Price} &= 2,200 \times 1.01593 \\ \text{Fair Futures Price} &= \text{Rs.2,235.05}\end{aligned}$$

3. Calculation of fair futures price (November 2012 RTP)

Suppose that there is a future contract on a share presently trading at Rs.1000. The life of future contract is 90 days and during this time the company will pay dividends of Rs.7.50 in 30 days, Rs.8.50 in 60 days and Rs.9.00 in 90 days. Assuming that the CCRFI is 12%, you are required to find out:

- Fair value of the contract if no arbitrage opportunity exists
- Value of cost to carry

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.1,000
Time period	90 days (or) 0.25 years
Rate of interest	12% per annum
Dividend	Rs.7.50 in M1 Rs.8.50 in M2 Rs.9.00 in M3
Storage cost	0
Type of compounding	Daily or continuous

Computation of PV of Dividend Income:

Amount of Dividend	Rs.7.50	Rs.8.50	Rs.9.00
Time period	1 month (or) 0.0833 years	2 month (or) 0.1667 year	3 month (or) 0.25 year
Rate of interest	12% per annum	12% per annum	12% per annum
Type of compounding	Continuous	Continuous	Continuous
PV of Dividend	$\frac{7.50}{e^{(0.12)(0.0833)}} = \frac{7.50}{e^{0.01}} = 7.43$	$\frac{8.50}{e^{(0.12)(0.1667)}} = \frac{7.50}{e^{0.02}} = 8.33$	$\frac{9.00}{e^{(0.12)(0.25)}} = \frac{7.50}{e^{0.03}} = 8.73$

PV of dividend income = 7.43 + 8.33 + 8.73 = 24.49

Adjusted spot price:

Adjusted spot price = Spot Price - PV of dividend income = 1,000 - 24.49 = Rs.975.51

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Adjusted Spot Price} \times e^{rt} \\ \text{Fair Futures Price} &= 975.51 \times e^{(0.12) \times 0.25} \\ \text{Fair Futures Price} &= 975.51 \times e^{0.03} \\ \text{Fair Futures Price} &= 975.51 \times 1.030455 \\ \text{Fair Futures Price} &= \text{Rs.1,005.22} \end{aligned}$$

WN 2: Computation of cost to carry:

- Cost to Carry = Fair Futures Price – Spot Price
- Cost to Carry = 1,005.22 – 1,000 = Rs.5.22

4. Calculation of interest rate (November 2013 RTP)

Suppose current price of an index is Rs.13,800 and yield on index is 4.8% (p.a.). A 6-month future contract on index is trading at Rs.14,340. Assuming that Risk Free Rate of Interest is 12%, show how Mr. X (an arbitrageur) can earn an abnormal rate of return irrespective of outcome after 6 months. You can assume that after 6 months index closes at Rs. 10,200 and Rs. 15,600 and 50% of stock included in index shall pay dividend in next 6 months. Also calculate implied risk free rate.

Answer**WN 1: Computation of fair futures price:****Base data:**

Spot price	Rs.13,800
Time period	6 months (or) 0.5 year (or) 1 half year
Rate of interest	12% per annum (or) 6% per half year
Dividend (Note 1)	4.8% per annum (or) 2.4% per half year
Storage cost	0
Type of compounding	Half-yearly (equal to time period of contract)

Note 1: Dividend yield:

- Dividend yield is 4.8 percent per annum. 50 percent of stock included in index will declare dividend in next 6 months and hence the proportionate dividend for half year is 2.4% (4.8% x 50%)

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times (1 + (r - y))^t \\ \text{Fair Futures Price} &= 13,800 \times (1 + (6\% - 2.4\%))^1 \\ \text{Fair Futures Price} &= 13,800 \times (1 + 3.6\%) \\ \text{Fair Futures Price} &= 14,296.80 \end{aligned}$$

WN 2: Arbitrage mechanism and computation of implied risk-free rate:

- Actual futures price is Rs.14,340 whereas fair futures price is Rs.14,296.80. Futures are over-valued and hence we should buy spot and sell futures

Arbitrage steps:

Particulars	Price after 6 months	
	Rs.10,200	Rs.15,600
Day 0		
• Buy share in spot market	Rs.13,800	Rs.13,800
• Enter into futures contract to sell share at Rs.14,340 after 6 months	Rs.14,340	Rs.14,340
Day 1 to Day 180		
• Earn dividend income (13,800 x 2.4%)	Rs.331.20	Rs.331.20
Day 180		
• Sell share (Share would be sold at Rs.14,340 irrespective of actual price)	Rs.14,340	Rs.14,340
• Income earned (14,340 + 331.20 – 13,800)	Rs.871.20	Rs.871.20

Implied risk-free rate:

- Investor would earn Rs.871.20 on an investment of Rs.13,800. There is no risk involved in this due to hedging done by investor

$$\text{Implied Risk Free Rate} = \frac{871.20}{13,800} \times \left(\frac{12}{6}\right) \times 100 = 12.63\%$$

5. Arbitrage through futures (May 2015 RTP)

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield is 1.75% and risk free rate of interest is 4.16%, you are required to determine:

- ❖ Calculate the justified forward price on this contract.
- ❖ Suppose after 28 days of the purchase of the contract the index value stands at 2450 then determine gain/ loss on the above long position.
- ❖ If at expiration of 90 days the Index Value is 2470 then what will be gain on long position.

Note: Take 365 days in a year and value of $e^{0.005942} = 1.005960$ & $e^{0.001849} = 1.001851$

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.2,290
Time period	90 days (or) 90/365 year
Rate of interest	4.16% per annum
Dividend (Note 1)	1.75% per annum
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,290 \times e^{(4.16-1.75)\left(\frac{90}{365}\right)} \\ \text{Fair Futures Price} &= 2,290 \times e^{0.005942} \\ \text{Fair Futures Price} &= 2,290 \times 1.005960 \\ \text{Fair Futures Price} &= \text{Rs. 2,303.65} \end{aligned}$$

WN 2: Computation of gain/loss after 28 days if index stands at 2,450:

Date	Position	Action	Reference Date	Rate
Day 1	Original Position	Buy	Day 90	(2,303.65)
Day 28	Opposition Position	Sell	Day 90	2,460.05 (Note 1)
Profit				156.40

Note 1: Computation of futures price on day 28:

Spot price	Rs.2,450
Time period	62 days (or) 62/365 year
Rate of interest	4.16% per annum
Dividend (Note 1)	1.75% per annum
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

$$\begin{aligned} \text{Fair Futures Price} &= \text{Spot Price} \times e^{(r-y)t} \\ \text{Fair Futures Price} &= 2,290 \times e^{(4.16-1.75)\left(\frac{62}{365}\right)} \\ \text{Fair Futures Price} &= 2,290 \times e^{0.00409} \\ \text{Fair Futures Price} &= 2,290 \times 1.00410 \\ \text{Fair Futures Price} &= \text{Rs. 2,460.05} \end{aligned}$$

WN 3: Computation of gain/loss if index expires at 2,470:

Date	Position	Action	Reference Date	Rate

Day 1	Original Position	Buy	Day 90	(2,303.65)
Day 90	Opposition Position	Sell	Day 90	2,470.00
Profit				166.35

6. Pricing future and arbitrage opportunity (Nov 2019 RTP)

Calculate the price of 3 months PQR futures, if PQR (FV Rs.10) quotes Rs.220 on NSE and the three months future price quotes at Rs.230 and the one month borrowing rate is given as 15 percent and the expected annual dividend yield is 25 percent per annum payable before expiry. Also examine arbitrage opportunities.

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.220
Time period	3 months (or) 0.25 year
Rate of interest	15 percent per annum (or) 1.25% per month
Dividend	Rs.2.50 in Month 3 (Note 1)
Storage cost	0
Type of compounding	Monthly

Note 1: Dividend Income:

- Dividend yield of 25 percent is given in the question and the same is payable before expiry. Dividend yield is normally computed on market value. However, the same will not be logical in this question as the interest rate is 15 percent and normally dividend yield is lower than interest rate
- ICAI in this question has considered dividend yield as dividend-rate and computed the same on face value
- Dividend = 25% × 10 = Rs.2.50

Computation of PV of Dividend Income:

Amount of Dividend	Rs.2.50
Time period	3 months (or) 0.25 year
Rate of interest	15% per annum (or) 1.25% per month
Type of compounding	Monthly

$$\text{Present value} = \frac{\text{Future value}}{(1 + r)^t}$$

$$\text{Present value} = \frac{2.50}{(1 + 1.25\%)^3} = \frac{2.50}{1.0380} = 2.41$$

Fair Futures Price:

$$\text{Fair Futures Price} = \text{Adjusted Spot Price} \times (1 + r)^t$$

$$\text{Fair Futures Price} = 217.59 \times (1 + 1.25\%)^3 = 217.59 \times 1.0380 = \text{Rs. 225.86}$$

Note:

- Adjusted spot price = Spot Price – PV of Dividend Income
- Adjusted spot price = 220 – 2.41 = Rs.217.59

WN 2: Strategy if actual futures price is Rs230:

- Fair futures price is Rs.225.86 whereas actual futures price is Rs.230. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = 4.14

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take loan of Rs.2.41 for 3 months @ 1.25% per month. This would be repaid out of dividend income	2.41

2. Take loan of Rs.217.59 for 3 months @1.25% per month. This would be repaid out of sell proceeds of share	217.59
3. Buy 1 share in spot market	220.00
4. Enter into futures contract to sell share at Rs.230	230.00
Day 90	
5. Receive dividend of Rs.2.50 and repay loan of Rs.2.41	2.50
6. Sell share in futures market and receive Rs.230	230.00
7. Repay loan of Rs.217.59 along with interest	225.86
8. Arbitrage gain (230 - 225.86)	4.14

7. Pricing future and arbitrage opportunity (November 2017 RTP)

The share of X Ltd. is currently selling for Rs.300. Risk free interest rate is 0.8% per month. A three months futures contract is selling for Rs.312. Develop an arbitrage strategy and show what your riskless profit will be 3 month hence assuming that X Ltd. will not pay any dividend in the next three months.

Answer:

WN 1: Computation of fair futures price:

Base data:

Spot price	Rs.300
Time period	3 months (or) 0.25 year
Rate of interest	0.8% per month (or) 9.6% per annum
Dividend	0
Storage cost	0
Type of compounding	Monthly

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + r)^t$

Fair Futures Price = $300 \times (1 + 0.80\%)^3 = 300.00 \times 1.0242 = \text{Rs. } 307.26$

WN 2: Strategy if actual futures price is Rs.312:

- Fair futures price is Rs.307.26 whereas actual futures price is Rs.312. This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- **Arbitrage gain = Difference between FFP and AFP = 4.24**

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take loan of Rs300.00 for 3 months @0.80% per month. This would be repaid out of sell proceeds of share	300.00
2. Buy 1 share in spot market	300.00
3. Enter into futures contract to sell share at Rs.312	312.00
Day 90	
4. Sell share in futures market and receive Rs.312	312.00
5. Repay loan of Rs.300.00 along with interest	307.26
6. Arbitrage gain (312 - 307.26)	4.24

8. Valuation and arbitrage with futures (Nov 2019 Exam):

The NSE-50 Index futures are traded with rupee value being Rs. 100 per index point. On 15th September, the index closed at 1195, and December futures (last trading day December 15) were trading at 1225. The historical dividend yield on the index has been 3% per annum and the borrowing rate was 9.5% per annum.

- Determine whether on September 15, the December futures were underpriced or overpriced?
- What arbitrage transaction is possible to gain out this mispricing?
- Calculate the gains and losses if the index on 15th December closes at

- a. 1260
- b. 1175.

Assume 365 days in a year for your calculations.

Answer:

WN 1: Computation of Fair Futures Price:

Base information:

Spot price	1195
Time period	15 days + 31 days + 30 days + 15 days = 91 days
Rate of interest	9.5% per annum (or) 2.3685% per 91 days
Dividend	3% per annum (or) 0.7479% per 91 days
Storage cost	0
Type of compounding	Once in 91 days

$$FFP = \text{Spot Price} \times (1 + (r - y))$$

$$FFP = 1195 \times (1 + (2.3685\% - 0.7479\%))$$

$$FFP = 1195 \times (1 + 1.6206\%) = 1,214.37$$

- Fair futures price is Rs.1,214.37 whereas actual futures price is Rs.1,225. Actual futures price is higher than fair futures price and hence futures are overpriced

WN 2: Arbitrage strategy:

- Fair futures price is Rs.1,21,437 (1,214.37 x 100) whereas actual futures price is Rs.1,22,500 (1,225 x 100). This would mean that futures are over-valued
- We should sell in the futures market and buy in the spot market to exploit arbitrage opportunity
- Arbitrage gain = Difference between FFP and AFP = 1,22,500 - 1,21,437 = Rs.1063**

Arbitrage steps:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500
3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,22,500	1,22,500
6. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437
7. Arbitrage gain	1,063

WN 3: Computation of arbitrage gain if index closes at 1,260 and 1,175:

Index closes at Rs.1,260:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500
3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,26,000 (1,260 x 100)	1,26,000
6. Loss in futures contract (Selling price was Rs.1,225; Opposite purchase price is Rs.1,260) Loss (100 x (1,225 - 1,260))	(3,500)
7. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437

8. Arbitrage gain	1,063

Index closes at Rs.1,175:

Particulars	Amount
Day 0	
1. Take a bank loan for Rs.1,19,500 @ 9.5% for 91 days	1,19,500
2. Buy shares worth of index in spot market	1,19,500
3. Enter into contract to sell index @ 1,22,500 after 91 days	
Day 1 to Day 91	
4. Company declared dividend, use the same to pay interest of 3 percent and hence net interest cost will be 6.50 percent	
Day 91	
5. Sell index for Rs.1,17,500 (1,175 x 100)	1,17,500
6. Gain in futures contract (Selling price was Rs.1,225; Opposite purchase price is Rs.1,175) Loss (100 x (1,225 - 1,175))	5,000
7. Repay loan along with net interest of 6.5 percent (1,19,500 + (1,19,500 x 6.5% x (91/365)))	1,21,437
8. Arbitrage gain	1,063

9. Valuation of futures (Nov 2019 Exam):

A future contract is available on R Ltd. that pays an annual dividend of Rs. 4 and whose stock is currently priced at Rs. 125. Each future contract calls for delivery of 1,000 shares to stock in one year, daily marking to market. The corporate treasury bill rate is 8%.

Required:

- Given the above information, what should the price of one future contract be ?
- If the company stock price decreases by 6%, what will be the price of one futures contract ?
- As a result of the company stock price decrease, will an investor that has a long position in one futures contract of R Ltd. realizes a gain or loss ? What will be the amount of his gain or loss ?
(Ignore margin and taxation, if any)

Answer:

WN 1: Computation of fair futures price:**Base data:**

Spot price	Rs.125
Time period	1 year
Rate of interest	8% per annum
Dividend	Rs.4 in year 1
Storage cost	0
Type of compounding	Yearly

Note: It is assumed that dividend will be paid at the end of year 1

Computation of PV of Dividend Income:

Amount of Dividend	Rs.4
Time period	1 year
Rate of interest	8% per annum
Type of compounding	Yearly

$$\text{Present value} = \frac{4}{1.08} = 3.70$$

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price x (1 + r)ⁿ

Fair Futures Price = 122.30 x (1.08)¹ = Rs. 131

Price of one contract = 131 x 1,000 = Rs.1,31,000

Note:

- Adjusted spot price = Spot Price - PV of Dividend Income
- Adjusted spot price = 125 - 3.70 = Rs.121.30

WN 2: Computation of fair futures price if stock price decreases by 6%**Base data:**

Spot price	Rs.125 x 94% = Rs.117.50
Time period	1 year
Rate of interest	8% per annum
Dividend	Rs.4 in year 1
Storage cost	0
Type of compounding	Yearly

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + r)^n$

Fair Futures Price = 113.80 x (1.08)¹ = Rs. 122.90

Price of one contract = 122.90 x 1,000 = Rs.1,22,900

Note:

- Adjusted spot price = Spot Price - PV of Dividend Income
- Adjusted spot price = 117.50 - 3.70 = Rs.113.80

WN 3: Computation of gain or loss:

- If the investor has taken a long position, decrease in price will result in loss for the investor.
- Amount of loss will be: Rs. 1, 31,000 - Rs. 1,22,900 = Rs. 8,100

10. Concept of Contango and Backwardation:

Mr. SG sold five 4-Month Nifty Futures on 1st February 2020 for ` 9,00,000. At the time of closing of trading on the last Thursday of May 2020 (expiry), Index turned out to be 2100. The contract multiplier is 75.

Based on the above information calculate:

- The price of one Future Contract on 1st February 2020.
- Approximate Nifty Sensex on 1st February 2020 if the Price of Future Contract on same date was theoretically correct. On the same day Risk Free Rate of Interest and Dividend Yield on Index was 9% and 6% p.a. respectively.
- The maximum Contango/ Backwardation.
- The pay-off of the transaction.

Note: Carry out calculation on month basis.

Answer:

Particulars	Calculation	Amount
Price of one contract	$\frac{9,00,000}{5}$	Rs.1,80,000
Nifty on Feb 1, 2020:		
Fair futures price	$\frac{1,80,000}{75}$	2,400
Spot price calculation	$SP \times (1 + (r - y)^t) = 2,400$ $SP \times (1 + \left(\left(\frac{0.09}{3}\right) - \left(\frac{0.06}{3}\right)\right)^1) = 2,400$ $SP \times (1 + 0.01) = 2,400$ $SP = \frac{2,400}{1.01}$	Rs.2,376.24
Contango/backwardation:		
Basis	Spot price - futures price 2,376.24 - 2,400	-23.76
Contango	Note 1	23.76
Pay-off (profit)	5 contracts x 75 x (2,400 - 2,100)	Rs.1,12,500

Note 1:

If Basis is negative the market is said to be in Contango and when it is positive the market is said to be Backwardation. Since current Spot Price is 2400 and Nifty Index is 2376.24, the Basis is negative and hence there is Contango Market and maximum Contango shall be 23.76

Part II – Hedging with Futures

11. Hedging with futures (May 2016 RTP, May 2019 RTP)

BSE	5,000
Value of portfolio	10,10,000
Risk free interest rate	9% per annum
Dividend yield on index	6% per annum
Beta of portfolio	1.5

We assume that a future 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:

- ❖ Price of future contract.
- ❖ The gain on short futures position if index turns out to be 4,500 in three months.

Answer:

WN 1: Computation of fair futures price:**Base data:**

Spot price	Rs.5,000
Time period	4 months (or) 0.33 year
Rate of interest	9% per annum (or) 3% per 4 months
Dividend	6% per annum (or) 2% per 4 months
Storage cost	0
Type of compounding	Once in four months

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + (r - y))^t$

Fair Futures Price = 5,000 $\times (1 + (0.03 - 0.02))^1$ = 5,000 $\times$ 1.01 = Rs. 5,050

WN 2: Computation of no of contracts taken for hedging:

- The investor wants to hedge the portfolio for another three months. He plans to use four months BSE index futures for hedging the portfolio. This is an acceptable strategy as the four months futures contract would remain active till the hedging period of three months
- We are planning for hedging the portfolio and that would make the beta of portfolio to 0 from current 1.5 times

Security	Beta	Weight	Product
Portfolio	1.50	10,10,000	15,15,000
BSE futures	1.00	(15,15,000)	(15,15,000)
Total	0.00	10,10,000	0

Note:

- Investor currently has invested Rs.10,10,000. Portfolio has beta of 1.5 times and hence risk-adjusted portfolio value is Rs.15,15,000
- We need Beta of 0 times and hence sum of product will be zero. This would make the product of BSE futures as balancing figure and same would be -15,15,000. Beta of BSE futures is 1 (market beta) and hence weight is -15,15,000
- We will not be adding BSE futures weight while adding the overall weights. This is because money of Rs.15,15,000 will not be blocked in BSE futures and only the margin for the same would be blocked
- We need to take position of -15,15,000 in BSE futures. Negative would indicate that we need to sell BSE futures

No of contracts to be sold = $\frac{15,15,000}{50 \times 5,050} = 6 \text{ Contracts}$

WN 3: Computation of profit/loss:

Date	Position	Action	Reference Date	Rate
Day 1	Original position	Sell	Day 120	5,050.00
Day 90	Opposite position	Buy	Day 120	(4,511.25)
Profit per BSE				538.75
Profit per contract (538.75 $\times$ 60)				26,937.50

Profit for 6 contracts (26,937.50 x 6)	1,61,625

Note: Computation of futures price on day 90 for day 120:

Base data:

Spot price	Rs.4,500
Time period	1 month
Rate of interest	9% per annum (or) 0.75% per month
Dividend	6% per annum (or) 0.50% per month
Storage cost	0
Type of compounding	Monthly

Fair Futures Price:

Fair Futures Price = Adjusted Spot Price $\times (1 + (r - y))^t$

Fair Futures Price = 4,500 $\times (1 + (0.0075 - 0.0050))^1$ = 4,500 $\times 1.0025$ = Rs. 4,511.25

12. Hedging with futures (November 2014 RTP)

A Mutual Fund is holding the following assets

Investments in diversified equity shares

Cash and Bank Balances

Rs.90 Crores

Rs.10 Crores

The Beta of the 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.

Answer:

WN 1: Computation of number of contracts for hedging:

Security	Beta	Weight	Product
Equity shares	1.10	90,00,00,000	99,00,00,000
Cash	0.00	10,00,00,000	-
Index futures	1.00	(99,00,00,000)	(99,00,00,000)
Total	0	100,00,00,000	0

Note:

- It is assumed that beta of 1.1 times is for equity shares of Rs.90 crores. Alternatively, it can be assumed that beta of overall portfolio is 1.1 times.

No of contracts for hedging = $\frac{99,00,00,000}{4,300 \times 50} = 4,605$ Contracts

WN 2: Impact of hedging if the index falls by 10 percent:

- Beta of equity shares is 1.1 times. This would mean that if index falls by 10 percent, equity shares will fall by 11 percent
- We have purchased equity shares of Rs.90 crores and fall in share price will lead to loss. Loss in equity portfolio = 90 crores $\times 11\%$ = Rs.9.9 crores
- Index has fallen by 10 percent. We have sold equity shares and this will lead to profit for the company. Gain in futures = (4,605 contracts $\times 4,300 \times 50$) $\times 10\%$ = Rs.9.9 Crores
- Net gain/loss = 0. This proves that hedge has enabled the fund manger to save from loss despite 10 percent fall in index

13. Hedging with futures (November 2016 RTP)

A trader is having in its portfolio shares worth Rs.85 lakhs at current price and cash Rs.15 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%. Determine:

- ❖ Current portfolio beta
- ❖ Portfolio beta after 3 months if the trader on current date goes for long position on Rs. 100 lakhs Nifty futures.

Answer:

WN 1: Computation of portfolio Beta:

Security	Beta	Weight	Product
Shares	1.60	85,00,000	1,36,00,000
Cash	0.00	15,00,000	-
Total	1.36	1,00,00,000	1,36,00,000

$$\text{Portfolio Beta} = \frac{\text{Sum of product}}{\text{Sum of weights}} = \frac{1,36,00,000}{1,00,00,000} = 1.36 \text{ Times}$$

WN 2: Computation of portfolio Beta if the trader goes on long position on Rs.100 lacs Nifty futures:

Security	Beta	Weight	Product
Shares	1.60	85,00,000	1,36,00,000
Cash	0.00	15,00,000	-
Nifty futures	1.00	1,00,00,000	1,00,00,000
Total	2.36	1,00,00,000	2,36,00,000

$$\text{Portfolio Beta} = \frac{2,36,00,000}{1,00,00,000} = 2.36 \text{ Times}$$

14. Hedge ratio (May 2017 RTP)

A company is long on 10 MT of Rs. 474 per kg (spot) and intends to remain so for the ensuing quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75. What is its hedge ratio? What is the amount of the Rs future it should short to achieve a perfect hedge?

Answer:

Note 1: Computation of Beta:

$$\text{Beta} = \frac{\text{Change in spot market}}{\text{Change in futures market}} \times \text{Correlation coefficient}$$

$$\text{Beta} = \frac{4}{6} \times 0.75 = 0.50$$

Note 2: Computation of futures position for perfect hedge:

Security	Beta	Weight	Product
Spot market	0.50	47,40,000 (474 × 10,000)	23,70,000
Futures	1.00	(23,70,000)	(23,70,000)
Total	0.00	47,40,000	0

- We have to short futures worth Rs.23,70,000 for perfect hedge

15. Hedging with futures (May 2013)

On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	β
A	349.30	5,000	1.15
B	480.50	7,000	0.40
C	593.52	8,000	0.90
D	734.70	10,000	0.95
E	824.85	2,000	0.85

The cost of capital to the investor is 10.5% per annum. You are required to calculate.

- The beta of his portfolio.
- The theoretical value of the NIFTY futures for February 2013.
- The number of contracts of NIFTY the investors needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures are trading lot requirement of 200 units. Assume that the futures are trading at their fair value.
- The number of future contracts the investor should trade if he desire to reduce the beta of his portfolios to 0.6

(No. of days in a year be treated as 365. Given: $\ln(1.105) = 0.0998$ e $(0.015858) = 1.01598$)

Answer:

WN 1: Computation of Beta of portfolio:

Security	Beta	Weight	Product
A	1.15	17,46,500	20,08,475
B	0.40	33,63,500	13,45,400

C	0.90	47,48,160	42,73,344
D	0.95	73,47,000	69,79,650
E	0.85	16,49,700	14,02,245
Total	0.8491	1,88,54,860	1,60,09,114

$$\text{Portfolio Beta} = \frac{\text{Sum of product}}{\text{Sum of weights}} = \frac{1,60,09,114}{1,88,54,860} = 0.8491 \text{ Times}$$

WN 2: Computation of fair futures price:**Base data:**

Spot price	Rs.5,900
Time period	58 days (or) 58/365 years
Rate of interest	10.50% normal rate (or) 9.98% continuous compounded rate per annum (Note 1)
Dividend	0
Storage cost	0
Type of compounding	Continuous

Note 1:

- Cost of capital of the company is 10.50 percent per annum. This can be converted into CCRFI rate using natural log values (ln)
- $\ln(1.105) = 0.0998$. This would mean that normal cost of capital of 10.50 per annum can be converted into continuous compounded rate of 9.98 percent per annum

Fair Futures Price:

Fair Futures Price = Spot Price $\times e^{rt}$
Fair Futures Price = $5,900 \times e^{(0.0998)(\frac{58}{365})}$
Fair Futures Price = $5,900 \times e^{0.015858}$
Fair Futures Price = $5,900 \times 1.01598$
Fair Futures Price = Rs. 5,994.28

WN 3: Calculation of number of contracts for perfect hedging:

Security	Beta	Weight	Product
Portfolio	0.8491	1,88,54,860	1,60,09,114
Futures	1.00	(1,60,09,114)	(1,60,09,114)
Total	0	1,88,54,860	0

- We should sell NIFTY futures worth Rs.1,60,09,114 for perfect hedge

$$\text{No of contracts to be sold} = \frac{1,60,09,114}{200 \times 5,994.28} = 13.35 \text{ rounded off to 13 contracts}$$

WN 4: Calculation of number of contracts to reduce beta to 0.6 Times:

Security	Beta	Weight	Product
Portfolio	0.8491	1,88,54,860	1,60,09,114
Futures	1.00	(46,96,198)	(46,96,198)
Total	0.60	1,88,54,860	1,13,12,916

- We should sell NIFTY futures worth Rs.46,96,198 to reduce Beta to 0.6 Times

$$\text{No of contracts to be sold} = \frac{46,96,198}{200 \times 5,994.28} = 3.917 \text{ rounded off to 4 contracts}$$

16. Hedging with futures (November 2015)

On April 1, 2015, an investor has portfolio consisting of eight securities as shown below:

Security	Price	No. of shares	β
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24

G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is given to be 20% per annum. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for advice. You can make use of the following information/assumptions:

- ❖ The current S&P CNX Nifty value is 8500.
- ❖ S&P CNX Nifty futures can be traded in units of 25 only.
- ❖ The May futures are currently quoted at 8700 and the June Futures are being quoted at 8850.

You are required to:

- Calculate the beta of his portfolio.
- Calculate the theoretical value of the futures contracts according the investor for contracts expiring in (1) May, (2) June. [Given $e^{0.03} = 1.03045$; $e^{0.04} = 1.04081$; $e^{0.05} = 1.05127$]
- Calculate the number of units of S&P CNX Nifty that he would have to sell if he desires to hedge until June (1) his total portfolio, (2) 90% of his portfolio and (3) 120% of his portfolio.
- Determine the number of futures contracts the investor should trade if he desires to reduce the beta of his portfolio to 0.9.

Answer:

WN 1: Computation of Beta of portfolio:

Security	Beta	Weight	Product
A	0.59	11,760	6,938
B	1.32	2,54,960	3,36,547
C	0.87	99,030	86,156
D	0.35	1,560	546
E	1.16	1,12,760	1,30,802
F	1.24	2,06,550	2,56,122
G	1.05	1,54,380	1,62,099
H	0.76	1,53,450	1,16,622
Total	1.1019	9,94,450	10,95,832

$$\text{Beta} = \frac{\text{Sum of Product}}{\text{Sum of weights}} = \frac{10,95,832}{9,94,450} = 1.1019 \text{ Times}$$

WN 2: Computation of Fair Futures Price:

Contract expiring in May:

Base data:

Spot price	8,500
Time period	2 months (or) 0.16667 year
Rate of interest	20%
Dividend	0
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

Fair Futures Price = Spot Price $\times e^{rt}$
Fair Futures Price = $8,500 \times e^{(0.20)(0.16667)}$
Fair Futures Price = $8,500 \times e^{0.03333}$
Fair Futures Price = $8,500 \times 1.03387$
Fair Futures Price = Rs. 8,788

Note: Computation of $e^{0.03333}$:

$e^{0.03333}$ shall be computed using interpolation formula as follows

$e^{0.03}$	=	1.03045
$e^{0.04}$	=	1.04081
$e^{0.01}$	=	0.01036
$e^{0.0033}$	=	0.00342 (0.01036 $\times$ 33/100)
$e^{0.0067}$	=	0.00694 (0.01036 $\times$ 67/100)

$e^{0.0333}$	=	$1.03045 + 0.00342 = 1.03387$
(or)		
$e^{0.0333}$	=	$1.04081 - 0.00694 = 1.03387$

Contract expiring in June:**Base data:**

Spot price	8,500
Time period	3 months (or) 0.25 year
Rate of interest	20%
Dividend	0
Storage cost	0
Type of compounding	Continuous

Fair Futures Price:

Fair Futures Price = Spot Price $\times e^{rt}$
Fair Futures Price = $8,500 \times e^{(0.20)(0.25)}$
Fair Futures Price = $8,500 \times e^{0.05}$
Fair Futures Price = $8,500 \times 1.05127$
Fair Futures Price = Rs. 8,935.80

WN 3: Computation of number of contracts for hedging portfolio till June:**Scenario 1: Hedging full portfolio:**

- Investor wants to hedge full portfolio and hence the Beta will come down to zero

Security	Beta	Weight	Product
Security	1.1019	9,94,450	10,95,832
Nifty futures	1	(10,95,832)	(10,95,832)
Total	0	9,94,450	0

$$\text{No of contracts to sell} = \frac{10,95,832}{25 \times 8,850} = 4.95 \sim 5 \text{ contracts}$$

Scenario 2: Hedging 50% portfolio:

$$\text{No of contracts to sell} = 4.95 \times 0.50 = 2.475 \sim 2 \text{ or } 3 \text{ contracts}$$

Scenario 3: Hedging 120% portfolio:

$$\text{No of contracts to sell} = 4.95 \times 1.20 = 5.94 \sim 6 \text{ contracts}$$

17. Hedging with futures

A portfolio manager has the following five stocks in his portfolio

Security	No of shares	Price/share	Beta
A	10000	50	1.2
B	5000	20	2.0
C	8000	25	0.7
D	1000	100	1.0
E	500	200	1.3

- Compute portfolio beta?
- If the manager wants to reduce the beta to 0.8, how much risk free investment would he bring in? What will be the new portfolio?
- If the manager wants to increase the beta to 1.4, how much of risk free investment should he sell? What will be the new portfolio?
- Suppose Nifty spot is 1200 points and Nifty futures is 1250 points and futures have a contract multiplier of 200, how can he obtain the same position as in (ii) by dealing in Nifty futures?
- How can he obtain the same position as in (iii) by dealing in Nifty futures?

Answer:**WN 1: Computation of portfolio Beta:**

Security	Beta	Weight	Product
A	1.20	5,00,000	6,00,000

B	2.00	1,00,000	2,00,000
C	0.70	2,00,000	1,40,000
D	1.00	1,00,000	1,00,000
E	1.30	1,00,000	1,30,000
Total	1.17	10,00,000	11,70,000

- Portfolio Beta = 1.17 Times

WN 2: Reducing Beta to 0.8 Times:

It is assumed that investment in shares would continue to be Rs.10,00,000 and the investor would bring in additional money for risk-free investment

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Risk-free	0.00	4,62,500	0
Total	0.80	14,62,500	11,70,000

Note:

- Beta of risk-free asset is zero and hence product of risk-free asset will be zero
- Total of product = 11,70,000 + 0 = 11,70,000
- Overall beta = 0.8 Times
- Total of weights = 11,70,000/0.80 = Rs.14,62,500
- Weight of risk-free asset = 14,62,500 - 10,00,000 = Rs.4,62,500
- Investor needs to bring risk-free investment of Rs.4,62,500 to reduce beta to 0.8 times

WN 3: Increasing Beta to 1.4 Times:

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Risk-free	0.00	(1,64,286)	0
Total	1.40	8,35,714	11,70,000

- Investor should borrow Rs.1,64,286 to increase beta to 1.4 times

WN 4: Changing beta through futures:**Reducing beta to 0.8 times:**

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Futures	1.00	(3,70,000)	(3,70,000)
Total	0.80	10,00,000	8,00,000

$$\text{No of contracts to be sold} = \frac{3,70,000}{200 \times 1,250} = 1.48 \sim 1 \text{ or } 2 \text{ contracts}$$

Increasing beta to 1.4 times:

Security	Beta	Weight	Product
Portfolio	1.17	10,00,000	11,70,000
Futures	1.00	2,30,000	2,30,000
Total	1.40	10,00,000	14,00,000

$$\text{No of contracts to be bought} = \frac{2,30,000}{200 \times 1,250} = 0.92 \sim 1 \text{ contract}$$

18. Hedging with futures (November 2013)

Ram buys 10,000 shares of X Ltd. at a price of Rs. 22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of Rs. 40 per share. He obtains a complete hedge by Nifty futures at Rs. 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 Beta of A Limited if the overall loss of the investor is Rs.11,450?

Computation of Beta of A Limited:

Security	Beta	Weight	Product
X Limited	1.50	2,20,000	3,30,000
A Limited	2.00	-2,00,000	-4,00,000
Nifty Futures	1.00	70,000	70,000

Total	0	20,000	0

Note:

- We need a perfect hedge and hence total of product would be zero.
- Product for X Limited is Rs.3,30,000 and for nifty futures is Rs.70,000. This would mean that product for A Limited will be -4,00,000
- **Beta of A Limited = $-4,00,000/-2,00,000 = 2$ times**

Analysis of loss of Rs.11,450:

- Ram has purchased shares of X Limited of Rs.2,20,000. Price of X Limited has dropped by 2% and hence loss of X Limited shares would be Rs.4,400 ($2,20,000 \times 2\%$)
- Ram has sold shares of A Limited of Rs.2,00,000. Price of A Limited has appreciated by 3 percent. Ram has sold shares and price has appreciated. This would lead to loss for the investor of Rs.6,000 ($2,00,000 \times 3\%$)
- Net loss from Nifty futures = $11,450 - 4,400 - 6,000 = \text{Rs.}1,050$
- Nifty futures have dropped by 1.5%. Investor has made loss of Rs.1,050. This is possible when we have purchased Nifty futures.
- Amount of futures bought = $(1,050/1.5\%) = \text{Rs.}70,000$

19. Hedging with futures (November 2016)

Details about portfolio of shares of an investor is as below:

Shares	No of shares (lakh)	Price per share	Beta
A Limited	3.00	500	1.40
B Limited	4.00	750	1.20
C Limited	2.00	250	1.60

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91. He is considering two below mentioned alternative strategies:

- Dispose off a part of his existing portfolio to acquire risk free securities, or
- Take appropriate position on Nifty Futures which are currently traded at Rs.8,125 and each Nifty points is worth Rs.200

You are required to determine:

- Portfolio Beta
- The value of risk free securities to be acquired
- The number of shares of each company to be disposed off
- The number of Nifty contracts to be bought/sold and
- The value of portfolio beta for 2% rise in Nifty

Answer:**WN 1: Computation of Beta:**

Shares	Beta	Weight	Product
A Limited	1.40	1,500	2,100
B Limited	1.20	3,000	3,600
C Limited	1.60	500	800
Overall	1.30	5,000	6,500

WN 2: Computation of risk-free securities to be acquired to get target Beta of 0.91 times:

Particulars	Beta	Weight	Product
Equity portfolio	1.30	3,500	4,550
Risk-free securities	0	1,500	0
Overall	0.91	5,000	4,550

- ❖ The company needs target beta of 0.91 times and we first update that. Based on target Beta of 0.91 times and weight of 5,000 we should get overall product of 4,550
- ❖ Product for risk-free security will be zero irrespective of weight and hence product for equity portfolio will be 4,550
- ❖ Weight for equity portfolio = $4,550/1.30 = 3,500$
- ❖ Weight for risk-free security = $5,000 - 3,500 = 1,500$
- ❖ **Hence, we should buy risk-free securities of 1,500 lacs**

WN 3: Computation of number of shares to be disposed-off:

- ❖ The company currently has a share portfolio of 5,000 lacs and the revised portfolio is 3,500 lacs. Hence, we should dispose 30 percent of share portfolio to reduce Beta.

Shares	Existing shares (in lacs)	Shares to be disposed-off (in lacs)
A Limited	3.00	0.90
B Limited	4.00	1.20
C Limited	2.00	0.60

WN 4: Adjustment of Beta through Nifty Futures:

Particulars	Beta	Weight	Product
Equity portfolio	1.30	5,000	6,500
Nifty Futures	1.00	-1,950	-1,950
Overall	0.91	5,000	4,550

- ❖ The company currently has portfolio of 5,000 lacs and the risk adjusted value (product) for the same is 6,500 lacs
- ❖ The company can reduce the risk through Nifty Futures. The overall Beta has to be 0.91 and the product will be 4,550 lacs
- ❖ **Nifty futures will have Beta of 1 time and weight for the same will not appear in total of weights. This is because the portfolio value will continue to be 5,000 lacs despite entering into long/short Nifty Futures**
- ❖ Value of Nifty Futures = 4,550 - 6,500 = -1,950 lacs; Answer is negative and hence we should go for short position

$$\text{No of contracts to be short} = \frac{1,950 \text{ lacs}}{8,125 \times 200} = 120 \text{ contracts}$$

WN 5: Computation of Beta for 2% rise in Nifty:

- ❖ The share portfolio will improve by 2.6% (2% x 1.3 times) for a 2% rise in Nifty. Profit on portfolio is equal to Rs.130 lacs (5,000 x 2.6%)
- ❖ Nifty futures will have a loss of 2 percent as the investor has entered into short position. Loss on Nifty Futures is equal to Rs.39 lacs (1,950 x 2%)
- ❖ **Overall profit = Rs.91 lacs or 1.82% of portfolio**

$$\text{Beta} = \frac{\text{change in portfolio}}{\text{Change in market}} = \frac{1.82}{2.00} = 0.91 \text{ Times}$$

20. Computation of portfolio Beta (May 2017, May 2020 RTP)

A is an investor and having in its portfolio shares worth Rs.1,20,00,000 at current price and Cash of Rs.10,00,000. The Beta of share portfolio is 1.4. After four months the price of shares dropped by 1.8%. You are required to determine:

- Current Portfolio Beta
- Portfolio Beta after four months-if A on current date goes for long position on Rs.1,30,00,000 Nifty Futures

Show calculations in lacs with four decimal points

Answer:

WN 1: Computation of Portfolio Beta:

Particulars	Beta	Weight	Product
Equity portfolio	1.40	120	168
Cash	0.00	10	0
Total	1.2923	130	168

WN 2: Computation of Beta if shares change by 1.8%:

- ❖ The share portfolio will fall by 1.8%. Loss on share portfolio is equal to Rs.2.16 lacs (120 lacs x 1.8%)
- ❖ The share portfolio has fallen by 1.8%. Beta of shares is 1.40 and hence Nifty will fall by 1.2857% (1.8/1.4). Nifty futures will have a loss of 1.2857 percent as the investor has entered into long position. Loss on Nifty Futures is equal to Rs.1.6714 lacs (130 lacs x 1.2857%)
- ❖ **Overall loss= Rs.2.16 lacs + Rs.1.6714 lacs = Rs.3.8314 lacs**
- ❖ **Overall loss in percentage = (3.8314 lacs/130 lacs) = 2.9472%**

$$\text{Beta} = \frac{\text{change in portfolio}}{\text{Change in market}} = \frac{2.9472}{1.2857} = 2.2923 \text{ Times}$$

21. Computation of net realization (May 2013 RTP)

A wheat trader has planned to sell 440000 kgs of wheat after 6 months from now. The spot price of wheat is Rs. 19 per kg and 6 months future on same is trading at Rs. 18.50 per kg (Contract Size= 2000 kg). The price is expected to fall to as low as Rs. 17.00 per kg 6 month hence. What trader can do to mitigate its risk of reduced profit? If he decides to make use of future market what would be effective realized price for its sale when after 6 months is spot price is Rs. 17.50 per kg and future contract price for 6 months is Rs. 17.55.

Answer:

WN 1: Computation of futures profit/loss:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	Day 180	18.50
Day 180	Opposite Position	Buy	Day 180	(17.55)
Net profit per Kg in futures market				0.95

- ❖ Investor originally entered into contract to sell wheat at the rate of Rs.18.50 in futures market. The same would be cancelled on Day 180 to get the net profit/loss
- ❖ The contract would be cancelled on Day 180 at the futures rate of Rs.17.55 and hence the net profit per Kg of Wheat is Rs.0.95

WN 2: Computation of effective realized price:

Particulars	Amount
Realization in the spot market	17.50
Futures Profit	0.95
Effective realization	18.45

22. Computation of net realization (Nov 2020 RTP):

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 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.

Answer:

Part 1:

- Since trader has planned to sell after 3 months now it implies, he is in Long Position in Cash or Spot Market.

Part 2:

- 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.

Part 3:**Computation of futures profit/loss:**

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Sell	3 months	59.00
3 months	Opposite Position	Buy	3 months	(58.00)
Net profit per Kg in futures market				1.00

- ❖ Investor originally entered into contract to sell rice at the rate of Rs.59.00 in futures market. The same would be cancelled in month 3 to get the net profit/loss
- ❖ The contract would be cancelled in month 3 at the futures rate of Rs.58.00 and hence the net profit per Kg of rice is Rs.1.00

Computation of effective realized price:

Particulars	Amount
Realization in the spot market	57.00
Futures Profit	1.00
Effective realization	58.00

23. Change in beta through risk free asset and futures (November 2014 RTP)

Mr. A has a portfolio of Rs. 5 crore consisting of equity shares of X Ltd. and Y Ltd. with beta of 1.15. Other information is as follows:

- ❖ Spot Value of Index Future = 21000
- ❖ Multiplier = 150

You are requested to reduce beta of portfolio to 0.85 and increase beta to 1.45 by using:

- (a) Change in composition through Risk Free securities
- (b) Index futures

Answer:

WN 1: Reduction of Beta to 0.85 Times:**Approach 1 - Using Risk-free Securities:**

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	369.5652	425
Risk-free security	0.00	130.4348	0
Total	0.85	500	425

- ❖ Investor should buy sell shares and buy risk-free securities worth Rs.130.4348 lacs to reduce Beta to 0.85 times

Approach 2- Using Index Futures:

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	500	575
Index Futures	1.00	-150	-150
Total	0.85	500	425

- ❖ Investor should sell Nifty Futures worth Rs.150 lacs to reduce Beta to 0.85 Times

No of contracts to be short = $\frac{150 \text{ lacs}}{21000 \times 150} = 4.76 \text{ contracts (or) } 5 \text{ Contracts}$

WN 2: Increase of Beta to 1.45 Times:**Approach 1 - Using Risk-free Securities:**

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	630.4348	725
Risk-free security	0.00	-130.4348	0
Total	1.45	500	725

- ❖ Investor should borrow money of Rs.130.4348 lacs and invest the same in equity portfolio. This will increase Beta to 1.45 times

Approach 2- Using Index Futures:

Security	Beta	Weight (in lacs)	Product
Equity portfolio	1.15	500	575
Index Futures	1.00	150	150
Total	1.45	500	725

- ❖ Investor should buy Nifty Futures worth Rs.150 lacs to increase Beta to 1.45 Times

No of contracts to be bought = $\frac{150 \text{ lacs}}{21000 \times 150} = 4.76 \text{ contracts (or) } 5 \text{ Contracts}$

24. Beta calculation - reverse working (May 2015 RTP)

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.

Answer:

WN 1: Analysis of loss of \$ 1,14,500:

Security	Amount bought/sold	% change	Profit/loss
X Inc	22,00,000	(2%)	(44,000) [22,00,000 x -2%]
A Inc	(20,00,000)	3%	(60,000) [-20,00,000 x 3%]
Index Futures	7,00,000 [-10,500/-1.5%]	(1.5%)	(10,500) [1,14,500 - 44,000 - 60,000]
Total			(1,14,500)

- ❖ The investor has made loss of \$ 1,14,500. He has made loss of 44,000 in X Inc and 60,000 in A Inc. Hence the balance loss of 10,500 would be in index futures
- ❖ Index futures have fallen by 1.5% and hence amount of index futures dealt was 7,00,000 [-10,500/-1.5%]

$\text{No of contracts to be bought} = \frac{7,00,000}{1,000} = 700 \text{ Contracts}$

Note: There is an error in question, and it should have been no of contracts to be bought

WN 2: Computation of Beta of A Inc:

Security	Beta	Weight	Product
X Inc	1.5 [33,00,000/22,00,000]	22,00,000	33,00,000
A Inc	2	(20,00,000)	(40,00,000)
Nifty Futures	1	7,00,000	7,00,000
Total	0	2,00,000	0

- ❖ The investor has obtained a perfect hedge and hence overall Beta and total of products will be zero.
- ❖ Reverse working we will get total of X Inc to be 33,00,000
- ❖ Beta of X Inc = 33,00,000/22,00,000 = 1.5 Times

25. Impact of hedging (May 2017 RTP)

Miss K holds 10,000 shares of IBS Bank @ 2,738.70 when 1 month Index Future was trading @ 6,086 The share has a Beta (β) of 1.2. How many Index Futures should she short to perfectly hedge his position. A single Index Future is a lot of 50 indices. Justify your result in the following cases:

- when the Index zooms by 1%
- when the Index plummets by 2%.

Answer:

WN 1: Computation of index futures to hedge the position:

Security	Beta	Weight (in lacs)	Product (in lacs)
IBS Bank	1.20	273.87	328.644
Index Futures	1.00	(328.644)	(328.644)
Total	0	273.87	0

Amount of index futures to be short = Rs.328.644 lacs

$\text{No of contracts} = \frac{328.644 \text{ lacs}}{6,086 \times 50} = 108 \text{ contracts}$

WN 2: Position of the investor if index zoomed by 1%

Particulars	Calculation	Amount
Profit on purchase of shares	273.87 lacs x 1.20%	3.28644 lacs
Loss on Nifty Futures	328.644 lacs x 1.00%	(3.28644 lacs)
Net profit/loss		0

- ❖ Market has increased by 1% and hence share will increase by 1.2% due to Beta of 1.2 times

WN 3: Position of the investor if index plummets by 2%

Particulars	Calculation	Amount
Loss on purchase of shares	273.87 lacs x 2.40%	(6.57288 lacs)
Profit on Nifty Futures	328.644 lacs x 2.00%	6.57288 lacs
Net profit/loss		0

❖ Market has fallen by 2% and hence share will fall by 2.4% due to Beta of 1.2 times

26. Swap agreement (May 2018 RTP)

TMC Holding Ltd. has a portfolio of shares of diversified companies valued at Rs. 400 crore enters into a swap arrangement with None Bank on the terms that it will get 1.15% quarterly on notional principal of Rs. 400 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 21,600. You are required to determine the net payment to be received/ paid if Sensex turns out to be 21,860, 21,780, 22,080 and 21,960 at the end of each quarter.

WN 1: Computation of net-payment to be received/paid for every quarter:

Quarter	Sensex	Sensex Return %	Amount payable (Rs. Crore)	Fixed return receivable (Rs. Crore)	Net payment(-) / receipt(+)
0	21,600	-	-	-	-
1	21,860	1.2037	4.8148 [400 cr x 1.2037%]	4.6000 [400 cr x 1.15%]	-0.2148
2	21,780	-0.3660	-1.4640	4.6000	+6.0640
3	22,080	1.3774	5.5096	4.6000	-0.9096
4	21,960	-0.5435	-2.1740	4.6000	6.7740

Part III - Maintenance Margin and Open Interest**27. Maintenance of margin - Mark to Market (May 2015 RTP, Nov 2018 RTP)**

Sensex futures are traded at a multiple of 50. Consider the following quotations of sensex futures in the 10 trading days during February, 2017:

Day	High	Low	Closing
4-2-09	3306.4	3290.0	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

You have bought one sensex futures contract on February 04. The average daily absolute change in the value of the contract is Rs.10,000 and standard deviation of these changes is Rs.2,000. The maintenance margin is 75% of initial margin. You are required to determine the daily balances in the margin account and payment of margin calls, if any.

Answer:

- Initial margin = Daily absolute change + (3 x standard deviation)
- Initial margin = 10,000 + (3 x 2,000) = Rs.16,000
- Maintenance margin = 16,000 x 75% = Rs.12,000

Date	Price	Profit/Loss	Margin balance	Deposit/ withdrawal	Revised balance
Feb 4	3296.50	0	16,000	0	16,000
Feb 5	3294.40	-105	15,895	0	15,895
Feb 6	3230.40	-3,200	12,695	0	12,695
Feb 7	3212.30	-905	11,790	4,210	16,000
Feb 10	3267.50	2,760	18,760	0	18,760
Feb 11	3263.80	-185	18,575	0	18,575

Feb 12	3292.00	1,410	19,985	0	19,985
Feb 14	3309.30	865	20,850	0	20,850
Feb 17	3257.80	-2,575	18,275	0	18,275
Feb 18	3,102.60	-7,760	-10,515	5,485	16,000

Part IV – Basics of Option

Part V –Payoff table and Payoff graph

28. Application of option strategy:

Mr. A is considering writing a 30-day option on ABC Limited which is currently trading at Rs.60 per share. The exercise price of the share is also Rs.60 and the premium received on the option will be Rs.3.75. At what share prices will he make money, at what price will he start to lose money and at what prices will he lose Rs.5 and Rs.10 on each option that is written?

Answer:

- Type of option is not mentioned in the question. It is assumed that it is a call option

Particulars	Make money	Lose money	Loss of Rs.5	Loss of Rs.10
Actual price	63.74	63.76	68.75	73.75
Exercise price	60.00	60.00	60.00	60.00
Gross payoff	-3.74	-3.76	-8.75	-13.75
Premium	3.75	3.75	3.75	3.75
Net payoff	0.01	-0.01	-5.00	-10.00

Note:

- Price at which profit would be earned = Price below 63.75 (63.75 is break-even price at which profit/loss would be zero)
- Price at which loss would be incurred = Price above 63.75
- Price at which loss will be Rs.5 = Rs.68.75
- Price at which loss will be Rs.10 = Rs.73.75

29. Payoff for option strategy (Nov 2019 RTP)

The equity share of VCC Ltd. is quoted at Rs. 210. A 3-month call option is available at a premium of Rs. 6 per share and a 3-month put option is available at a premium of Rs. 5 per share. Ascertain the net payoffs to the optionholder of a call option and a put option.

- the strike price in both cases in Rs. 220; and
- the share price on the exercise day is Rs. 200,210,220,230,240.

Also indicate the price range at which the call and the put options may be gainfully exercised.

Answer:

WN 1: Pay-off table for call holder:

Price	200	210	220	230	240
Exercise price	220	220	220	220	220
Action	Lapse	Lapse	Lapse	Exercise	Exercise
GPO	0	0	0	10	20
Premium	-6	-6	-6	-6	-6
NPO	-6	-6	-6	4	14

- Break-even price = Exercise price + Premium = 220 + 6 = Rs.226
- Option can be gainfully exercised if the price is greater than Rs.226

WN 2: Pay-off table for put holder:

Price	200	210	220	230	240
Exercise price	220	220	220	220	220
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Gross payoff	20	10	0	0	0
Premium	-5	-5	-5	-5	-5
Net payoff	15	5	-5	-5	-5

- Break-even price = Exercise price - Premium = Rs.220 - 5 = Rs.215

- Option can be gainfully exercise if the price is lower than Rs.215

30. Payoff for option strategy (November 2012 RTP)

A call and put exist on the same stock each of which is exercisable at Rs. 60. They now trade for:

Market price of Stock or stock index Rs.55

Market price of call Rs.9

Market price of put Rs.1

Calculate the expiration date cash flow, investment value, and net profit from:

- Buy 1.0 call
- Write 1.0 call
- Buy 1.0 put
- Write 1.0 put

for expiration date stock prices of Rs. 50, Rs. 55, Rs. 60, Rs. 65, Rs. 70.

Answer:

WN 1: Computation of expiration date cash flow, investment value and net profit from buying one call:

Expected market price	50	55	60	65	70
Action	Lapse	Lapse	Lapse	Exercise	Exercise
Expiration date cash flow	0	0	0	-60	-60
Gross pay-off (investment value)	0	0	0	5	10
Premium	9	9	9	9	9
Net profit	-9	-9	-9	-4	1

- Expiration date cash flow will occur if the option is exercised. It would be an outflow if the share is purchased and an inflow if the share is sold

WN 2: Computation of expiration date cash flow, investment value and net profit from writing one call:

Expected market price	50	55	60	65	70
Action	Lapse	Lapse	Lapse	Exercise	Exercise
Expiration date cash flow	0	0	0	60	60
Gross pay-off (investment value)	0	0	0	-5	-10
Premium	9	9	9	9	9
Net profit	9	9	9	4	-1

WN 3: Computation of expiration date cash flow, investment value and net profit from buying one put:

Expected market price	50	55	60	65	70
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Expiration date cash flow	60	60	0	0	0
Gross pay-off (investment value)	10	5	0	0	0
Premium	1	1	1	1	1
Net profit	9	4	-1	-1	-1

WN 4: Computation of expiration date cash flow, investment value and net profit from writing one put:

Expected market price	50	55	60	65	70
Action	Exercise	Exercise	Lapse	Lapse	Lapse
Expiration date cash flow	-60	-60	0	0	0
Gross pay-off (investment value)	-10	-5	0	0	0
Premium	1	1	1	1	1
Net profit	-9	-4	1	1	1

31. Payoff for option (May 2016, Nov 2018 RTP)

The market received rumour about ABC corporation's tie-up with a multinational company. This has induced the market price to move up. If the rumour is false, the ABC corporation stock price will probably fall dramatically. To protect from this an investor has bought the call and put options. He purchased one 3 months call with a striking price of Rs.42 for Rs.2 premium, and paid Re.1 per share

premium for a 3 months put with a striking price of Rs.40.

- ❖ Determine the Investor's position if the tie up offer bids the price of ABC Corporation's stock up to Rs.43 in 3 months.
- ❖ Determine the Investor's ending position, if the tie up programme fails and the price of the stocks falls to Rs. 36 in 3 months.

Answer:

Let us assume 1 lot of option contract is for 100 shares

Particulars	Price of 43	Price of 36
GPO of call option	100	0
GPO of put option	0	400
Total GPO	100	400
Premium	-300	-300
Net profit/loss	-200	100

32. Option strategy (May 2018 RTP, May 2018)

Mr. X established the following spread on the Delta Corporation's stock :

Purchased one 3-month call option with a premium of Rs. 30 and an exercise price of Rs. 550. Purchased one 3-month put option with a premium of Rs. 5 and an exercise price of Rs. 450. Corporation's stock is currently selling at Rs. 500. Determine profit or loss, if the price of Delta Corporation's :

- ❖ remains at Rs.500 after 3 months.
- ❖ falls at Rs.350 after 3 months.
- ❖ rises to Rs.600.

Assume the size option is 100 shares of Delta Corporation.

Answer:

Particulars	Price of 500	Price of 350	Price of 600
GPO of call option	-	-	50
GPO of put option	-	100	-
Total GPO	-	10,000	5,000
Premium	-3,500	-3,500	-3,500
Net profit/loss	-3,500	6,500	1,500

33. Option strategy (Nov 2018 RTP)

Ram holding shares of Reliance Industries Limited which is currently selling at Rs.1,000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance share.

Strike Price	Option	Premium
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value. Recommend a hedging strategy with option and show how his position will be protected.

Answer:

Instead of selling the stock of Reliance Limited, Ram must cover his risk by buying or long position in Put option with appropriate strike price. Since Ram's risk appetite is 5%, the most suitable strike price in put option shall be Rs.950 (Rs.1,000 - 5% of Rs.1,000). Impact of hedging will be as under:

- ❖ If the price is less than Rs.950, then investor can sell the stock for Rs.950. He would be paying premium of Rs.8 and hence net realization will be Rs.942
- ❖ If the price is more than Rs.950, then investor can sell the stock for market price. He would be paying premium of Rs.8 and hence net realization will be Market price - Premium
- ❖ Thus, from the above, it can be seen that the value of holding of Ram shall never be less than Rs.942 as put option will compensate for loss below price of Rs.950. However, this strategy will involve a cost of Rs.8

Part VI - Option Valuation

34. Put call parity

Three-month call and three-month put are available on Multan Ltd's stock. The exercise price is Rs.100. The CCRFI is 12% p.a.

- If the put rules at Rs.5, and the share is worth Rs.95, Compute the value of the call.
- If the put quotes Rs.3 and the call is worth Rs.4 what is the share worth?
- If the market price of the call is Rs.8 and the market price of the share is Rs.102, what is the value of the put?
- Rework the above three scenarios in case dividend of Rs.1 is to be paid at the end of first month.

Answer:

WN 1: Valuation of call option:

Share + Put = Call + Present value of exercise price

$$95 + 5 = \text{Call} + \frac{100}{e^{rt}}$$

$$95 + 5 = \text{Call} + \frac{100}{e^{(0.12)(0.25)}}; 100 = \text{Call} + \frac{100}{1.03045}$$

$$100 = \text{Call} + 97.04$$

$$\text{Call} = \text{Rs. 2. 96}$$

WN 2: Valuation of share:

Share + Put = Call + Present value of exercise price

$$\text{Share} + 3 = 4 + 97.04$$

$$\text{Share} = \text{Rs. 98. 04}$$

WN 3: Valuation of put option:

Share + Put = Call + Present value of exercise price

$$102 + \text{Put} = 8 + 97.04$$

$$\text{Put} = \text{Rs. 3. 04}$$

WN 4: Rework of three scenarios if dividend of Rs.1 is to be paid at the end of first month:

- Dividend of Rs.1 will be paid at the end of first month. In such a scenario we need to replace stock with price with adjusted stock price in the formula
- Adjusted stock price = Share price - Present value of dividend income

$$\text{PV of Dividend Income} = \frac{1}{e^{(0.12)\left(\frac{1}{12}\right)}} = \frac{1}{e^{0.01}} = \frac{1}{1.01005} = \text{Rs. 0.99}$$

Valuation of call option of Part 1:

$$\text{Adjusted stock price} = 95 - 0.99 = \text{Rs. 94.01}$$

Share + Put = Call + Present value of exercise price

$$94.01 + 5 = \text{Call} + 97.04$$

$$\text{Call} = \text{Rs. 1. 97}$$

Valuation of share of Part 2:

- Adjusted share price = Rs.98.04
- Adjusted share price = Share price - PV of dividend income
- 98.04 = Share price - 0.99
- Share price = Rs.99.03

Valuation of put option of Part 3:

- Share price = Rs.102
- Adjusted share price = 102 - 0.99 = Rs.101.01

Share + Put = Call + Present value of exercise price

$$101.01 + \text{Put} = 8 + 97.04$$

$$\text{Put} = \text{Rs. 4. 05}$$

35. Portfolio replication model

From the following data compute the value of the call option using replicating model. First use the stock equivalent approach and then the option equivalent approach. Are the results different? Also find value of put.

Upper price	90
Lower price	70
Time	1 year
CMP	75
Exercise price	65
T bill rate (p.a.)	4%

Answer:

WN 1: Valuation of call and put option using stock equivalent approach:

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
70	5
90	25

Step 2: Computation of no of calls to be bought:

$$\text{No of calls} = \frac{\text{Spread in stock price}}{\text{Spread in Intrinsic value}} = \frac{90 - 70}{25 - 5} = 1$$

Step 3: Computation of risk-free investment:

Risk – free investment = PV of $(JP_1 - IV \text{ at } JP_1)$

$$\text{Risk – free investment} = \text{PV of } (70 - 5) = \text{PV of } 65 = \frac{65}{e^{0.04(1)}} = \frac{65}{1.040811} = \text{Rs. 62.45}$$

Step 4: Valuation of call option:

$S_0 = (C_0 \times \text{No of calls}) + \text{Risk – free investment}$

$$75 = (C_0 \times 1) + 62.45;$$

Value of call = Rs. 12.55

Step 5: Valuation of Put option using PCPT:

Share + Put = Call + Present value of exercise price

$$75 + \text{Put} = 12.55 + 62.45$$

Value of put = 0

WN 2: Valuation of call and put option using option equivalent approach:

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
70	5
90	25

Step 2: Computation of no of calls to be bought:

$$\text{No of shares} = \frac{\text{Spread in Intrinsic value}}{\text{Spread in stock price}} = \frac{25 - 5}{90 - 70} = 1$$

Step 3: Computation of amount of borrowing:

Borrowing = PV of $(\text{No of shares} \times JP_1 - IV \text{ at } JP_1)$

$$\text{Borrowing} = \text{PV of } (1 \times 70 - 5) = \text{PV of } 65 = \frac{65}{e^{0.04(1)}} = \frac{65}{1.040811} = \text{Rs. 62.45}$$

Step 4: Valuation of call option:

Call = Share value bought – Borrowings

$$\text{Call} = (1 \times 75) - 62.45$$

Value of call = Rs. 12.55

Step 5: Valuation of Put option using PCPT:

Share + Put = Call + Present value of exercise price

$$75 + \text{Put} = 12.55 + 62.45$$

Value of put = 0

36. Risk Neutral model (May 2013 RTP)

The current market price of an equity share of Penchant Ltd is Rs.420. Within a period of 3 months, the maximum and minimum price of it is expected to be Rs. 500 and Rs. 400 respectively. If the risk free rate of interest be 8% p.a., what should be the value of a 3 months Call option under the "Risk Neutral" method at the strike rate of Rs. 450 ? Given $e^{0.02} = 1.0202$

Answer:

WN 1: Computation of upside and downside probability:

Expected share price = $PV \times e^{rt}$

Expected share price = $420 \times e^{(0.08)(0.25)} = 420 \times e^{0.02} = 420 \times 1.0202 = \text{Rs. } 428.48$

Let us assume p to be the probability of price reaching Rs.400 and 1-p to be the probability of price reaching Rs.500

Price	Probability	Product
400	P	400P
500	1-P	500 - 500P
Total		400P+500-500P = 428.48

$$400P + 500 - 500P = 428.48; -100P = -71.52; P = \frac{71.52}{100} = 0.7152$$

- Hence 0.7152 is the probability of price reaching Rs.400 and 0.2848 (1 - 0.7152) is the probability of price reaching Rs.500

WN 2: Valuation of call option:

Price	IV	Probability	Product
400	0	0.7152	0
500	50	0.2848	14.24
Value of call at end of M3			14.24

- Value of call on maturity date = Rs.14.24
- Today's value of call option = $(14.24/1.0202) = \text{Rs. } 13.96$

37. Calculation of probability of price rise (May 2012)

Sumana wanted to buy shares of EIL which has a range of Rs.411 to Rs.592 a month later. The present price per share is Rs.421. Her broker informs her that the price of this share can sore up to Rs. 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 Rs. 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 Rs. 592 so that buying of a one month CALL of EIL at the execution price of Rs. 522 is justified. Advice her. Take the one-month risk free interest to be 3.60% and $e^{0.036} = 1.037$

Answer:

Computation of upside and downside probability:

Expected share price = $PV \times e^{rt}$

Expected share price = $421 \times e^{(0.036)(1)} = 420 \times e^{0.036} = 420 \times 1.037 = \text{Rs. } 436.58$

Note: It is assumed that risk-free interest rate of 3.60% is the per month

Let us assume p to be the probability of price reaching Rs.411 and 1-p to be the probability of price reaching Rs.592

Price	Probability	Product
411	P	411P
592	1-P	592 - 592P
Total		411P+592-592P = 436.58

$$411P + 592 - 592P = 436.58; -181P = -155.42; P = \frac{155.42}{181} = 0.8587$$

- Hence 0.8587 is the probability of price reaching Rs.411 and 0.1413 (1 - 0.8587) is the probability of price reaching Rs.592

- Probability of price reaching Rs.592 = 14.13%

38. Binomial model (Nov 2019 RTP)

Consider a two year American call option with a strike price of Rs. 50 on a stock the current price of which is also Rs. 50. Assume that there are two time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk free interest rate is 6%. Using binominal option model, calculate the probability of price moving up and down. Also draw a two step binomial tree showing prices and payoffs at each node.

Answer:

WN 1: Computation of upside and downside probability:

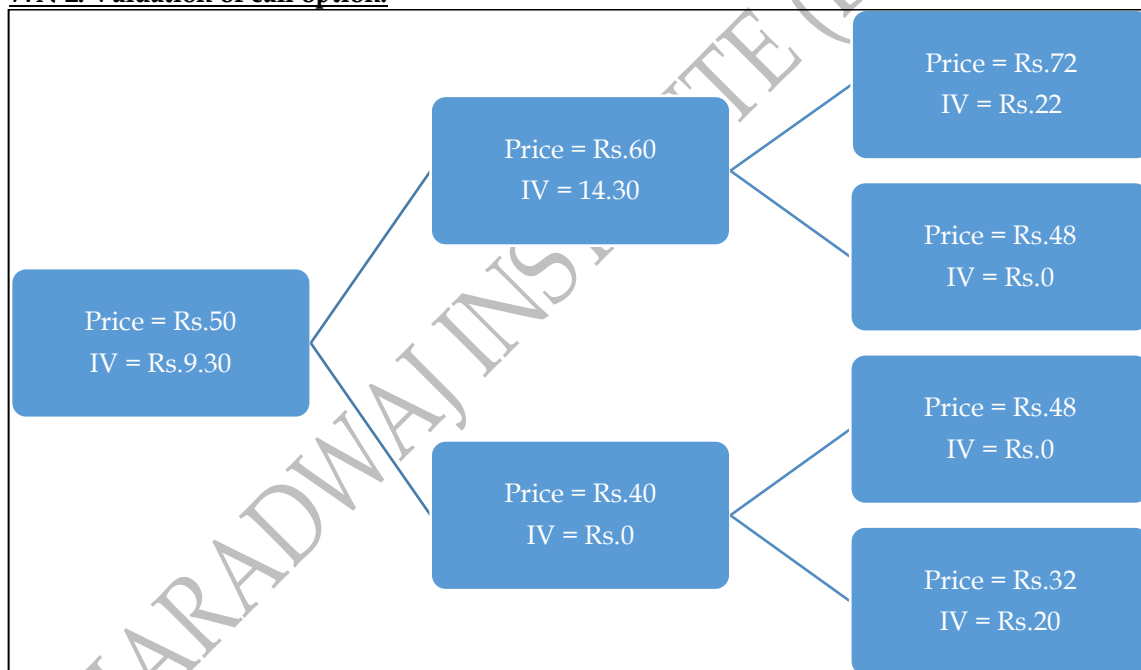
- Let us assume P to be the probability of price increase by 20% and 1-P to be the probability of price fall by 20%
- Risk-free rate of interest is 6% per annum
- Expected price at end of year = $50 + 6\% = \text{Rs. } 53$

Price	Probability	Product
60	P	60P
40	1-P	40-40P
Total		60P+40-40P=53

$$60P + 40 - 40P = 53; 20P = 13; P = \frac{13}{20} = 0.65$$

- Hence probability of price raise is 65% and probability of price fall is 35%

WN 2: Valuation of call option:



Note:

- Valuation of Rs.60 in year 1 will be higher of the following:
 - Immediate exercise: GPO = Rs.10
 - **Later exercise: $(22 \times 0.65) + (0 \times 0.35) = \text{Rs. } 14.30$**
- Valuation of Rs.40 in year 1 will be higher of the following:
 - Immediate exercise: GPO = 0
 - Later exercise: $(0 \times 0.65) + (0 \times 0.35) = \text{Rs. } 0$
- Valuation of Rs.50 in year 0 will be higher of the following:
 - Immediate exercise: GPO = 0
 - Later exercise: $(14.30 \times 0.65) + (0 \times 0.35) = \text{Rs. } 9.30$

Final value of Call:

- The above-computed value does not consider time value of money while rolling backwards and doing the valuation of option. We need to give effect of time value of money to find the value of option in Month 0

$$\text{Value of call option} = \frac{9.30}{(1.06)(1.06)} = \text{Rs. 8.28}$$

39. Valuation of option (May 2013)

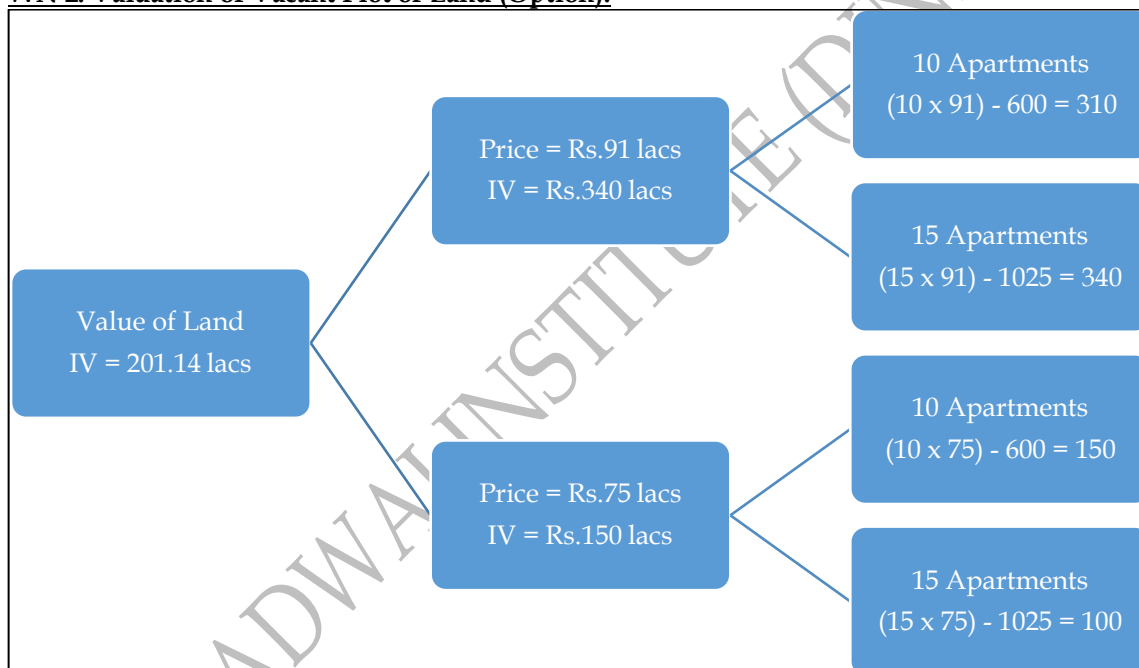
Ramesh owns a plot of land on which he intends to construct apartment units for sale. No. of apartment units to be constructed may be either 10 or 15. Total construction costs for these alternatives are estimated to be Rs. 600 lakhs or Rs. 1025 lakhs respectively. Current market price for each apartment unit is Rs. 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 Rs. 91 lakhs, if it is sluggish, the sale price for the same will be Rs. 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 Rs. 7 lakhs and the risk free interest rate is 10% p.a. Assume that the construction cost will remain unchanged.

Answer:

WN 1: Analysis of the question:

- Vacant plot of land is like an American option. The person can decide to start the construction immediately (exercising of option on day 0) or wait for a year and do construction (exercising of option at end of year 1)

WN 2: Valuation of Vacant Plot of Land (Option):



Note:

- Price of the Apartment at end of year can be either Rs.91 lacs or Rs.75 lacs. The company can decide on construction of 10 or 15 apartments depending on which is more beneficial
- Price of Rs.91 lacs:** The company can either earn Rs.310 lacs from 10 apartments or earn Rs.340 lacs from 15 apartments. The company will choose to construct 15 apartments and hence the intrinsic value will be Rs.340 lacs when price is Rs.91 lacs
- Price of Rs.75 lacs:** The company can either earn Rs.150 lacs from 10 apartments or earn Rs.100 lacs from 15 apartments. The company will choose to construct 10 apartments and hence the intrinsic value will be Rs.150 lacs when price is Rs.75 lacs
- Value of land on day 0 will be higher of immediate construction or later construction
 - Immediate construction:** The company can either earn Rs.200 lacs from 10 apartments (10 x 80 lacs - 600 lacs) or earn Rs.175 lacs from 15 apartments (15 x 80 lacs - 1025 lacs). The company will choose to construct 10 apartments and hence the intrinsic value will be Rs.200 lacs if company opts to do immediate construction
 - Later construction:** Weighted average of Rs.340 lacs and Rs.150 lacs with probability being the assigned weights. Value of later construction = (340 lacs x 0.375) + (150 lacs x 0.625) =

Rs.221.25. We need to discount this value to day 0 to compare the same with immediate construction value. **Present value of later construction = $(221.25/1.10) = \text{Rs.}201.14$ lacs**

- The company should wait for construction and should exercise option at end of year 1 (construction at end of year 1). The value of vacant plot of land is Rs.201.14 lacs

Computation of upside and downside probability:

- Let us assume P to be the probability of price increasing to Rs.91 lacs and 1-P to be the probability of price falling to Rs.75 lacs
- Risk-free rate of interest is 10% per annum
- Expected price at end of year = $(80 + 10\%) - 7 = \text{Rs.} 81$ lacs
- Current price of Apartment is Rs.80 lacs. We need 10 percent return from Apartment and the same would be Rs.8 lacs. We earn rental income of Rs.7 lacs and hence capital appreciation is expected to be Rs.1 lac. Hence expected price of Apartment at end of year 1 is Rs.81 lacs

Price	Probability	Product
91	P	91P
75	1-P	75-75P
Total		91P+75-75P=81

$$91P + 75 - 75P = 81; 16P = 6; P = \frac{6}{16} = 0.375$$

- Hence probability of price raise is 37.50% and probability of price fall is 62.50%

40. Valuation of option (May 2016 RTP)

IPL already in production of Fertilizer is considering a proposal of building a new plant to produce pesticides. Suppose, the PV of proposal is Rs. 100 crore without the abandonment option. However, if market conditions for pesticide turns out to be favourable the PV of proposal shall increase by 30%. On the other hand market conditions remain sluggish the PV of the proposal shall be reduced by 40%. In case company is not interested in continuation of the project it can be disposed off for Rs. 80 crore. If the risk free rate of interest is 8% then what will be value of abandonment option

Answer:

WN 1: Analysis of option:

- The PV of proposal is Rs.100 crores. This would be like the current market price of the share
- Share price can increase by 30% to Rs.130 crores or fall by 40% to Rs.60 crores. Question has not mentioned information on the time period over which the change is to happen. It is assumed that increase of 30%/decrease of 40% would happen over a period of one year
- The company can dispose the project for Rs.80 crores if the market conditions are not favourable. This is similar to put option with exercise price of Rs.80 crores

WN 2: Computation of upside and downside probability:

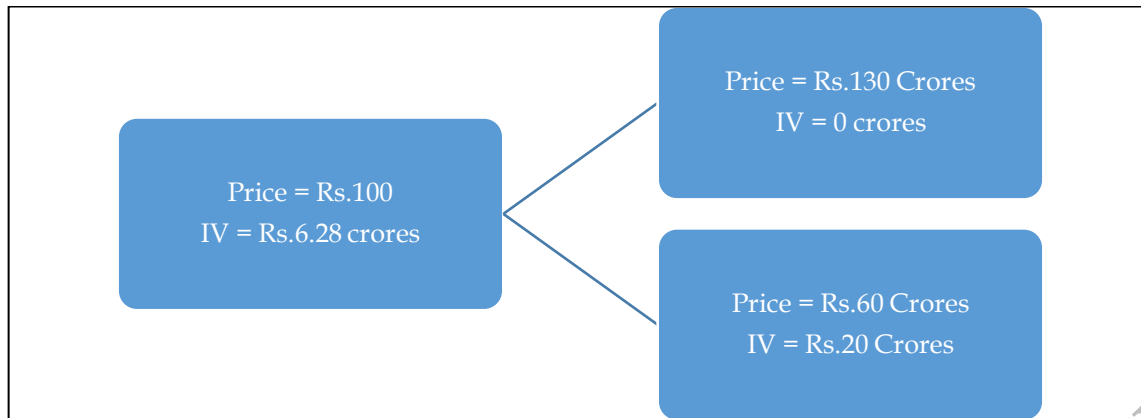
- Let us assume P to be the probability of price increasing to Rs.130 crores and 1-P to be the probability of price falling to Rs.60 crores
- Risk-free rate of interest is 8% per annum
- Expected price at end of year = $(100 + 8\%) = \text{Rs.} 108$ crores

Price	Probability	Product
130	P	130P
60	1-P	60-60P
Total		130P+60-60P=108

$$130P + 60 - 60P = 108; 70P = 48; P = \frac{48}{70} = 0.686$$

- Hence probability of price raise is 68.60% and probability of price fall is 31.40%

WN 3: Valuation of abandonment option (Put Option):

**Note:**

- Value of option in year 1 is as per GPO of Put option
- Value of option today = $(0 \times 0.686) + (20 \times 0.314) = \text{Rs.6.28 Crores}$

The above analysis does not consider the time value of money and the final value of abandonment option is computed below:

$$\text{Value of abandonment option} = \frac{6.28 \text{ crores}}{1.08} = \text{Rs. 5.81 crores}$$

41. Black-scholes model (May 2020 RTP)

From the following details find the value of call option

Current share price	80
Option exercise price	75
Risk free interest rate	12%
Maturity period	6 months
Standard deviation	0.40

Given:

Number of SD from mean	Area of the left or right (one tail)
0.25	0.4013
0.30	0.3821
0.55	0.2912
0.60	0.2743

$$e^{0.06} = 1.062$$

$$\ln 1.0667 = 0.0646$$

Answer:

$$\text{Value of call option} = (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$$

Where:

$$d_1 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r + 0.5\sigma^2)t \right)}{\sigma\sqrt{t}}$$

$$d_2 = \frac{\left(\text{Naturallog} \left(\frac{S_0}{E} \right) + (r - 0.5\sigma^2)t \right)}{\sigma\sqrt{t}} \quad (\text{or}) \quad d_1 - \sigma\sqrt{t}$$

Term	Calculation	Amount
S_0 (CMP)	Given	80
Exercise Price	Given	75
$\frac{S_0}{E}$	$\frac{80}{75}$	1.0667
$\text{Naturallog} \left(\frac{S_0}{E} \right)$	Given	0.0646
$r + 0.5\sigma^2$	$0.12 + 0.5 \times 0.40 \times 0.40$	0.20
$(r + 0.5\sigma^2)t$	0.20×0.5	0.10
$\sigma\sqrt{t}$	$0.40\sqrt{0.5}$	0.2828
d_1	$\frac{0.0646 + 0.10}{0.2828}$	0.5820

$r - 0.5\sigma^2$	$0.12 - 0.5 \times 0.40 \times 0.40$	0.04
$(r - 0.5\sigma^2)t$	0.04×0.5	0.02
d_2	$\frac{0.0646 + 0.02}{0.2828}$ (or) $0.5820 - 0.2828$	0.2992
$N(d_1)$	Note 1	0.7196
$N(d_2)$	Note 2	0.6176
PV_{EP}	$\frac{75}{e^{(0.12)(0.5)}} = \frac{70}{e^{0.06}} = \frac{70}{1.062}$	70.62
Value of call	$= (S_0 \times N(d_1)) - (PV_{EP} \times N(d_2))$ $= (80 \times 0.7196) - (70.62 \times 0.6176)$	13.95

Note 1: Computation of $N(d_1)$:

Z value	Given Prob	Residual prob (1 - Given Prob)
0.55	0.2912	0.7088
0.60	0.2743	0.7257

Note:

- Probability for positive Z values will be higher than 0.5. However, the given probability is less than 0.5 and this is because of single tail values
- Actual probability = 1 - Given Probability

$$\text{Prob of 0.5820} = \text{Prob of 0.55} + \left((\text{Prob of 0.60} - \text{Prob of 0.55}) \times \frac{0.5820 - 0.55}{0.60 - 0.55} \right)$$

$$\text{Prob of 0.5820} = 0.7088 + \left((0.7257 - 0.7088) \times \frac{0.0320}{0.0500} \right) = 0.7196$$

Note 2: Computation of $N(d_2)$:

Z value	Given Prob	Residual prob (1 - Given Prob)
0.25	0.4013	0.5987
0.30	0.3821	0.6179

$$\text{Prob of 0.2991} = \text{Prob of 0.25} + \left((\text{Prob of 0.30} - \text{Prob of 0.25}) \times \frac{0.2991 - 0.2500}{0.3000 - 0.2500} \right)$$

$$\text{Prob of 0.2991} = 0.5987 + \left((0.6179 - 0.5987) \times \frac{0.0491}{0.0500} \right) = 0.6176$$

42. Miscellaneous - Expected value (November 2012)

You as an investor had purchased a 4 month call option on the equity shares of X Ltd. of Rs.10, of which the current market price is Rs. 132 and the exercise price Rs. 150. You expect the price to range between Rs. 120 to Rs. 190. The expected share price of X Ltd. and related probability is given below:

Expected Price	120	140	160	180	190
Probability	0.05	0.20	0.50	0.10	0.15

Compute the following:

- ❖ Expected Share price at the end of 4 months.
- ❖ Value of Call Option at the end of 4 months, if the exercise price prevails.
- ❖ In case the option is held to its maturity, what will be the expected value of the call option?

Answer:**Computation of expected share price and value of call option:**

Expected Price	Probability	Product	Intrinsic value	Product
120	0.05	6.00	0.00	0.00
140	0.20	28.00	0.00	0.00
160	0.50	80.00	10.00	5.00
180	0.10	18.00	30.00	3.00
190	0.15	28.50	40.00	6.00
Expected value		160.50		14.00

- Expected share price at end of month 4 = Rs.160.50
- Expected value of call option at end of month 4 = Rs.14.00

- If the exercise price prevails on the maturity date then the share price will be equal to exercise price. If both are same, option will lapse and value of call option will be zero

43. Option valuation (November 2015)

Mr. Dayal is interested in purchasing equity shares of ABC Ltd. which are currently selling at Rs. 600 each. He expects that price of share may go upto Rs. 780 or may go down to Rs. 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of ABC Ltd. can be exercised at the end of three months with a strike price of Rs. 630.

- ❖ What combination of share and option should Mr. Dayal select if he wants a perfect hedge?
- ❖ What should be the value of option today (the risk free rate is 10% p.a.)?
- ❖ What is the expected rate of return on the option?

Answer:

WN 1: Valuation of option:

- Call option can be valued either using risk neutral model or portfolio replication model
- Any option valued under risk neutral model will give expected rate of return as equal to risk-free rate. Hence third part of the question will be redundant if option is valued as per portfolio replication model
- Hence, we are going ahead with valuation of option as per portfolio replication model

Step 1: Computation of intrinsic values at two judgement prices:

Judgement price	Intrinsic value
780	150
480	0

Step 2: Computation of no of calls to be bought:

$$\text{No of calls} = \frac{\text{Spread in stock price}}{\text{Spread in Intrinsic value}} = \frac{780 - 480}{150 - 0} = 2 \text{ calls}$$

Step 3: Computation of risk-free investment:

Risk – free investment = PV of $(JP_1 - IV \text{ at } JP_1)$

$$\text{Risk – free investment} = \text{PV of } (480 - 0) = \text{PV of } 480 = \frac{480}{(1 + 2.5\%)} = \frac{480}{1.025} = \text{Rs. 468.29}$$

Step 4: Valuation of call option:

$$S_0 = (C_0 \times \text{No of calls}) + \text{Risk – free investment}$$

$$600 = (C_0 \times 2) + 468.29; 2C_0 = 131.71$$

Value of call = Rs. 65.86

WN 2: Combination of share and option should Mr. Dayal select if he wants a perfect hedge

- No of calls to be bought as per the above computation is 2 calls
- Hence combination of 2 calls and 1 share will lead to perfect hedge. Alternatively, we can say that we should purchase 0.50 shares for every 1 call option

WN 3: Expected return on option:

- Expected value of call option at end of M3 = $(150 \times 0.40) + (0 \times 0.60) = \text{Rs. 90}$

$$\text{Return on call option} = \frac{90 - 65.86}{65.86} \times 100 = 36.65\% \text{ per 3 months (or) } 146.60\% \text{ p.a.}$$

44. Option valuation (May 2017 RTP)

Ram chemical is in production line of chemicals and considering a proposal of building new plant to produce pesticides. The Present value (PV) of new proposal is Rs.150 crores. Since this is a new product market, survey indicates following variation in present value (PV):

Condition favourable in first year	PV will increase 30% from original estimate
Condition sluggish in first year	PV will decrease by 40% from original figures

In addition Rama chemical has a option to abandon the project at the end of year and dispose it at Rs.100 Crores. If risk free rate of interest is 8%, what will be the present value of put option?

Answer:

WN 1: Computation of probability:

Let us assume p to be the probability of PV touching 195 crores and 1-p to be the probability of price touching 90 crores.

PV	Probability	Product
195	P	195P
90	1-P	90-90P
Expected PV		162

- ❖ Expected PV at end of the year will be Rs.162 Crores [150 crores + 8%]
- ❖ $195P + 90 - 90P = 162$
- ❖ $105P = 72$
- ❖ $P = 72/105 = 0.6857$
- ❖ Probability of PV touching Rs.195 Crores is 0.6857 and probability of PV touching 90 Crores is 0.3143

WN 2: Computation of value of put option:

PV	EP	GPO	Probability	Product [GPO x Prob]
195	100	0	0.6857	0
90	100	10	0.3143	3.143
Future value of Put				3.143
Present value of Put = $\frac{3.143}{1.08}$				2.91 Crores

45. Option valuation (November 2017)

A call option on gold with exercise price of Rs.26,000 per ten gram and three months to expire is being traded at a premium of Rs.1,010 per ten gram. It is expected that in three months time the spot price might change to Rs.27,300 or Rs.24,700 per ten gram. At present this option is at-the-money and the rate of interest with simple compounding is 12% per annum. Is the current premium for the option justified? Evaluate the option and comments.

Answer:

WN 1: Computation of probability:

Let us assume p to be the probability of price touching Rs.27,300 and 1-p to be the probability of price touching Rs.24,700

PV	Probability	Product
27,300	P	27,300P
24,700	1-P	24,700 - 24,700P
Expected Price		26,780

- ❖ The exercise price of Gold is Rs.26,000. The option is at the money and hence exercise price is equal to current market price.
- ❖ Interest rate is 12% per annum and hence the same for three months will be 3%
- ❖ Expected price at end of 3 months = Rs.26,780 (26,000 + 3%)
- ❖ $27,300P - 24,700 - 24,700P = 26,780$
- ❖ $2,600P = 2,080$
- ❖ $P = 2,080/2,600 = 0.80$
- ❖ Probability of price touching Rs.27,300 is 0.80 and probability of price touching 24,700 is 0.20

WN 2: Computation of value of call option:

PV	EP	GPO	Probability	Product [GPO x Prob]
27,300	26,000	1,300	0.80	1,040
24,700	26,000	0	0.20	0
Future value of Call				1,040
Present value of Put = $\frac{1,040}{1.03}$				1,010

Hence the current premium of Rs.1,010 is justified as fair option price is Rs.1,010

Chapter 9 – Foreign Exchange Exposure and Risk Management**Theory to Solve Problems****Why exchange rate is required?**

1. Export	Receive dollars, convert to INR	Hence exchange rate is important
2. Import	Buy dollars and pay dollars	Hence exchange rate is important
3. Global finance	Raise money globally, receive dollars and convert to INR	Hence exchange rate is important
4. Global investment	Buy dollars and pay investment	Hence exchange rate is important

Nature of quotation:

- ❖ Exchange rate is that rate at which one currency is exchanged (bought & sold) for another.
- ❖ **Example:** Rs.12 per apple is the exchange rate between apple and rupees. Rs. is the price and Apple is the product.
- ❖ Rs.65 per dollar is the exchange rate between dollar and rupees. Here Rs. is the price and dollar is the product

Direct quote Vs indirect quote:

- ❖ Direct quote expresses the exchange rate as home currency per unit of foreign currency. Rs.65 per dollar is the direct quote in India.
- ❖ Indirect quote expresses the exchange rate as foreign currency per unit of home currency. Rs.65/dollar is the indirect quote in USA.
- ❖ In short an exchange rate which is a direct quote in one country is an indirect quote in another country.

Conversion of direct quote into indirect quote:

- ❖ A direct quote and an indirect quote are an inverse of each other.
- ❖ Indirect quote = $1/\text{direct quote}$

Price and Product:

- ❖ In a direct quote home currency is the price and foreign currency is the product
- ❖ In an indirect quote foreign currency is the price and home currency is the product
- ❖ In either case the first currency is the price and the second currency is the product
- ❖ To decide price & product it would be good to view every quote as a direct quote. This is because what is indirect for someone is direct for someone else.

American Term Versus European Terms:

- ❖ An exchange rate which is in the direct mode in USA is said to be in American terms. Example: USD/GBP, USD/INR
- ❖ An exchange rate which is in the indirect mode in USA is said to be in European terms. Example: GBP/USD, INR/USD
- ❖ Internationally all exchange rates are expressed with reference to USD
- ❖ All international quotes except Pound are expressed in European terms [Indirect mode in USA]

Concept: Bid, Ask, Spread and middle rates

Term	Meaning
1. Bid rate	The rate at which the bank buys the product
2. Ask rate	The rate at which the bank sells the product
3. Spread rate	The difference between bid and ask rate
4. Middle rate	Simple average of bid and ask rate. This is used primarily for statistical purpose
5. Spread %	Spread is calculated as a percentage of offer rate when the same is expressed in percentage

Two way quote:

- In a two way quote Bid precedes Ask. Rs.62.50-62.80 per Dollar means that bank is buying dollar at 62.50 and the bank is selling dollar at 62.80.

Quote in decimals:

- The numbers after the decimal are referred to as PIPS.
- If the numbers before the decimal in bid and ask is identical then while quoting the ASK portion of the two way quote only the PIP is quoted. Example: Rs.67.80 – 67.90 per USD is quoted as Rs.67.80-90.
- If the numbers in the PIP are same those numbers are not quoted in the two way quote in case of ASK. Example Rs.12.315-70 / rand mean 12.315-12.370.

Cross rates:

- ❖ Cross rate is the rate which does not contain USD in it. Example: Rs./YEN, Rs/GBP etc/
- ❖ Straight rate is the rate at which has USD in it. Example: Rs/USD, USD/GBP.

Cross multiplication:

- ❖ Cross multiplication is the procedure by which when two exchange rates are given a third exchange rate is ascertained.

Three rules of cross multiplication

$\text{Bid} \left(\frac{A}{C} \right) = \text{Bid} \left(\frac{A}{B} \right) \times \text{Bid} \left(\frac{B}{C} \right)$
$\text{Ask} \left(\frac{A}{C} \right) = \text{Ask} \left(\frac{A}{B} \right) \times \text{Ask} \left(\frac{B}{C} \right)$
$\text{Bid} \left(\frac{A}{B} \right) = \frac{1}{\text{Ask} \left(\frac{B}{A} \right)}$
$\text{Ask} \left(\frac{A}{B} \right) = \frac{1}{\text{Bid} \left(\frac{B}{A} \right)}$

Forward rate:

- ❖ Forward rate is the rate that is contracted today for the exchange of currencies at a specified future date
- ❖ In contrast spot rate is the rate at which the currencies are exchanged today
- ❖ The forward rate can be either expressed either as
 - Outright forward rate
 - Swap rate
- ❖ The forward differential is called as the swap rate. Example: Spot rate: Rs.62/USD; Forward Rs.64/USD; Swap = Rs2/USD

Spot rate:

- ❖ Like spot rate which has both bid & ask rate, Forward too has a bid and ask rate, consequently there will be a swap bid and swap ask.

	Spot	Forward	Swap
BID	P	R	R-P
ASK	Q	S	S-Q
Spread	Q-P	S-R	

Rules:

- ❖ In a direct quote if forward rate is greater than the spot rate then the foreign currency is appreciating (at a premium). For example if spot rate is 104 YEN/USD and forward is 106 YEN/USD then USD is appreciating.
- ❖ In a direct quote if forward rate is less than spot rate then the foreign currency is depreciating (at a discount). If spot is 110 YEN/USD and forward is 105 YEN/USD then USD is depreciating.
- ❖ If one currency is appreciating with reference to the other then the other is depreciating with reference to the first currency.
- ❖ If forward bid in points is less than forward ask in points, then forward rate of foreign currency is at a premium.

- ❖ If forward bid in points is more than forward ask in points, then forward rate of foreign currency is at a discount
- ❖ Swap points can be converted into an outright rate by
 - If **ascending order**, Add the swap points to the spot rate
 - If **descending order**, deduct the swap points from the spot rate
- ❖ If the swap points for the desired forward period are not given then the same is to be computed using interpolation method. For example if the swap points for 1, 2 and 3 months are given, then the swap points for 2.5 months can be computed by using interpolation technique on 2 and 3 months swap points

Calculation of % of appreciation/depreciation:

The price of a bottle of coke is Rs.10 today and is expected to be Rs.11, 6 months from now. Compute appreciation/depreciation %?

In the case of a direct quote

Particulars	Formula
For the Product Currency	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$
For the Price Currency	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$

Interest rate parity theory:

- ❖ High interest rates in a country will be offset by depreciation in a currency of that country.
 - Example: If interest rate in India is 5 percent and that in USA is 2 percent then the rupee is expected to depreciate against the dollar.
 - Example: If interest rate in India is 6 percent and that in England is 9 percent then the dollar will depreciate against the rupee

Formula	$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
R_h = Risk free rate of home country R_f = Risk free rate of foreign country F_1 = Forward rate e_0 = Spot rate	

- ❖ If the above equilibrium does not hold good, arbitrage opportunities will open up as a result of which over a period of time the above equilibrium will start holding hold.
- ❖ The interest rates must be expressed for the same period as the forward period.
- ❖ To arrive at the forward rate:
 - Add the appreciation percent of the product to the spot rate
 - Deduct the depreciation percent of the produce from the spot rate

Arbitrage:

- ❖ Arbitrage involves play in exchange rate differentials. This happens when a product is quoted at two different prices in two different markets.
 - Space arbitrage means buying and selling at the same time in two different markets (bank A and bank B)
 - Time arbitrage means entering into contract today to buy & sell in two different period either in the same bank or different bank

Steps in case of space arbitrage:

- ❖ Step 1: Express the exchange rate in different banks in same mode (currency A/currency B)
- ❖ Step 2:
 - Buy from the bank which has the lower ask rate
 - Sell to bank which has the higher bid rate
- ❖ Step 3: If the result of step 2 is gain, arbitrage exist.

Steps in case of time arbitrage:

- ❖ Time arbitrage means buying in one market (spot or forward) and selling in another market (spot or forward)

- ❖ Step 1: Compute fair home interest rate using IRPT formula. Home in this would be the first currency in the pair of currencies.
- ❖ Step 2: Identify whether arbitrage exists and record the flow of money as per the following details:

❖ Actual $R_h < \text{Fair } R_h$	❖ From home to foreign
❖ Actual $R_h = \text{Fair } R_h$	❖ No arbitrage
❖ Actual $R_h > \text{Fair } R_h$	❖ From Foreign to Home

- ❖ Show how arbitrage gain works
 - Borrow in the currency of the country from which money flow in
 - Convert @ spot rate into the other currency
 - Invest the converted amount
 - Take forward cover
 - Realize the investment along with the interest thereon
 - Reconvert @ the forward rate
 - Repay the principal along with the interest thereon
 - Compute arbitrage gain

Time arbitrage (Bid rate not equal to ask rate)

- ❖ In this case instead of using a detailed formula, we will first check whether there is arbitrage in borrowing from one country and then check whether there is arbitrage in borrowing from another country.
- ❖ While converting we must be clear about selecting the bid or ask rate as the case may be
- ❖ While reconvert we must appropriately select the bid or ask rate as the case may be and this should be kept in mind while taking the forward cover also.

Purchasing power parity theory:

- ❖ High inflation rate in a country is offset by depreciation in a currency of that country.
 - Example: If the price of bike in India is Rs.50,000 and the same in USA is USD 1000. Then the exchange rate should be Rs.50/USD. If the exchange rate is not Rs.50, then arbitrage opportunities will open up.
 - If the inflation for the bike is 5 percent in India and 2 percent in USA, the price one year later in India will be Rs.52500 and USD 1020 respectively. The exchange rate will therefore be Rs.51.47 USD.
 - The rupee has depreciated against the dollar because the inflation rate in India is higher than the rate in USA.

Formula	$\frac{1 + I_h}{1 + I_f} = \frac{F_1}{e_0}$
I_h = Inflation rate of home country I_f = Inflation rate of foreign country F_1 = Forward rate e_0 = Spot rate	

Risk Management:

Technique No.1 - Currency Invoicing:

- ❖ The exchange rate risk is eliminated if:
 - In case of exports the invoicing is in home currency
 - In case of imports invoicing in home currency
- ❖ Currency invoicing does not eliminate the exchange rate risk in a transaction. It only transfers the risk to the counterparty
- ❖ If the counterparty is unwilling to accept the invoicing strategy an insistence on home currency invoicing can lead to loss of business

Principle: Which invoicing to do

- ❖ The decision on whether to do home currency invoicing or foreign currency invoicing depends on whether the foreign currency is expected to appreciate or depreciate
- ❖ The decision on invoicing will depend on which alternative will lead to higher inflow of INR in case of exports and will lead to lower INR outflow in case of imports
- ❖ The above points are relevant only if the company wants to take advantage of exchange rate risk

- ❖ If the company wants to avoid exchange rate risk then it should invoice in home currency

Technique No.2 - Leading & Lagging

- ❖ The term lead means "NOW" and the term lag means "LATER"
- ❖ Leading a receipt means receiving payment now and lagging a receipt means receiving payment later
- ❖ Leading a payment means making payment now and lagging a payment means making payment later
- ❖ The company should choose an option which leads to higher inflow of INR in case of receivables and lower outflow of INR in case of payables

Technique No.3 - Netting:

- ❖ Netting refers to the process by which dues receivable and dues payable between two parties are set off against each other
- ❖ This would require
 - The receivable and payable are converted to the same currency if they are not in same currency
 - They mature on the same date

Types of Netting:

- ❖ Bilateral netting - Involves two parties only
- ❖ Multilateral netting - Involves more than 2 parties

Note: Multilateral netting is likely to be feasible only amongst group companies because a company might not like the other company to know at to which company it deals with

Technique 4 - Forward contract:

When to take forward contract:

- The decision is dependent on
 - Whether you are an importer or an exporter
 - Whether the forward rate will be greater than the expected spot rate on the date of maturity of the forward cover
- Forward cover will be taken if
 - In the case of importer it results in payment of Lower INR
 - In the case of exporter it results in receipt of higher INR

Situation	Exporter	Importer
Forward rate > expected spot rate	Take FC	Exposed
Forward rate < expected spot rate	Exposed	Take FC

Cancellation of forward contract:

- A forward contract can be cancelled if a customer so desires
- This would be taking a position opposite to that of the original position
- The cancellation can be done either on due date or before the due date

Step 1: Identify original position

- Exporter - Sell forward
- Importer - Buy forward

Step 2: Take opposite position

- Applicable rate: Spot if you come on due date and forward if you come early
- No of months forward: No of months by which we are early

Step 3: Amount of settlement - Compare the new rate and the old rate and arrive at the amount of settlement.

Honour of forward contract:

- ❖ A forward contract can be honoured either on due date or early
- ❖ If honour takes place on due date, no further transaction is required except the exchange of currencies at agreed rates

- ❖ If honour happens early following steps are involved
 - A. Identify original position – Forward
 - B. Identify opposite position – Forward
 - C. Take new position – Spot
 - D. Compute effective rate (A+B+C)
 - E. Loss/gain = Original rate – effective rate

Roll over of a forward contract:

- Roll over of a forward contract can take place either
 - Early or
 - On due date
- Roll over involves
 - Identifying the original position
 - Entering into opposite position
 - Entering into new position

Extension of contract when customer doesn't appear on due date:

Cancellation Rate	Spot rate + margin on the date on which customer appears for cancellation
Amount payable by the customer	Difference between customer's original customer rate and cancellation rate as calculated above
Swap loss	It is an amount paid by bank due to cancellation by customer to another bank in the interbank channel. Bank generally does a swap by taking 1 transaction in spot and taking cover by a reverse position in the immediate forward rate. All this is done on due date
Interest on outlay of funds	Bank will charge interest to the customer on the cancellation charges paid by bank by cancelling contract on due date. It is calculated on banks original covered rate and the reverse rate on the maturity date. Interest is calculated for the period of disappearance of the customer from the due date
Total cost to customer	Cancellation charges + Swap loss + Interest on outlay of funds

Money market hedge:

- Money market hedge involves creating a matching dollar liability for a dollar asset for an exporter and vice versa for an importer.

Steps in the case of exporter:

- Step 1: Identify that a foreign currency receivable exists
- Step 2: Borrow foreign currency such that the amount borrowed along with interest thereon mature in value to the foreign currency asset of Step 1
- Step 3: Convert the foreign currency borrowed in step 2 into home currency
- Step 4: Invest the home currency for a period maturing on the date when the foreign currency receivable of step 1 matures
- Step 5: Realize on the maturity value of the home currency investment of step 4 along with investment thereon.
- Step 6: Collect the foreign currency receivable of step 1 and repay the foreign currency liability and interest thereon

Steps in the case of importer:

- Step 1: Identify that a foreign currency liability exists
- Step 2: Identify the amount to be invested to create a foreign currency asset
- Step 3: Borrow money in Home currency (Step 2 * conversion rate)
- Step 4: Convert the value of step 3 to foreign currency
- Step 5: Invest the foreign currency of step 4
- Step 6: Realize the investment along with interest thereon
- Step 7: Settle foreign currency liability of step 2 with realization of step 6
- Step 8: Repay the home currency borrowing along with interest thereon

Miscellaneous areas:**Nostro, Vostro and Loro account:**

Type of account	Meaning	Example
Nostro account	A bank's foreign currency account maintained by the bank in a foreign country and in the home currency of that country	ICICI Bank having a \$ account with CITI Bank USA
Vostro account	Local currency account maintained by a foreign bank/branch	CITI Bank USA having an INR account with ICICI Bank, India
Loro account	Loro account is an account wherein a bank remits funds in foreign currency to another bank for credit to an account of a third bank	

Exchange position versus cash position:

- ❖ Exchange position refers to the extent of overbought/oversold position of a foreign currency by a bank
- ❖ Cash position refers to the actual foreign currency balance maintained in a Nostro account by a bank

Transaction affecting Exchange position and cash position:

Transaction	Exchange position	Cash position
Immediate cash flow (Telegraphic transfer)	Yes	Yes
Demand draft	Yes – Sale Transaction	No. Will be impacted only when the draft is realized
Bills purchase	Yes – Buy Transaction	No. Will be impacted only when the bill is realized
Forward purchase/sale	Yes	No. Will be impacted only on delivery

Note:

- ❖ Exchange position records all purchase and sale of foreign currency irrespective of cash flow.
- ❖ Cash position is impacted only when the cash flow happens for a transaction

Currency futures:

- ❖ A futures contract gives the right as well as an obligation to buy/sell a currency at a specified rate on the future date

Futures mechanism:

- ❖ **Day 1:** Enter into a futures contract to buy/sell a currency at a specified rate. The exchange rate will be different in the spot market and futures market
- ❖ **Maturity date:**
 - Realize/pay the foreign currency amount using the spot rate in the cash market
 - Calculate gain/loss on futures position = (Realization using originally contracted rate – Payment using today's futures rate)

Note: The above gain/loss has been calculated on the assumption that company sells the foreign currency initially.

Practical Problems
Overview: • Part I – Basics of International Finance • Part II – Premium/discount and appreciation/depreciation • Part III – IRPT and PPT • Part IV – Arbitrage • Part V – Currency Invoicing

- Part VI – Leading and Lagging
- Part VII – Netting
- Part VIII – Forward Contract
- Part IX – Money Market Hedge
- Part X – Exchange Position and Cash Position
- Part XI – Currency Futures and Options
- Part XII – Currency Swaps
- Part XIII – Multiple Forex Hedging Strategies

Part I – Basics of International Finance

1. Cross rate (May 2017 RTP, Nov 2018 RTP)

On January 28, 2012 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 affect the remittance only on February 4, 2012. The interbank market rates were as follows:

	January, 28	February 4
Bombay US\$1	Rs. 45.85/45.90	Rs.45.91/45.97
London Pound 1	\$1.7840/1.7850	\$1.7765/1.7775
Pound 1 =	SGD 3.1575/3.1590	SGD 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?
- ❖ Find out how much INR can the company get by selling 1,50,000 SGD on January 28, 2012

Answer:

Part 1 – Computation of gain/loss due to delay in remittance by Bank:

Computation of likely outflow if payment was done on January 28:

- Known component = SGD 25,00,000 (SGD 25,00,000 is called as known component as we know that we have to buy SGD 25,00,000 and we need to use INR to buy the same)
- Unknown component = ? INR (we are planning to sell INR but how many INR needed is not known and hence INR is unknown component)

Unknown component = Known component x ?

$$\text{INR} = \text{SGD} \times \left(\frac{\text{INR}}{\text{SGD}} \right)$$

Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (SGD). Customer is going to buy SGD and bank is going to sell SGD. Bank sells SGD at Ask rate and hence Ask rate will be used in the formula

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{SGD}} \right)$$

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 25,00,000 \times \left\{ \left[45.90 \times 1.7850 \times \frac{1}{3.1575} \right] + 0.125\% \right\}$$

$$\text{INR} = 25,00,000 \times \{ [25.94822] + 0.125\% \}$$

$$\text{INR} = 25,00,000 \times 25.98066$$

$$\text{INR outflow} = \text{Rs.6,49,51,650}$$

Note:

- Exchange margin is an additional income for banker and the same would increase the spread between bid and ask rate. Exchange margin is added to ask rate which increases customer outflow and the same is deducted from bid rate leading to lower inflow for customer.
- Exchange margin can be applied individually on every quote (or) we apply it finally on the cross quote. In this question we have applied it finally on cross quote

Computation of actual outflow when payment was done on February, 04:

$$\text{INR} = \text{SGD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 25,00,000 \times \left\{ \left[45.97 \times 1.7775 \times \frac{1}{3.1380} \right] + 0.125\% \right\}$$

$$\text{INR} = 25,00,000 \times \{ [26.03941] + 0.125\% \}$$

$$\text{INR} = 25,00,000 \times 26.07196$$

$$\text{INR outflow} = \text{Rs.} 6,51,79,900$$

Computation of loss:

Loss = Actual Payment on February 04 – Probable payment on January 28

$$\text{Loss} = \text{Rs.} 6,51,79,900 - \text{Rs.} 6,49,51,650 = \text{Rs.} 2,28,250$$

Part 2 – Computation of INR receipt by selling 1,50,000 SGD on January 28:

Known component = SGD 1,50,000; Unknown component = ? INR

Unknown component = Known component $\times$?

$$\text{INR} = \text{SGD} \times \left(\frac{\text{INR}}{\text{SGD}} \right)$$

Deciding Bid rate/Ask Rate:

We need to check what the customer is doing with denominator currency (SGD). Customer is going to sell SGD and bank is going to buy SGD. Bank buys SGD at Bid rate and hence bid rate will be used in the formula

$$\text{INR} = \text{SGD} \times \text{Bid} \left(\frac{\text{INR}}{\text{SGD}} \right)$$

$$\text{INR} = \text{SGD} \times \text{Bid} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) \times \text{ASK} \left(\frac{\text{GBP}}{\text{SGD}} \right)$$

$$\text{INR} = 1,50,000 \times \left\{ \left[45.85 \times 1.7840 \times \frac{1}{3.1590} \right] - 0.125\% \right\}$$

$$\text{INR} = 1,50,000 \times \{ [25.89313] - 0.125\% \}$$

$$\text{INR} = 1,50,000 \times 25.86076$$

$$\text{INR inflow} = \text{Rs.} 38,79,114$$

2. Calculation of security return (May 2012)

The price of a bond just before a year of maturity is USD 5,000. Its redemption value is USD 5,250 at the end of the said period. Interest is USD 350 per annum. The dollar appreciates by 2% during the said period. Calculate the rate of return

Answer:**Computation of rate of return:**

- Let us assume today's exchange rate is Rs.50/USD. Today's investment is Rs.2,50,000 (USD 5,000 $\times$ 50)
- USD has appreciated by 2 percent and the same would be Rs.51/USD
- Investment of USD 5,000 will become USD 5,100 by end of period
- Maturity value of investment is equal to Rs.2,60,500 (5,100 $\times$ 51)

$$\text{Return in home currency (INR)} = \frac{2,60,500 - 2,50,000}{2,50,000} \times 100 = 4.2\%$$

3. Computation of cover rate and profit and loss (Nov 2013)

You, a foreign exchange dealer of your bank, are informed that your bank has sold a T.T. on Copenhagen for Dansk Kroner 10,00,000 at the rate of Danish Kroner 1 = Rs.6.5150. You are required to cover the transaction either in London or New York market. The rate on that date are as under:

Mumbai-London	Rs.74.3000	Rs.74.3200
Mumbai-New York	Rs.49.2500	Rs.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 in the transaction?

Answer:**WN 1: Covering in New York Market:**

- Known component = 10,00,000 DKK
- Unknown component = ? INR

$$\text{INR} = \text{DKK} \times \text{ASK} \left(\frac{\text{INR}}{\text{DKK}} \right)$$

$$\text{INR} = 10,00,000 \times \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{DKK}} \right)$$

$\text{INR} = 10,00,000 \times \left(49.2625 \times \frac{1}{\text{Bid} \left(\frac{\text{DKK}}{\text{USD}} \right)} \right)$
$\text{INR} = 10,00,000 \times \left(49.2625 \times \frac{1}{7.5670} \right)$
$\text{INR} = 10,00,000 \times (6.510176)$
$\text{INR} = 65,10,176$
$\text{Profit/Loss} = (10,00,000 \times 6.5150) - (10,00,000 \times 6.510176)$
Profit/Loss = 65,15,000 - 65,10,176 = Rs.4,824

WN 2: Covering in London Market:

- ❖ Known component = 10,00,000 DKK
- ❖ Unknown component = ? INR

$\text{INR} = \text{DKK} \times \text{ASK} \left(\frac{\text{INR}}{\text{DKK}} \right)$
$\text{INR} = 10,00,000 \times \text{ASK} \left(\frac{\text{INR}}{\text{GBP}} \times \frac{\text{GBP}}{\text{DKK}} \right)$
$\text{INR} = 10,00,000 \times \left(74.3200 \times \frac{1}{\text{Bid} \left(\frac{\text{DKK}}{\text{GBP}} \right)} \right)$
$\text{INR} = 10,00,000 \times \left(74.3200 \times \frac{1}{11.4200} \right)$
$\text{INR} = 10,00,000 \times (6.507881)$
$\text{INR} = 65,07,881$
$\text{Profit/Loss} = (10,00,000 \times 6.5150) - (10,00,000 \times 6.507881)$
Profit/Loss = 65,15,000 - 65,07,881 = Rs.7,119

Conclusion:

- ❖ The transaction should be covered in London Market
- ❖ The cover rate is Rs.6.507881/DKK and the profit is Rs.7,119

4. Decision on hedging (May 2014, Nov 2018 RTP)

JKL Ltd., an Indian company has an export exposure of JPY 10,000,000 payable August 31, 2014. Japanese Yen (JPY) is not directly quoted against Indian Rupee. The current spot rates are:

INR/US \$ = Rs. 62.22

JPY/US\$ = JPY 102.34

It is estimated that Japanese Yen will depreciate to 124 level and Indian Rupee to depreciate against US \$ to Rs. 65. Forward rates for August 2014 are

INR/US \$ = Rs. 66.50

JPY/US\$ = JPY 110.35

Required:

(i) Calculate the expected loss, if the hedging is not done. How the position will change, if the firm takes forward cover?

(ii) If the spot rates on August 31, 2014 are:

INR/US \$ = Rs. 66.25

JPY/US\$ = JPY 110.85

Is the decision to take forward cover justified?

WN 1: Computation of collections as per different rates:**Collection as per current spot rates:**

- ❖ Known component = 1,00,00,000 JPY
- ❖ Unknown component = ? INR

$\text{INR} = \text{JPY} \times \left(\frac{\text{INR}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{JPY}} \right)$
$\text{INR} = 1,00,00,000 \times \left(62.22 \times \frac{1}{102.34} \right)$
$\text{INR} = 1,00,00,000 \times (0.6080)$

INR = 60,80,000

Note: The given quotes have been interpreted as INR/USD and JPY/USD as per current exchange rates.

Collection as per expected spot rates:

- ❖ Known component = 1,00,00,000 JPY
- ❖ Unknown component = ? INR

$INR = JPY \times \left(\frac{INR}{JPY} \right)$
$INR = 1,00,00,000 \times \left(\frac{INR}{USD} \times \frac{USD}{JPY} \right)$
$INR = 1,00,00,000 \times \left(65 \times \frac{1}{1244} \right)$
$INR = 1,00,00,000 \times (0.5242)$
INR = 52,42,000

Collection as per forward rates:

- ❖ Known component = 1,00,00,000 JPY
- ❖ Unknown component = ? INR

$INR = JPY \times \left(\frac{INR}{JPY} \right)$
$INR = 1,00,00,000 \times \left(\frac{INR}{USD} \times \frac{USD}{JPY} \right)$
$INR = 1,00,00,000 \times \left(66.50 \times \frac{1}{110.35} \right)$
$INR = 1,00,00,000 \times (0.6026)$
INR = 60,26,000

Collection as per actual spot rates:

- ❖ Known component = 1,00,00,000 JPY
- ❖ Unknown component = ? INR

$INR = JPY \times \left(\frac{INR}{JPY} \right)$
$INR = 1,00,00,000 \times \left(\frac{INR}{USD} \times \frac{USD}{JPY} \right)$
$INR = 1,00,00,000 \times \left(66.25 \times \frac{1}{110.85} \right)$
$INR = 1,00,00,000 \times (0.5977)$
INR = 59,77,000

WN 2: Computation of expected loss and decision on forward cover:

Expected loss w/o hedging = Realization on expected spot rates – Realization on current spot rates
Expected loss w/o hedging = 52,42,000 – 60,80,000
Expected loss w/o hedging = Rs.8,38,000
Expected loss with hedging = Realization on forward rates – Realization on current spot rates
Expected loss with hedging = 60,26,000 – 60,80,000
Expected loss with hedging = Rs.54,000
Benefit of forward cover = Realization on forward rates – Realization on actual spot rates
Benefit of forward cover = 60,26,000 – 59,77,000
Benefit of forward cover = Rs.49,000

The company has benefitted due to forward cover and hence the decision to take forward cover is justified.

5. Computation of quoted rate (May 2018)

An imported 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 49.3700/3800 and USD/SGD 1.7058/68. The swap points are:

USD/INR		USD/SGD	
Spot/September	0300/0400	1 st month forward	48/49
Spot/October	1100/1300	2 nd month forward	96/97

Spot/November	1900/2200	3 rd 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.

Answer:

Note: The given quotes have been interpreted as INR/USD and SGD/USD as per current exchange rates

Note 1: Computation of relevant rates:

INR/USD

Particulars	Bid rate	Ask Rate
Spot rate	49.3700	49.3800
Add: Swap points for October	0.1100	0.1300
Revised rate	49.4800	49.5100
Add: Exchange margin	0.0500	0.0500
Rate for October 31	49.5300	49.5600

SGD/USD:

Particulars	Bid rate	Ask Rate
Spot rate	1.7058	1.7068
Add: Swap points for October	0.0096	0.0097
Rate for October 31	1.7154	1.7165

Note 2: Computation of quoted rate:

- ❖ Known component = SGD
- ❖ Unknown component = INR
- ❖ Required quote = (INR/SGD)

$\frac{\text{INR}}{\text{SGD}} = \frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SGD}}$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{SGD}} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \text{ASK} \left(49.5600 \times \frac{1}{\text{BID} \left(\frac{\text{USD}}{\text{SGD}} \right)} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = \left(49.5600 \times \frac{1}{1.7154} \right)$
$\text{ASK} \left(\frac{\text{INR}}{\text{SGD}} \right) = 28.8912$

6. Computation of return:

With the relaxation of investment norms in India in international market upto USD 2,50,000 Mr.X to hedge himself against the risk of declining Indian economy and weakening of Indian Rupee during last few year decided to diversify into International market.

Accordingly, Mr.X invested a sum of Rs.1.58 Crores on 1.1.2011 in S&P Index. On 1.1.2012, Mr.X sold his investment. The other relevant data is given below:

Particulars	1.1.2011	1.1.2012
Index of stock market in India	7395	?
S&P Index	2028	1919
Exchange rate	62.00/62.25	67.25/67.50

You are required to:

- (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 1.1.2012 at which Mr.X would be indifferent between investment in S&P Index and Indian Stock Market

Answer:

WN 1: Computation of return for US Investor:

$$\text{Return} = \frac{\text{Ending Index} - \text{Opening index}}{\text{Opening Index}} \times 100$$

$$\text{Return} = \frac{1,919 - 2,028}{2,028} \times 100 = -5.37\%$$

WN 2: Return of Mr.X for holding period:

Particulars	Calculation	Amount
Amount of investment		Rs.1,58,00,000
Investment in USD	$1,58,00,000 \times \left(\frac{1}{62.25}\right)$	USD 2,53,815.26
Purchase price of S&P		2,028
Ending price of S&P		1,919
Proceeds realized in USD	$2,53,815.26 \times \left(\frac{1919}{2028}\right)$	USD 2,40,173.32
Exchange rate on 1.1.2012		67.25
INR realization on 1.1.2012	$2,40,173.32 \times 67.25$	Rs.1,61,51,655
Return in INR	1,61,51,655 - 1,58,00,000	3,51,655
Return in %	$\frac{3,51,655}{1,58,00,000} \times 100$	2.23%

WN 3: Computation of indifferent level of index for investment in Indian stock market:

- ❖ The investor is earning a return of 2.23% in US market. He would want to earn the same rate of return in Indian market
- ❖ Closing index value = 7,395 + 2.23% = 7,560

Part II - Premium/Discount and Appreciation/Depreciation**7. Forward gain/loss (Nov 2014 RTP)**

Your forex dealer had entered into a cross currency deal and had sold USD 10,00,000 against EURO at USD 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 USD 1	INR 31.4300/4500
1 month margin	25/20
2 months margin	45/35
Spot USD 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?

Answer:

- Squaring up means that we have to take opposite position. The forex dealer has sold USD 10,00,000 and hence he has to now buy 10,00,000 USD
- The forex dealer has sold 10,00,000 USD and he would get 14,40,000 EUROS (10,00,000 × 1.4400)
- In order to square up the position, the dealer has to buy 10,00,000 USD

Known component = USD 10,00,000; Unknown component = ? EUROS
Unknown component = Known component × ?
$EUR = USD \times \left(\frac{EUR}{USD}\right)$
Deciding Bid rate/Ask Rate: We need to check what the forex dealer is doing with denominator currency (USD). Forex dealer is going to buy USD and the other bank is going to sell USD. Bank sells USD at ASK rate and hence ASK rate will be used in the formula $EUR = USD \times ASK \left(\frac{EUR}{USD}\right)$ $EUR = 10,00,000 \times 1.4450$ Euros outflow = EUR 14,45,000
Net loss of forex dealer = Receipt of EUR 14,40,000 - Payment of EUR 14,45,000 = EUR 5,00,000
The dealer has made a loss of 5,000 EUROS and he should buy the same by paying INR. It is assumed that forex dealer is based out of India and hence loss is finally converted into INR
Known component = EUR 5,000; Unknown component = ? INR
Unknown component = Known component × ?
$INR = EUR \times \left(\frac{INR}{EUR}\right)$

Deciding Bid rate/Ask Rate:

We need to check what the forex dealer is doing with denominator currency (EUR). Forex dealer is going to buy EUR and the other bank is going to sell EUR. Bank sells EUR at ASK rate and hence ASK rate will be used in the formula

$$\text{INR} = \text{EUR} \times \text{ASK} \left(\frac{\text{INR}}{\text{EUR}} \right)$$

$$\text{INR} = \text{EUR} \times \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \times \frac{\text{USD}}{\text{EUR}} \right)$$

$$\text{INR} = 5,000 \times 31.4500 \times \frac{1}{1.4400}$$

Loss in INR = Rs.1,09,201.39

8. Covering an exchange transaction (Nov 2014)

Edelweiss Bank Ltd. sold Hong Kong dollar 2 crores value spot to its customer at Rs.8.025 and covered itself in the London market on the same day, when the exchange rates were

USD 1 = HKD 7.5880 – 7.5920

Local interbank market rates for USD were

Spot USD – Rs.60.70 – 61.00

Calculate the cover rate and ascertain the profit or loss on the transaction.

Answer:

- The bank has sold HKD 2,00,00,000 at the rate of Rs.8.025 and hence the sale proceeds would be Rs.16,05,00,000
- The bank now needs to cover the transaction. Covering the transaction would mean taking an opposite position and hence the bank has to buy HKD 2,00,00,000

Known component = HKD 1,00,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$\text{INR} = \text{HKD} \times \left(\frac{\text{INR}}{\text{HKD}} \right)$
Deciding Bid rate/Ask Rate:
- In this question the bank is going to deal with some other bank. The bank would be considered similar to normal customer when dealing with another bank. - Bank needs to buy HKD 2,00,00,000. This would be sold by another bank and the other bank will be selling this at Ask rate
$\text{INR} = \text{HKD} \times \text{Ask} \left(\frac{\text{INR}}{\text{HKD}} \right)$
$\text{INR} = \text{HKD} \times \text{Ask} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{Ask} \left(\frac{\text{USD}}{\text{HKD}} \right)$
$\text{INR} = 2,00,00,000 \times 61.00 \times \frac{1}{7.5880}$
$\text{INR} = 2,00,00,000 \times 8.039009$
$\text{INR} = \text{Rs. } 16,07,80,180$
Cover rate = Rs.8.039009/HKD
Profit = 16,05,00,000 – 16,07,80,180 = Rs.2,80,180

9. Computation of premium/discount % (Nov 2016)

On April 3, 2016, a Bank quotes the following:

- ❖ Spot exchange rate (USD 1) = INR 66.2525/67.5945
- ❖ 2 months' swap points = 70/90
- ❖ 3 months' swap points = 160/186

In a spot transaction, delivery is made after two days. Assume pot date as April 5, 2016 and 1 swap point = 0.0001.

You are required to:

- (i) Ascertain swap points for 2 months and 15 days (For June 20, 2016)
- (ii) Determine foreign exchange rate for June 20, 2016 and
- (iii) Compute the annual rate of premium/discount of USD on INR, on an average rate

Answer:**WN 1: Computation of swap points for 2 months and 15 days:**

Particulars	Bid	Ask
Swap points for 2 months	70	90

Swap points for 3 months	160	186
Swap points for 30 days	90	96
Swap points for 15 days	45	48
Swap points for 30 days $\times \left(\frac{15}{30}\right)$		
Swap points for 2 months and 15 days	115	138

WN 2: Computation of exchange rate for June 20, 2016:

Particulars	Bid	Ask
Spot rate	66.2525	67.5945
Add: Swap points for 2.5 months	0.0115	0.0138
Exchange rate for June 20, 2016	66.2640	67.6083

WN 3: Computation of premium/discount percentage of USD:

Particulars	Bid	Ask
Spot rate	66.2525	67.5945
Exchange rate for June 20, 2016	66.2640	67.6083
Premium	0.0115	0.0138
Average rate (Spot + Forward)/2	66.2583	67.6014
Premium %	$\frac{0.0115}{66.2583} \times \frac{12}{2.5} \times 100 = 0.0833\%$	$\frac{0.0138}{67.6014} \times \frac{12}{2.5} \times 100 = 0.0980\%$

Part III - IRPT and PPT**10. IRPT (Nov 2012)**

The US dollar is selling in India at Rs.55.50. If the interest rate in India is 10% per annum and the corresponding rate in USA is 4%

- Do you expect that USD will be at a premium or at discount in the Indian forex market?
- What will be the expected forward rate for US dollar in India after six months and 1 year?
- What will be the rate of forward premium or discount?
- What will be the forward rate after 365 days if the interest rates are compounded continuously?

Answer:**Part a:**

- Interest rate in USA is lower than that of India. High interest rates in India will be offset by depreciation of INR. Hence the USD will be at a premium in the Indian forex market

Part b:**6-month forward rate:**

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 5% per half year
Foreign currency = USD
R _f (USA rate) = 2% per half year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 5\%}{1 + 2\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.05}{1.02} = \text{RS. } 57.13 \text{ per USD}$

1-year forward rate:

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 10% per year
Foreign currency = USD
R _f (USA rate) = 4% per year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 10\%}{1 + 4\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.10}{1.04} = \text{Rs. } 58.70 \text{ per USD}$

Part c:**Computation of forward premium or discount:****Using 6-month rates:**

Premium or discount % For USD (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$ $\frac{57.13 - 55.50}{55.50} \times \frac{12}{6} \times 100$	5.87% (appreciation)
Premium or discount % For INR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{55.50 - 57.13}{57.13} \times \frac{12}{6} \times 100$	-5.71% (depreciation)

Using 1-year rates:

Premium or discount % For USD (product)	$\frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{12}{m} \times 100$ $\frac{58.70 - 55.50}{55.50} \times \frac{12}{12} \times 100$	5.77% (appreciation)
Premium or discount % For INR (price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{55.50 - 58.70}{58.70} \times \frac{12}{12} \times 100$	-5.45% (depreciation)

Part d:

- Interest rates are compounded continuously and hence we should calculate effective rate using e^x values
- Interest rate in India = 10% per annum; Effective rate = $e^{0.10} - 1 = 10.52\%$
- Interest rate in USD = 4% per annum; Effective rate = $e^{0.04} - 1 = 4.08\%$

Spot rate = INR 55.50/USD
Home currency = INR
R _h (Indian rate) = 10.52% per year
Foreign currency = USD
R _f (USA rate) = 4.08% per year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$; $\frac{1 + 10.52\%}{1 + 4.08\%} = \frac{F_1}{55.50}$
$F_1 = \frac{55.50 \times 1.1052}{1.0408} = \text{Rs. } 58.93 \text{ per USD}$

11. Law of one price - estimating future rate

A laptop bag is priced at USD 105.00 in New York. The same bag is priced at Rs.4,200 in Mumbai.

- ❖ Determine exchange rate in Mumbai.
- ❖ Determine the price of the bag in both the cities if next year price increases by 7 percent in Mumbai and by 4 percent in New York
- ❖ Determine the appreciation or depreciation in Rupee in one year from now

Answer:**WN 1: Computation of spot exchange rate and forward exchange rate:****Spot exchange rate:**

Price of bag in India = Rs.4,200
Price of bag in USA = USD 105
Price of Bag in India = Price of Bag in USA
Rs.4,200 = USD 105; Rs.40 = USD 1
Spot exchange rate = Rs.40/USD

Forward exchange rate after 1 year:

Price of bag in India = Rs.4,200 + 7% = Rs.4,494
Price of bag in USA = USD 105 + 4% = USD 109.20
Price of Bag in India = Price of Bag in USA
Rs.4,494 = USD 109.20; Rs.41.15 = USD 1

1-year forward rate = Rs.41.15/USD

WN 2: Computation of appreciation/depreciation in rupee (Price):

Premium or discount % For INR (Price)	$\frac{\text{Spot rate} - \text{Forward rate}}{\text{Forward rate}} \times \frac{12}{m} \times 100$ $\frac{40 - 41.15}{41.15} \times \frac{12}{12} \times 100$	-2.80% (depreciation)

12. Arbitrage opportunity (Nov 2018)

Spot rate 1 USD = Rs.68.50; USD premium on a six month forward is 3%. The annualized interest in USA is 4% and 9% in India. Is there any arbitrage possibility? If yes, how a trader can take advantage of the situation if he is willing to borrow USD 3 million.

Answer:**WN 1: Computation of fair interest rate of home currency:**

- ❖ Spot rate = INR 68.50/USD
- ❖ Forward rate = INR 70.555/USD (Spot rate + 3%)
- ❖ Actual Interest rate of home country = 9%
- ❖ Actual interest rate of foreign country = 4%

$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}$
$\frac{1 + R_h}{1 + 2\%} = \frac{70.555}{68.50}$
$\frac{1 + R_h}{1.02} = 1.03$
$1 + R_h = 1.02 \times 1.03$
$1 + R_h = 1.0506$
$R_h = 5.06\%$

Actual interest rate in India (4.5%) is lower than Fair interest rate (5.06%). Hence we should borrow in India and invest in USA.

Particulars	Calculation	Amount (in lacs)
Day 0:		
1. Borrow INR equivalent of 3 million USD for 6 months at 4.5%	30 lacs x 68.50	INR 2,055
2. Convert INR into USD at spot rate	2,055/68.50	USD 30
3. Invest USD 30 lacs for 6 months at 2%		USD 30
4. Enter into forward contract to convert USD into INR at INR 70.555/USD		USD 30
Year 2:		
5. Redeem USD deposit along with interest	30 + 2%	USD 30.60
6. Convert USD into INR at forward rate	30.60 x 70.56	INR 2,159.136
7. Repay INR loan along with interest	2,055 + 4.5%	INR 2,147.475
8. Arbitrage gain		INR 11.661

- ❖ Arbitrage gain = Rs.11,66,100 (or) USD 16,526 (11,66,100/70.56)

Part IV - Arbitrage

13. Time arbitrage

The interest rate on pounds is 12 percent in UK and 7 percent in US. The pound spot rate is 1.79 and the one-year forward rate is 1.68. Check whether arbitrage opportunity exists.

Answer:

The given quote has been interpreted as USD/GBP. This is because GBP is costlier currency as compared to USD

WN 1: Computation of Fair home currency interest rate:

Spot rate = USD 1.79/GBP
1-year forward rate = USD 1.68/GBP
Home currency = USD
Fair interest rate in USA = ?

Foreign currency = GBP
R _f (UK) rate = 12% per annum
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + R_h}{1 + 12\%} = \frac{1.68}{1.79}$
$1 + R_h = \frac{1.68 \times 1.12}{1.79} = 1.0512$
Fair interest rate in USA = 5.12%
Actual interest rate in USA = 7.00%

WN 2: Arbitrage mechanism:

- Actual interest rate is higher than fair interest rate. In order to exploit the arbitrage opportunities, we should borrow money from UK and invest in USA. We are investing in USA as we will earn interest higher than the fair rate

Particulars	Amount
Day 0:	
Borrow 1,00,000 GBP @ 12% for 1 year	GBP 1,00,000
Convert GBP into USD at spot rate (1,00,000 x 1.79)	USD 1,79,000
Invest USD 1,79,000 @ 7% for 1 year	USD 1,79,000
Enter into forward contract to convert investment proceeds @ USD 1.68 per GBP after one year	
Day 365:	
Redeem USD deposit along with interest (1,79,000 + 7%)	USD 1,91,530
Convert USD into GBP at pre-agreed forward rate (1,79,000/1.68)	GBP 1,14,005.95
Repay GBP loan along with interest (1,00,000 + 12%)	GBP 1,12,000
Arbitrage gain	GBP 2,005.95

14. Time arbitrage (May 2016, May 2018)

Given the following information:

Exchange rate - Canadian dollar 0.665 per DM (spot)

Canadian dollar 0.670 per DM (3 months)

Interest rates - DM 7% p.a.

Canadian Dollar - 9% p.a.

What operations would be carried out to take the possible arbitrage gains?

Answer:

WN 1: Computation of Fair home currency interest rate:

Spot rate = CAD 0.665/DM
3-month forward rate = CAD 0.670/DM
Home currency = CAD
Fair interest rate in Canada = ?
Foreign currency = DM
R _f (DM) rate = 7% per annum (or) 1.75% per 3 months
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + R_h}{1 + 1.75\%} = \frac{0.670}{0.665}$
$1 + R_h = \frac{0.670 \times 1.0175}{0.665} = 1.0252$
Fair interest rate in CAD = 2.52% per 3 months (or) 10.08% per annum
Actual interest rate in CAD = 9.00% per annum (or) 2.25% per 3 months

WN 2: Arbitrage mechanism:

- Actual interest rate is lower than fair interest rate. In order to exploit the arbitrage opportunities, we should borrow money in CAD and invest in DM. We are borrowing in CAD as we are paying interest lower than the fair rate

Particulars	Amount
Day 0:	
Borrow 1,00,000 CAD @ 9% for 3 months	CAD 1,00,000
Convert CAD into DM at spot rate (1,00,000/0.665)	DM 1,50,375.94
Invest DM 1,50,375.94 @ 7% for 3-months	DM 1,50,375.94

Enter into forward contract to convert investment proceeds @ CAD 0.670 per DM after three months	
Month 3:	
Redeem DM deposit along with interest (1,50,375.94 + 1.75%)	DM 1,53,007.52
Convert DM into CAD at pre-agreed forward rate (1,53,007.52 x 0.670)	CAD 1,02,515.04
Repay CAD loan along with interest (1,00,000 + 2.25%)	CAD 1,02,250
Arbitrage gain	CAD 265.04

15. Arbitrage (Nov 2020 RTP):

Citi Bank quotes JPY/ USD 105.00 -106.50 and Honk Kong Bank quotes USD/JPY 0.0090 - 0.0093.

(a) Are these quotes identical if not then how they are different.

(b) Is there a possibility of arbitrage?

(c) If there is an arbitrage opportunity, then show how would you make profit from the given quotation in both cases if you are having JPY 1,00,000 or US\$ 1,000.

Answer:

Part 1:

No, while Citi Bank's quote is a Direct Quote for JPY (i.e. for Japan) the Hong Kong Bank quote is a Direct Quote for USD (i.e. for USA)

Part 2:

To decide on arbitrage, we need to convert the quote in similar terms and hence we can convert USD/JPY quote of Honk Kong Bank into JPY/USD rate

BID $\left(\frac{\text{JPY}}{\text{USD}}\right)$	$= \frac{1}{0.0093}$	JPY 107.53/USD
BID $\left(\frac{\text{USD}}{\text{JPY}}\right)$	$= \frac{1}{0.0090}$	JPY 111.11/USD

- Arbitrage opportunity would exist as we can buy USD at the rate of JPY 106.50/USD in Citi Bank and sell the same at JPY 107.53/USD in Hong Kong Market

Part 3:**Profit if we start with JPY 1,00,000**

Particulars	Calculation	Amount
Sell 1,00,000 JPY and buy USD at the rate of 106.50 (Citi Bank)	$= \frac{1,00,000}{106.50}$	USD 939.97
Sell USD 939.97 in Hong Kong Market	939.97×107.53	JPY 1,00,967.44
Arbitrage gain	1,00,967.44 - 1,00,000	JPY 967.44

Profit if we start with USD 1,000:

Particulars	Calculation	Amount
Sell 1,000 USD in Hong Kong Market	$1,000 \times 107.53$	JPY 1,07,530
Sell JPY 1,07,530 in Citi Bank	$\frac{1,07,530}{106.50}$	USD 1,009.67
Arbitrage gain	1,009.67 - 1,000	USD 9.67

16. Asymmetrical rates

Following are the rates quoted at Mumbai for Pounds Sterling

Rs/GBP 82.03-90
3 month forward 20-30

Interest rates (3months)		
	Rupees	Pounds
Investment	8%	5%
Borrowing	10%	8%

❖ Verify whether there is any scope for covered interest arbitrage if you borrow rupees

❖ Verify whether there is any scope for covered interest arbitrage if you borrow pounds

Answer:

WN 1: Check on arbitrage opportunity if we borrow in INR:

Particulars	Amount
Day 0:	
Borrow 1,00,000 INR @ 10% for 3 months	INR 1,00,000
Convert INR into GBP at spot rate (1,00,000 / 82.90)	GBP 1,206.27
Invest GBP 1,206.27 @ 5% for 3 months	GBP 1,206.27
Enter into forward contract to convert investment proceeds @ INR 82.23-83.20 per GBP after 3-months	
Day 90:	
Redeem GBP deposit along with interest (1,206.27 + 1.25%)	GBP 1,221.35
Convert GBP into INR at pre-agreed forward rate (1,221.35 x 82.23)	INR 1,00,431.61
Repay INR loan along with interest (1,00,000 + 2.5%)	INR 1,02,500
Arbitrage gain/loss	(INR 2,068.39)

- There is no arbitrage opportunity if we borrow money in INR

WN 2: Check on arbitrage opportunity if we borrow in GBP:

Particulars	Amount
Day 0:	
Borrow 1,00,000 GBP @ 8% for 3 months	GBP 1,00,000
Convert GBP into INR at spot rate (1,00,000 x 82.03)	INR 82,03,000
Invest INR 82,03,000 @ 8% for 3 months	INR 82,03,000
Enter into forward contract to convert investment proceeds @ INR 82.23-83.20 per GBP after 3-months	
Day 90:	
Redeem INR deposit along with interest (82,03,000 + 2%)	INR 83,67,060
Convert INR into GBP at pre-agreed forward rate (83,67,060/83.20)	GBP 1,00,565.63
Repay GBP loan along with interest (1,00,000 + 2%)	GBP 1,02,000
Arbitrage gain/loss	(GBP 1,434.37)

- There is no arbitrage possibility if we borrow money in GBP

17. Triangular arbitrage (May 2020 RTP)

Followings are the spot exchange rates quoted at three different forex markets:

INR/USD	Rs.48.30 in Mumbai
INR/GBP	Rs.77.52 in London
USD/GBP	USD 1.6231 in New York

The arbitrageur has USD 1,00,00,000. Assuming that there are no transaction costs, explain whether there is any arbitrage gain possible from the quoted spot exchange rates

Answer:

- The arbitrageur has USD 1,00,00,000. He can convert this into other currency and convert it back into USD in following two ways:
 - USD - INR - GBP - USD
 - USD - GBP - INR - USD

Option 1: USD - INR - GBP - USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into INR (1,00,00,000 x 48.30)	INR 48,30,00,000
Convert INR into GBP (48,30,00,000/77.52)	GBP 62,30,650
Convert GBP into USD (62,30,650 x 1.6231)	USD 1,01,12,968
Arbitrage gain (USD 1,01,12,968 - USD 1,00,00,000)	USD 1,12,968

- Above approach can lead to arbitrage gain of USD 1,12,968

Option 2: USD - GBP - INR - USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into GBP (1,00,00,000 / 1.6231)	GBP 61,61,050
Convert GBP into INR (61,61,050 x 77.52)	INR 47,76,04,596
Convert INR into USD (47,76,04,596/48.30)	USD 98,88,294
Arbitrage gain (USD 98,88,294 - USD 1,00,00,000)	(USD 1,11,706)

- This approach is not preferable as the same leads to loss

Conclusion:

- The company should use approach 1 and the same can help in earning USD 1,12,968

18. Arbitrage (Nov 2018 RTP):

The current spot exchange rate is \$1.35/£ and the three-month forward rate is \$1.30/£. According to your analysis of the exchange rate, you are quite confident that the spot exchange rate will be \$1.32/£ after 3 months.

(i) Suppose you want to speculate in the forward market then what course of action would be required and what is the expected dollar Profit (Loss) from this speculation?

(ii) What would be your Profit (Loss) in Dollar terms on the position taken as per your speculation if the spot exchange rate turns out to be \$1.26/£.

Assume that you would like to buy or sell £1,000,000.

Answer:

i) If you believe the spot exchange rate will be \$ 1.32/£ in three months, you should buy £ 1,000,000 forward for \$1.30/£ and sell at \$ 1.32/£ 3 months hence. Your expected profit will be: £1,000,000 x (\$1.32 - \$1.30) = \$20,000

(ii) If the spot exchange rate turns out to be \$1.26/£ in three months, your loss from the long position in Forward Market will be: £ 1,000,000 x (\$ 1.26 - \$1.30) = \$ 40,000

19. Triangular Arbitrage (May 2017 RTP):

Bharat Silk Limited, an established exporter of silk materials, has a surplus of USD 20 million as on 31st May, 2015. The banker of the company informs the following exchange rates that are quoted at three different forex markets:

- GBP/INR = 99.10 at London
- INR/GBP = 0.01 at London
- USD/INR = 64.10 at Mumbai
- INR/USD = 0.02 at Mumbai
- USD/GBP = 0.65 at New York
- GBP/USD = 1.5530 at New York

Assuming that there are no transaction costs, advise the company how to avail the arbitrage gain from the above quoted exchange rates.

Answer:

- The company has USD 2,00,00,000. It can convert this into other currency and convert it back into USD in following two ways:
 - USD - INR - GBP - USD
 - USD - GBP - INR - USD

Option 1: USD - INR - GBP - USD:

Particulars	Amount
USD available	USD 2,00,00,000
Convert USD into INR (2,00,00,000 x 64.10)	INR 128,20,00,000
Convert INR into GBP (128,20,00,000/99.10)	GBP 1,29,36,427.85
Convert GBP into USD (1,29,36,427.85 x 1.5530)	USD 2,00,90,272.45
Arbitrage gain (USD 2,00,90,272.45 - USD 2,00,00,000)	USD 90,272.45

- Above approach can lead to arbitrage gain of USD 90,272.45

Note:

- We have used the favorable quote for conversion. For instance, we can use one of the below quotes:
 - 2 Crores x 64.10 = INR 128.20 Crores
 - 2 crores/0.01 = INR 100 Crores
- We have used the quote of 64.10 and the same approach is used for other currency conversions as well

Option 2: USD - GBP - INR - USD:

Particulars	Amount
USD available	USD 2,00,00,000

Convert USD into GBP ($2,00,00,000 \times 0.65$)	GBP 1,30,00,000
Convert GBP into INR ($1,30,00,000/0.01$)	INR 130,00,00,000
Convert INR into USD ($130,00,00,000 \times 0.02$)	USD 2,60,00,000
Arbitrage gain (USD 2,60,00,000 – 2,00,00,000)	USD 60,00,000

- This approach leads to arbitrage gain of USD 60,00,000

Conclusion:

- The company should use approach 2 and the same can help in earning USD 60,00,000

20. Triangular Arbitrage (Nov 2014 RTP):

Following are the spot exchange rates quoted at three different forex markets:

- USD/INR = 59.25/59.35 in Mumbai
- GBP/INR = 102.50/103.00 in London
- GBP/USD = 1.70/1.72 in New York

The arbitrageur has USD 1,00,00,000. Assuming that the bank wishes to retain an exchange margin of 0.125%, explain whether there is any arbitrage gain possible from the quoted spot exchange rates.

Answer:

- The company has USD 1,00,00,000. It can convert this into other currency and convert it back into USD in following two ways:
 - USD – INR – GBP – USD
 - USD – GBP – INR – USD

Option 1: USD – INR – GBP – USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into INR ($1,00,00,000 \times (59.25 - 0.125\%)$)	INR 59,17,59,375
Convert INR into GBP 59,17,59,375 $103 + 0.125\%$	GBP 57,38,064.07
Convert GBP into USD ($57,38,064.07 \times (1.70 - 0.125\%)$)	USD 97,66,902.31
Arbitrage loss (97,66,902.31 – 1,00,00,000)	USD 2,33,097.69

- Above approach can lead to arbitrage loss of USD 2,33,097.69

Option 2: USD – GBP – INR – USD:

Particulars	Amount
USD available	USD 1,00,00,000
Convert USD into GBP 1,00,00,000 $1.72 + 0.125\%$	GBP 58,06,695.12
Convert GBP into INR ($58,06,695.12 \times (102.50 - 0.125\%)$)	INR 59,44,42,266.99
Convert INR into USD 59,44,42,266.99 $59.35 + 0.125\%$	USD 1,00,03,372.23
Arbitrage gain (USD 1,00,03,372.23 – 1,00,00,000)	USD 3,372.23

- This approach leads to arbitrage gain of USD 3,372.23

Conclusion:

- The company should use approach 2 and the same can help in earning USD 3,372.23

Part V – Currency Invoicing

Part VI – Leading and Lagging

21. Leading and lagging (May 2019 RTP)

The following 2-way quotes appear in the foreign exchange market

Spot rate Rs.46.00/46.25 per USD
 2-months forward rate Rs.47.00/ 47.50 per USD

Required:

- How many US dollars should a firm sell to get Rs.25 lacs after 2 months?
- How many rupees is the firm required to pay to obtain USD 2,00,000 in the spot market?
- Assume the firm has USD 69,000 in current account earning no interest. ROI on rupee investment is 10% p.a. Should the firm encash the USD now or 2 months later?

Answer:

WN 1: Computation of USD to buy Rs.25 lacs after two months:

Known component = INR 25,00,000; Unknown component = ? USD
Unknown component = Known component x ?
$USD = INR \times \left(\frac{USD}{INR} \right)$
$USD = INR \times ASK \left(\frac{USD}{INR} \right)$
$USD = 25,00,000 \times \left(\frac{1}{47} \right)$
USD outflow = 53,191,49

WN 2: Computation of INR required to buy USD 2,00,000 in spot market:

Known component = USD 2,00,000; Unknown component = ? INR
Unknown component = Known component x ?
$INR = USD \times \left(\frac{INR}{USD} \right)$
$INR = 2,00,000 \times ASK \left(\frac{INR}{USD} \right)$
$INR = 2,00,000 \times 46.25$
INR outflow = INR 92,50,000

WN 3: Decision on redeeming USD deposit:

Particulars	Redeem today	Redeem after 2 months
INR receipt today on conversion	31,74,000 (69,000 x 46)	-
Interest income for 2 months	52,900 (31,74,000 x 10% x 2/12)	-
INR receipt on conversion in M2	-	32,43,000 (69,000 x 47)
Total inflow in INR	32,26,900	32,43,000

- The company should wait and redeem USD deposit into INR at end of 2 months

22. Leading and lagging (Nov 2012)

Z Ltd. importing goods worth USD 2 million, requires 90 days to make the payment. The overseas supplier has offered a 60 days interest free credit period and for additional credit for 30 days and interest of 8% p.a. The bankers of Z Ltd offer a 30 days loan at 10% per annum and their quote for foreign exchange is as follows:

Spot 1 USD Rs. 56.50
 60 days forward for 1 USD Rs. 57.10
 90 days forward for 1 USD Rs. 57.50

You are required to evaluate the following options

- Pay the supplier in 60 days, or
- Avail the supplier's offer of 90 days credit.

Answer:

Computation of INR outflow:

Particulars	Pay in 60 days	Pay in 90 days
INR outflow with payment in day 60	11,42,00,000 (20,00,000 x 57.10)	-
Interest on loan for 30 days	9,51,667 (11,42,00,000 x 10% x 30/360)	-

USD interest for 30 days supplier credit		13,333 (20,00,000 × 8% × 30/360)
USD to be paid on day 90		20,13,333
INR outflow on day 90	-	11,57,66,648 (20,13,333 × 57.50)
Total inflow in INR	11,51,51,667	11,57,66,648

- We should make the payment in 60 days

23. Leading and lagging (May 2015 RTP)

Sun Ltd. is planning to import 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 irrecoverable letter of credit.

Additional information:

Present exchange rate Rs.100 = 340 yen

180 day's forward rate Rs.100 = 345 yen

Commission charges for letter of credit at 2 per cent per 12 months.

Advise the company whether the offer from the foreign branch should be accepted.

Answer:

WN 1: Financing the equipment with loan in India:

Particulars	Calculation	Amount (in lacs)
Payment on day 0	3,400 lacs × (100/340)	1,000.00
Interest for quarter 1	1,000 × 18% × 3/12	45.00
Interest for quarter 2	1,045 × 18% × 3/12	47.03
Total outflow		1,093.03

- Interest has been computed separately for quarter 1 and 2. This is because of quarterly compounding of interest rates

WN 2: Offer of foreign branch:

Part 1: Cost of letter of credit:

Particulars	Calculation	Amount (in lacs)
LC commission on day 0	3,400 × (100/340) × 2% × (6/12)	10.00
Interest for quarter 1	10 × 18% × 3/12	0.45
Interest for quarter 2	10.45 × 18% × 3/12	0.47
Total outflow		10.92

Part 2: Payment to foreign branch:

Particulars	Calculation	Amount (in lacs)
Loan taken		JPY 3,400
Interest for 6 months	3,400 × 2% × 6/12	JPY 34
Total payment at end of M6		JPY 3,434
INR outflow	3,434 × (100/345)	995.36

- Total outflow in option 2 = 10.92 + 995.36 = 1,006.28 lacs

Conclusion:

- The company should go ahead with acceptance of foreign branch as the same leads to lower outflow of INR

24. Leading and lagging (Nov 2014)

Gibraltar Limited has imported 5,000 bottles of shampoo at landed cost in Mumbai, of USD 20 each. The company has the choice for paying for the goods immediately or in 3 months time. It has a clean overdraft where 14% p.a. rate of interest is charged. Calculate which of the following two methods would be cheaper to Gibraltar Limited:

- Pay in 3 months time with interest @10% and cover risk forward for 3 months
- Settle now at a spot rate and pay interest on the overdraft for 3 months

The rates are as follows:

❖ Mumbai INR/USD spot : 60.25-60.55

❖ 3 months swap : 35/25

Answer:**Evaluation of option 1:**

Particulars	Calculation	Amount
USD liability on Day 0	5,000 x 20	USD 1,00,00
Add: Interest for 3 months @ 10%	1,00,000 x 10% x (3/12)	USD 2,500
Amount to be paid at end of Month 3		USD 1,02,500
INR outflow at end of Month 3	USD x ASK $\left(\frac{\text{INR}}{\text{USD}}\right)$ 1,02,500 x 60.30	INR 61,80,750

Evaluation of option 2:

Particulars	Calculation	Amount
USD liability on Day 0	5,000 x 20	USD 1,00,00
INR outflow on Day 0	USD x ASK $\left(\frac{\text{INR}}{\text{USD}}\right)$ 1,00,000 x 60.55	INR 60,55,000
Add: Interest for 3 months @ 14%	60,55,000 x 14% x (3/12)	INR 2,11,925
INR outflow at end of Month 3	60,55,000 + 2,11,925	INR 62,66,926

Conclusion: Option 1 is to be preferred as the same has lower outflow in INR.**Part VII – Netting****25. Netting (Nov 2015 RTP)**

AMK Ltd. an Indian 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:

US USD 12.5 million

UK GBP 6 million

Following exchange rate information is obtained

	USD/INR	GBP/INR
Spot	0.0215	0.0149
30 days forward	0.0217	0.0150

Annual borrowing/deposit rates (simple) are available:

- ❖ INR = 6.4%/6.2%
- ❖ USD = 1.6%/1.5%
- ❖ GBP = 3.9%/3.7%

The Indian operation is forecasting a deficit of Rs.500 million. It is assumed that interest rates are based on a year of 360 days.

- a) Calculate the cash balance at the end of 30 days period in INR for each company under each of the following scenarios:
 - 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
- b) Which method do you think is preferable from the parent company's point of view?

Answer:**WN 1: Cash balance in INR if the companies act independently:**

(in lacs)

Entity	Surplus/ Deficit	Invest/ Borrow	Interest rate	Maturity value	Maturity value (INR)
US	125 USD	Invest	1.5%	1,25.1625	5,767.569
UK	60 GBP	Invest	3.7%	60.185	4,012.333
India	(5,000) INR	Borrow	6.4%	(5,026.667)	(5,026.667)
Net cash balance on day 30					4,753.235

- Maturity value (col 5) = Surplus + Interest for 1 month
- Maturity value (INR) = Maturity value (col 5)/exchange rate

WN 2: Immediate cash pooling:

Entity	Surplus/ Deficit	Surplus/ Deficit (INR)	Invest/ borrow	Interest rate	Maturity value (INR)
US	125 USD	5,813.953			
UK	60 GBP	4026.846			
India	(5,000) INR	(5,000)			
Net balance		4,840.799	Invest	6.2%	4,865.810

- Surplus/deficit (INR) = Col 2/Exchange rate
- Maturity value = Col 3 + Interest for 1 month

Conclusion:

- The company should go for immediate cash pooling as the same has resulted in higher INR at end of day 30

26. Computation of net exposure (Nov 2019 RTP)

Following are the details of cash inflows and outflows in foreign currency denominations of MNP co. an Indian export firm, which have no foreign subsidiaries:

Currency	Inflow	Outflow	Spot rate	Forward rate
USD	4,00,00,000	2,00,00,000	48.01	48.82
French Franc	2,00,00,000	80,00,000	7.45	8.12
GBP	3,00,00,000	2,00,00,000	75.57	75.98
JPY	1,50,00,000	2,50,00,000	3.20	2.40

- Determine the net exposure of each foreign currency in terms of Rupees
- Are any of the exposure positions offsetting to some extent

WN 1: Computation of net exposure:

Currency	Inflow	Outflow	Net exposure	Spot rate	Net exposure at spot rate	Forward rate	Net exposure at forward rate	Spread	Net exposure at spread
USD	40	20	20	48.01	960.20	48.82	976.40	0.81	16.20
FFR	20	8	12	7.45	89.40	8.12	97.44	0.67	8.04
GBP	30	20	10	75.57	755.70	75.98	759.80	0.41	4.10
JPY	15	25	-10	3.20	-32.00	2.40	-24.00	-0.80	8.00
Total exposure					1,773.30		1,809.64		36.34

- Exposure of each currency is being offset partly because of payable/receivable. Additionally, exposure of JPY is being offset by a better forward rate.

Part VIII – Forward Contract**27. FC – Importer (Nov 2012 RTP)**

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st.Aug, 2012 for which it has to make a payment of US \$ 50,000 on November 30, 2012. The present exchange rate is 1 US \$ = Rs.40. It can purchase forward 1 US \$ at Rs.39. The company will have to make a upfront premium (margin) 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:

- If the exchange rate on November 30, 2012 is Rs. 42 per US \$.
- If the exchange rate on November 30, 2012 is Rs. 38 per US \$.

Answer:**WN 1: Computation of cover rate:**

Particulars	Calculation	Amount
Base rate		39.000
Premium	39 x 2%	0.780
Interest on premium	0.78 x 10% x (4/12)	0.026

Effective cover rate	39.806

WN 2: Computation of profit or loss through forward contract:

Particulars	ER of Rs.42	ER of Rs.38
Outflow under forward contract (1)	19,90,300 (50,000 × 39.806)	19,90,300 (50,000 × 39.806)
Outflow if forward contract was not taken (2)	21,00,000 (50,000 × 42)	19,00,000 (50,000 × 38)
Net profit/loss due to hedging (2 - 1)	1,09,700	(90,300)

28. FC - Exporter (May 2016)

A company expects to receive 500,000 CD falling due six months from now. The finance manager decides to hedge the transaction using forward contracts. Interest rate in Canada is 15 % while that in UK is 12%. Current spot rate is 1 GBP = 2.5 CD. Evaluate the situation if sterling was to

- Gain 4%
- Lose 2%
- Remain stable at present level

Assume that the forward exchange rate differential reflects the interest rate parity analysis of forward rates.

Answer:**WN 1: Computation of cover rate using IRPT:**

Spot rate = CD 2.50/GBP
Home currency = CD
R _h (CD) = 15% per annum (or) 7.5% per half-year
Foreign currency = GBP
R _f (GBP rate) = 12% per annum (or) 6% per half-year
$\frac{1 + R_h}{1 + R_f} = \frac{F_1}{e_0}; \frac{1 + 7.5\%}{1 + 6\%} = \frac{F_1}{2.50}$
$F_1 = \frac{2.50 \times 1.075}{1.06} = 2.5354 \text{ CD/GBP}$

WN 2: Computation of profit/loss for three scenarios:

Particulars	Gain of 4%	Loss of 2%	No change
Current Spot rate	2.5CD/GBP	2.5CD/GBP	2.5CD/GBP
Future spot rate	2.6CD/GBP	2.45CD/GBP	2.5CD/GBP
Forward rate (cover rate)	2.5354CD/GBP	2.5354CD/GBP	2.5354CD/GBP
Realization:			
Hedged (Forward rate) (5,00,000/Forward rate)	1,97,209.30	1,97,209.30	1,97,209.30
Unhedged (Future spot rate) (5,00,000/Future spot rate)	1,92,307.69	2,04,081.63	2,00,000
Profit/Loss due to hedging (Hedged - Unhedged)	4,901.61	-6,872.33	-2,790.70

Note:

- Any appreciation/depreciation percentage is to be applied only on product. In this case GBP is the product and appreciation/depreciation percentage is given for the product

29. Honor of forward contract - Early honor:

On 1 October 2015 Mr. X an exporter enters into a forward contract with a BNP Bank to sell US\$ 1,00,000 on 31 December 2015 at Rs. 65.40/\$. However, due to the request of the importer, Mr. X received amount on 28 November 2015. Mr. X requested the bank the take delivery of the remittance on 30 November 2015 i.e. before due date. The inter-banking rates on 28 November 2015 was as follows:

Spot	Rs.65.22/65.27
One Month Premium	10/15

If bank agrees to take early delivery then what will be net inflow to Mr. X assuming that the prevailing prime lending rate is 18%.

Answer:**WN 1: Computation of swap loss:**

Analysis from customer's point of view:

Date	Position	Action	Reference Date	Rate
Oct 1	Original Position	Sell (BID)	December 31	65.40
Nov 28	Opposite Position	Buy (ASK)	December 31	-65.42
Nov 28	New position	Sell (BID)	Nov 28	65.22
Effective rate			65.40 – 65.42 + 65.22	65.20
Swap loss per USD			65.40 – 65.20	0.20
Total Swap loss			0.20 x 1,00,000	20,000

❖ Swap loss is the difference between effective rate – original rate

WN 2: Computation of interest cost:**Analysis from bank's point of view:**

Particulars	Amount
Nov 28 – Bank will buy from customer	-65.40
Nov 28 – Bank will sell at spot rate to some other Bank	65.22
Outflow for banker	0.18
Total outflow for banker (1,00,000 x 0.18)	18,000
Interest cost to be recovered (18,000 x 18% x 31/365)	275

WN 3: Total outflow for early honour:

Particulars	Amount
Swap loss	20,000
Interest charges	275
Total recovery from customer	20,275

WN 4: Net realization for customer:

Particulars	Amount
Sale of 2,00,000 USD at original rate (1,00,000 x 65.40)	65,40,000
Less: Charges (WN 3)	(20,275)
Net realization for customer	65,19,725

Comment:

- ❖ Net realization is basically to be computed at effective rate of 65.20 per USD. Hence it can also be calculated as Rs.65,20,000 (1,00,000 x 65.20)
- ❖ Net realization = 65,20,000 – Interest cost (275) = Rs.65,19,725

30. Early cancellation (Nov 2015)

A bank enters into a forward purchase covering the export bill for Swiss France 1,00,000 at Rs 32.4000 due on 25th April and converted itself for same delivery in the local interbank market at Rs.32.4200. However, on 25th March exporter sought for cancellation of the contract as the tenor of the bill is changed.

In Singapore market, Swiss Francs were quoted against US 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=Rs.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 0.10% on buying and selling.

Answer:**Computation of cancellation gain/loss:**

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	April 25	32.4000
March 25	Opposite Position	Buy (ASK)	April 25	-32.9474
Loss on cancellation per USD			32.4000 – 32.9432	-0.05474

Total loss on cancellation	-0.05474 x 1,00,000	54,740

Note:

- It is assumed that original contract rate of 32.4000 is after including exchange margin of 0.10%
- Buy rate on March 25 for April 25 (one-month forward rate) is calculated as under:

$$\text{ASK} \left(\frac{\text{INR}}{\text{CHF}} \right) = \text{ASK} \left(\frac{\text{INR}}{\text{USD}} \right) \times \text{ASK} \left(\frac{\text{USD}}{\text{CHF}} \right)$$

$$\text{ASK} \left(\frac{\text{INR}}{\text{CHF}} \right) = 49.9154 \times \frac{1}{1.5150} = 32.9474$$

- 1-month forward ASK(INR/USD) rate = (49.4455+0.4200) + 0.10% = 49.9154
- Exchange margin is applicable only for interbank market rate and not considered for Singapore market. Hence USD/CHF rate has not been adjusted for exchange margin of 0.10%

31. Leading and lagging & FC-Cancellation (May 2012, May 2018 RTP)

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 Rs. 48.90.

The market rates for Rupee and Dollar are as under:

Spot	Rs.48.50/70
Two months	25/30 points
Three months	40/45 months

The company wants to cover the risk and it has two options as under:

- To cover payables in the forward market and
- 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?

Answer:**WN 1: Evaluation of option of covering payables in the forward market:**

Particulars	Calculation	Amount (in lacs)
Day 0: Enter into forward contract to buy 7,00,000 USD in M3 at Rs.49.15 per USD (48.70 + 0.45)		
Month 2: Receive 4,50,000 USD at contracted rate of 48.90	4.5 x 48.90	220.05
Day 60 to 90: Interest earned/saved for one month on Rs.220.05 lacs	220.05 x 1%	2.20
Day 90: Payment of 7,00,000 USD in M3	7 x 49.15	-344.05
Net outflow		-121.80

WN 2: Evaluation of option of lagging the receivables:

- The company plans to lag the receivables by one month. In this option the company will have to cover payables of 2,50,000 USD as balance 4,50,000 USD will be paid out of export proceeds
- Under this option the company will have to cancel the forward contract as they will not be able to honour the same in month 2

Calculation of cancellation gain or loss:

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Sell (BID)	Month 2	48.90
Day 0	Opposite Position	Buy (ASK)	Month 2	-49.00
Loss on cancellation per USD			48.90 - 49.00	-0.10
Total loss on cancellation			-0.10 x 4.5 lacs	0.45 lacs

Total outflow:

Particulars	Calculation	Amount (in lacs)
Day 0: Enter into forward contract to buy 2,50,000 USD in M3 at Rs.49.15 per USD (48.70 + 0.45)		
Day 0: Payment of cancellation loss		-0.45
Day 0 to Day 90: Interest on cancellation loss for 3 months	0.45 x 3%	-0.01
Day 90: Payment of 2,50,000 USD in M3	2.5 x 49.15	-122.88
Net outflow		-123.34

Conclusion:

- The company should go for option 1 as the same has lower net outflow. Hence we should go for covering the entire payables

32. Roll over - importer (May 2015 RTP)

An importer requests his bank to extend the forward contract for US\$ 20,000 which is due for maturity on 30 October, 2010, for a further period of 3 months. He agrees to pay the required margin money for such extension of the contract.

Contracted Rate - US\$ 1 = Rs. 42.32

The US Dollar quoted on 30-10-2010:-

- ❖ Spot - 41.5000/41.5200
- ❖ 3 months' Premium -0.87% /0.93%
- ❖ Margin money for buying and selling rate is 0.075% and 0.20% respectively.

Compute:

- The cost to the importer in respect of the extension of the forward contract, and
- The rate of new forward contract.

Answer:**WN 1: Computation of cancellation gain/loss:**

Date	Position	Action	Reference Date	Rate
Original date	Original Position	Buy (ASK)	October 31	-42.32
Oct 31	Opposite Position	Sell (BID)	October 31	41.47
Oct 31	New Position	Buy (ASK)	November 30	-41.99
Effective rate			-42.32+41.47-41.99	-42.81
Loss on cancellation per USD			-42.32+41.47	-0.85
Total loss on cancellation			-0.85 x 20,000	-17,000
Effective loss per USD			-42.81 - (-42.32)	0.49
Total effective loss			0.49 x 20,000	-9,800

- Cost to the importer in respect of extension of forward contract = Rs.17,000 (Loss on cancellation). However, the effective loss for the importer is Rs.9,800
- Rate of new forward contract = Rs.41.99

Note:**BID rate on October 31 for October 31:**

- BID rate on October 31 = $41.50 - 0.075\% = 41.50 - 0.0311 = \text{Rs.}41.4689 \sim \text{Rs.}41.47$
- It is assumed that margin money percentage of buying and selling rate is to be interpreted from banker point of view. Hence margin of 0.075% is considered for Banker buying rate (BID rate) and 0.20% is considered for Banker selling rate (ASK Rate)

ASK rate on October 31 for November 30:

- Spot ask rate = 41.52
- 3-month forward rate without exchange margin = $41.52 + 0.93\% = 41.9061$
- Final 3-month forward rate with exchange margin = $41.9061 + 0.20\% = 41.9899 \sim \text{Rs.}41.99$

33. Customer not appearing on due date (May 2015, May 2018)

An importer booked a forward contract with his bank on 10th April for USD 2,00,000 due on 10th June @ Rs. 64.4000. The bank covered its position in the market at Rs. 64.2800.

The exchange rates for dollar in the interbank market on 10 June and 20 June were:

	June 10	June 20
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 20th June for extension of contract with due date on 10th August. Rates rounded to 4 decimal in multiples of 0.0025. On 10th June, Bank Swaps by selling spot and buying one month forward. Calculate:

- ❖ Cancellation rate

- ❖ Amount payable on \$ 2,00,000
- ❖ Swap loss
- ❖ Interest on outlay of funds, if any
- ❖ New contract rate
- ❖ Total Cost

Answer:**WN 1: Evaluation from importer point of view:**

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.4000
June 20	Opposite Position	Sell (BID)	June 20	63.6175
June 20	New Position	Buy (ASK)	Aug 10	-64.3150
Effective rate			-64.40+63.6175-64.3150	-65.0975
Loss on cancellation per USD			-64.40+63.6175	-0.7825
Total loss on cancellation			-0.7825 x 2,00,000	-1,56,500
Effective loss per USD			-65.0975 - (-64.40)	-0.6975
Total effective loss			-0.6975 x 2,00,000	-1,39,500

Note:**BID rate on June 20 (Spot rate):**

- BID rate = 63.6800 - 0.10% = 63.6163 ~ 63.6175 (multiples of 0.0025)

ASK rate on June 20 for August 10:

- Ask rate without exchange rate = 64.2500
- Final Ask rate = 64.25 + 0.10% = 64.31425 ~ 64.3150

WN 2: Computation of swap loss (evaluation from bank point of view):

Date	Position	Action	Reference Date	Rate
Apr 10	Original Position	Buy (ASK)	June 10	-64.28
June 10	Opposite Position	Sell (BID)	June 10	63.80
June 10	New Position	Buy (ASK)	June 30	-63.95
Effective rate			-64.28+63.80-63.95	-64.43
Loss on cancellation per USD			-64.28+63.80	-0.48
Total loss on cancellation			-0.48 x 2,00,000	-96,000
Effective loss per USD			-64.43 - (-64.28)	-0.15
Total effective loss			-0.15 x 2,00,000	-30,000

Note:

- The customer did not come on due date and is yet to give instructions to the company on honour/instruction/cancellation
- As per FEDAI Rule 8 a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled on 15th day from the date of maturity.
- However, customer can ask for honour/cancellation/extension within 15 days and hence the bank is required to roll-over his contract with the next available contract. The process of extension has been presented in WN 2 and the effective loss of the bank will be recovered from the customer in the form of swap loss

WN 3: Final solution:

Particulars	Calculation	Amount
Cancellation rate	WN 1	63.6175
Amount payable on USD 2,00,000	WN 1	1,56,500
Swap loss	WN 2	30,000
Interest on outlay of funds (This is banker outflow on cancellation due to non-receipt of instructions from customer)	$96,000 \times 12\% \times \left(\frac{10}{365}\right)$	316
New Contract rate	WN 1	64.3150
Total cost	$1,56,500 + 30,000 + 316$	1,86,816

34. Customer not appearing on due date (Nov 2016)

On 10th July, an importer entered into a forward contract with bank for USD 50,000 due on 10th September at an exchange rate of Rs.66.8400. The bank covered position in the inter-bank market at Rs.66.6800.

How the bank would react if the customer requests on 20th September:

- ❖ To cancel the contract?
- ❖ To execute the contract?
- ❖ To extend the contract with due date to fall on 10th November?

The exchange rates for USD in the interbank market were as follows:

	September 10	September 20
Spot	66.1500/1700	65.9600/9900
Spot/September	66.2800/3200	66.1200/1800
Spot/October	66.4100/4300	66.2500/3300
Spot/November	66.5600/6100	66.4000/4900

Exchange margin was 0.1% on buying and selling. Interest on outlay of funds was 12%. You are required to show the calculations to:

- ❖ Cancel the contract
- ❖ Execute the contract and
- ❖ Extend the contract

Answer:

WN 1: Evaluation from importer point of view:

Date	Position	Action	Reference Date	Rate
July 10	Original Position	Buy (ASK)	Sep 10	-66.8400
Sep 20	Opposite Position	Sell (BID)	Sep 20	65.8940
Loss on cancellation per USD			-66.84+65.8940	-0.946
Total loss on cancellation			-0.946 x 50,000	47,300

Note:

BID rate on Sep 20 (Spot rate):

- BID rate = 65.9600 - 0.10% = 65.8940

WN 2: Computation of swap loss (evaluation from bank point of view):

Date	Position	Action	Reference Date	Rate
Jul 10	Original Position	Buy (ASK)	Sep 10	-66.68
Sep 10	Opposite Position	Sell (BID)	Sep 10	66.15
Sep 10	New Position	Buy (ASK)	Sep 30	-66.32
Effective rate			-66.68+66.15-66.32	-66.85
Loss on cancellation per USD			-66.68+66.15	-0.53
Total loss on cancellation			0.53 x 50,000	26,500
Effective loss per USD			-66.85 - (-66.68)	-0.17
Total effective loss			-0.17 x 50,000	8,500

Note:

- The customer did not come on due date and is yet to give instructions to the company on honour/instruction/cancellation
- As per FEDAI Rule 8 a forward contract which remains overdue without any instructions from the customers on or before due date shall stand automatically cancelled on 15th day from the date of maturity.
- However, customer can ask for honour/cancellation/extension within 15 days and hence the bank is required to roll-over his contract with the next available contract. The process of extension has been presented in WN 2 and the effective loss of the bank will be recovered from the customer in the form of swap loss

WN 3: Cost to be paid for cancellation/extension/honour:

Particulars	Calculation	Amount
Cancellation loss	WN 1	47,300
Swap loss	WN 2	8,500
Interest on outlay of funds (This is banker outflow on cancellation due to non-receipt of instructions from customer)	$26,500 \times 12\% \times \left(\frac{10}{365}\right)$	87
Total cost	47,300+8,500+87	55,887

WN 4: Action under different scenarios:**Situation 1: Cancel the contract:**

- The customer has to pay Rs.55,887 towards cancellation of contract.

Situation 2: Execute the contract:

- The customer has to pay Rs.55,887 towards cancellation of contract.
- Execution of the contract will happen at the spot rate of Sep 20. Ask rate on Sep 20 = $65.99 + 0.10\% = \text{Rs.}66.0560$. Total payment for purchase of 50,000 USD = $50,000 \times 66.0560 = \text{Rs.}33,02,800$
- Total payment = Rs.33,02,800 + Rs.55,887 = Rs.33,58,687**

Situation 3: Extend the contract:

- The customer has to pay Rs.55,887 towards cancellation of contract.
- New contract rate = $66.49 + 0.10\% = \text{Rs.}66.5565$

35. Profit/loss on forward contract (Nov 2016)

A company is considering hedging its foreign exchange risk. It has made a purchase on 1st July, 2016 for which it has to make a payment of USD 60,000 on December 31, 2016. The present exchange rate is Rs.65/USD. It can purchase forward 1USD at Rs.64. The company will have to make an upfront premium @ 2% of the forward amount purchased. The cost of funds to the company is 12% per annum. In the following situations, compute the profit/loss the company will make if it hedges its foreign exchange risk with the exchange rate on 31st December 2016 as:

- Rs.68 per USD
- Rs.62 per USD
- Rs.70 per USD
- Rs.65 per USD

Answer:**WN 1: Computation of cover rate:**

Particulars	Amount
Forward Rate	INR 64.00/USD
Forward premium ($64 \times 2\%$)	INR 1.28/USD
Interest on forward premium ($1.28 \times 12\% \times (6/12)$)	INR 0.0768/USD
Cover rate	INR 65.3568/USD

WN 2: Computation of profit/loss under different scenarios:

Particulars	Rs.68/USD	Rs.62/USD	Rs.70/USD	Rs.65/USD
Foreign currency exposure	60,000 USD	60,000 USD	60,000 USD	60,000 USD
Cover rate	65.3568	65.3568	65.3568	65.3568
Payment made under forward contract [A]	39,21,408	39,21,408	39,21,408	39,21,408
Spot rate	68.00	62.00	70.00	65.00
Payment made under spot rate [B]	40,80,000	37,20,000	42,00,000	39,00,000
Profit/Loss [B-A]	1,58,592	(2,01,408)	2,78,592	(21,408)

36. Time value and currency fluctuation component (Nov 2017 RTP)

India Imports co., purchased USD 100,000 worth of machines from a firm in New York, USA. The value of the rupee in terms of the Dollar has been decreasing. The firm in New York offers 2/10, net 90 terms. The spot rate for the USD is Rs. 55; the 90 days forward rate is Rs. 56.

- Compute the Rupee cost of paying the account within the 10 days.
- Compute the Rupee cost of buying a forward contract to liquidate the account in 90 days.
- The difference between part a and part b is the result of the time value of money (the discount for prepayment) and protection from currency value fluctuation. Determine the magnitude of each of these components.

Answer:

(i) Rupee cost of paying the account within 10 days = $98,000 \text{ USD} \times \text{Rs.}55 = \text{Rs.}53,90,000$

Note:

- ❖ 2/10 net 90 would mean that the company will get 2 percent discount if the payment is done in 10 days. Hence the company will be making a payment of only 98,000 USD

- ❖ It is assumed that current spot rate would be applicable for day 10 as well

(ii) Rupee cost of paying in 90 days = 1,00,000 USD × 56 = Rs.56,00,000

(iii) Computation of the difference in part (a) and part (b) and the magnitude of components:

Particulars	Calculation	Amount
Difference in part (a) and Part (b)	56,00,000 – 53,90,000	2,10,000
Time value of money component (difference between 1,00,00 USD and 98,000 USD)	(1,00,000 – 98,000) × 56	1,12,000
Currency value fluctuation component (difference between spot rate and forward rate)	98,000 × (56 – 55)	98,000

37. Discount computation (Nov 2018)

Excel Exporters are holding an Export bill in United States Dollar (USD) 1,00,000 due 60 days hence. They are worried about the falling USD value which is currently at Rs.45.60 per USD. The concerned export consignment has been priced on an exchange rate of Rs.45.50 per USD. The firm's banker have quoted a 60-day forward rate of Rs.45.20.

Calculate:

- Rate of discount quoted by the bank
- The probable loss of operating profit if the forward sale is agreed to

Answer:

WN 1: Computation of rate of discount quoted by the bank:

$$\text{Rate of discount} = \frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{365}{60} \times 100$$

$$\text{Rate of discount} = \frac{45.20 - 45.60}{45.60} \times \frac{365}{60} \times 100 = 5.34\%$$

WN 2: Probable loss of operating profit:

Particulars	Calculation	Amount
Amount billed	1,00,000 × 45.50	45,50,000
Expected realization	1,00,000 × 45.20	45,20,000
Loss of operating profit		30,000

38. Forward contract – Early Delivery (May 2019)

On 1st January 2019 Global Limited, an exporter entered into a forward contract with BBC Bank to sell USD 2,00,000 on 31st March 2019 at Rs.71.50/USD. However due to the request of the importer, Global Limited received the amount on 28 February 2019. Global Limited requested the Bank to take delivery of the remittance on 2nd March 2019. The Inter-banking rates on 28th February were as follows:

- ❖ Spot rate = Rs.71.20/71.25
- ❖ One month premium = 5/10

If bank agrees to make early delivery then what will be the net inflow to Global Limited assuming that the prevailing lending rate is 15%. Assume 365 days in a year.

Answer:

WN 1: Computation of swap loss:

Analysis from customer's point of view:

Date	Position	Action	Reference Date	Rate
Jan 1	Original Position	Sell	March 31	71.50
Feb 28	Opposite Position	Buy	March 31	(71.35)
Feb 28	New position	Sell	Feb 28	71.20
Effective rate			71.50 – 71.35 + 71.20	71.35
Swap loss per USD			71.50 – 71.35	0.15
Total Swap loss			0.15 × 2,00,000	30,000

- ❖ Swap loss is the difference between effective rate – original rate

WN 2: Computation of interest cost:

Analysis from bank's point of view:

Particulars	Amount
Feb 28 – Bank will buy from customer	(71.50)

Feb 28 – Bank will sell at spot rate to some other Bank	71.20
Outflow for banker	0.30
Total outflow for banker (2,00,000 × 0.30)	60,000
Interest cost to be recovered (60,000 × 15% × 31/365)	764

WN 3: Total outflow for early honour:

Particulars	Amount
Swap loss	30,000
Interest charges	764
Total recovery from customer	30,764

WN 4: Net realization for customer:

Particulars	Amount
Sale of 2,00,000 USD at original rate (2,00,000 × 71.50)	1,43,00,000
Less: Charges (WN 3)	(30,764)
Net realization from customer	1,42,69,236

Comment:

- ❖ Net realization is basically to be computed at effective rate of 71.35 per USD. Hence it can also be calculated as Rs.1,42,70,000 (2,00,000 × 71.35)
- ❖ Net realization = 1,42,70,000 – Interest cost (764) = Rs.1,42,69,236

39. Forward contract – Early Delivery (Nov 2018)

On 19th January, Bank A entered into forward contract with a customer for forward sale of USD 7,000, delivery 20th March at Rs.46.67. On the same day, it covered its position by buying forward from the market due 19th March at the rate of Rs.46.655. On 19th February, the customer, approaches the bank and requests for early delivery of USD. Rates prevailing in the interbank markets on that date are as under:

- ❖ Spot rate = Rs.46.5725/5800
- ❖ March = Rs.46.3550/3650

Interest on outflow of funds is 16% and on inflow of funds is 12%. Flat charges for early delivery are Rs.100. What is the amount that would be recovered from the customer on the transaction?

Note: Calculation are to be made on months basis than on days basis.

Answer:**WN 1: Computation of swap loss:****Analysis from customer's point of view:**

Date	Position	Action	Reference Date	Rate
Jan 19	Original Position	Buy	March 19	(46.67)
Feb 19	Opposite Position	Sell	March 19	46.3550
Feb 19	New position	Buy	Feb 19	(46.5800)
Effective rate			-46.6700 + 46.3550 - 46.5800	-46.8950
Swap loss per USD			46.8950 – 46.67	0.225
Total Swap loss			0.225 × 7,000	1,575

- ❖ Swap loss is the difference between effective rate – original rate

WN 2: Computation of interest cost:**Analysis from bank's point of view:**

Particulars	Amount
Feb 19 – Bank will sell to customer at original contracted rate	46.67
Feb 19 – bank will have to buy in spot market from other bank to make the above sale	(46.58)
Inflow for banker	0.09
Total inflow for banker (0.09 × 7,000)	630
Interest to be paid to customer (630 × 12% × 1/12)	6.30

WN 3: Total outflow for early honour:

Particulars	Amount
Swap loss	1,575
Flat charges	100
Interest to be paid to customer	(6.30)

Total recovery from customer	1,668.70

WN 4: Net payment by customer:

Particulars	Amount
Purchase of 7,000 USD at original rate (7,000 x 46.67)	3,26,690
Add: Charges (WN 3)	1,668.70
Total outflow for customer	3,28,358.70

40. Decision on hedging exposure - Nov 2019:

Following information relates to M/s A Ltd. which is a manufacturing-cum-exporting unit. It is exporting some electronic components to Japan, USA and Europe on 90 days credit terms:

Cost and Sales information:

Particulars	Japan	USA	Europe
Variable cost per unit	Rs.225	Rs.395	Rs.510
Export sale price per unit	Yen 650	USD 10.23	EUR 11.99
Receipts from sale due in 90 days	YEN 78,00,000	USD 1,02,300	EUR 95,920
Foreign exchange rate information:	YEN/INR	USD/INR	EUR/INR
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

Advise the company by calculating average contribution to sales ratio whether it should hedge its currency risk or not.

Answer:**Decision on whether to hedge the forex exposure:**

Particulars	Japan	USA	Europe	Total
Receipts from sale due in 90 days	YEN 78,00,000	USD 1,02,300	EUR 95,920	
Export sale price per unit	Yen 650	USD 10.23	EUR 11.99	
No of units sold	12,000	10,000	8,000	
Variable cost per unit	225	395	510	
Total variable costs	Rs.27,00,000	Rs.39,50,000	Rs.40,80,000	Rs.1,07,30,000
Realization if exposure is hedged:				
3-month forward rate	2.427	0.0216	0.0178	
Realization in INR (Exposure/rate)	Rs.32,13,844	Rs.47,36,111	Rs.53,88,764	Rs.1,33,38,719
Contribution				26,08,719
Contribution to sales ratio				19.56%
Realization if exposure is not hedged:				
3-month spot rate	2.459	0.02156	0.0179	
Realization in INR (Exposure/rate)	31,72,021	47,44,898	53,58,659	1,32,75,578
Contribution				25,45,578
Contribution to sales ratio				19.17%

Decision: A Ltd. is advised to hedge its foreign currency exchange risk.

Part IX - Money Market Hedge

41. MMH exporter (May 2019 RTP)

An exporter is a UK based company. Invoice amount is \$3,50,000. Credit period is three months. Exchange rates in London are:

- ❖ Spot Rate (\$/£) 1.5865 - 1.5905
- ❖ 3-month Forward Rate (\$/£) 1.6100 - 1.6140

Rates of interest in Money Market :

	Deposit	Loan
\$	7%	9%
£	5%	8%

- a) Compute and show how a money market hedge can be put in place.
- b) Compare and contrast the outcome with a forward contract.
- c) Rework the MMH if the tax rates in UK is 30% and in USA is 40%

Answer:

WN 1: Creation of Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Asset		USD 3,50,000.00
Create a matching liability - we will take a USD loan which will mature to USD 3,50,000	$\frac{3,50,000}{1 + 2.25\%}$	USD 3,42,298.29
Convert USD 3,42,298.29 into GBP at spot rate	$3,42,298.29 \times \left(\frac{1}{1.5905}\right)$	GBP 2,15,214.27
Invest GBP 2,15,214.27 for three months at the rate of 5%		GBP 2,15,214.27
Day 90:		
Receive USD 3,50,000 from customer and repay USD Loan		USD 3,50,000.00
Redeem GBP deposit along with interest	$2,15,214.27 + 1.25\%$	GBP 2,17,904.45

- Net inflow with money market hedge = GBP 2,17,904.45

WN 2: Computation of inflow under forward contract:

$$\text{GBP} = \text{USD} \times \left(\frac{\text{GBP}}{\text{USD}}\right); \text{GBP} = \text{USD} \times \text{BID} \left(\frac{\text{GBP}}{\text{USD}}\right)$$

$$\text{GBP} = 3,50,000 \times \frac{1}{\text{ASK} \left(\frac{\text{USD}}{\text{GBP}}\right)} = 3,50,000 \times \frac{1}{1.6140} = \text{GBP } 2,16,852.54$$

Conclusion:

- Company should go ahead with money market hedge option as the same leads to higher inflow of INR

WN 3: Evaluation of MMH with taxes:

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Asset		USD 3,50,000.00
Create a matching liability - we will take a USD loan which will mature to USD 3,50,000	$\frac{3,50,000}{1 + 1.35\%}$	USD 3,45,337.94
Borrowing rate = 2.25% per quarter. Post-tax rate = $2.25 \times 60\% = 1.35\%$		
Convert USD 3,42,298.29 into GBP at spot rate	$3,45,337.94 \times \left(\frac{1}{1.5905}\right)$	GBP 2,17,125.39
Invest GBP 2,15,214.27 for three months at the rate of 5% per annum. Quarterly rate = 1.25% Post-tax rate = $1.25\% \times 70\% = 0.875\%$		GBP 2,17,125.39
Day 90:		
Receive USD 3,50,000 from customer and repay USD Loan		USD 3,50,000.00
Redeem GBP deposit along with interest	$2,17,125.39 + 0.875\%$	GBP 2,19,025.24

- In case tax rates are given then we should work with post-tax interest rates for borrowing as well as investment

42. MMH - exporter (Nov 2012 RTP)

An Indian exporting firm, Rohit and Bros., would like to cover itself against a likely depreciation of pound sterling. The following data is given:

- ❖ Receivables of Rohit and Bros : £ 500,000
- ❖ Spot rate : Rs.56.00/£
- ❖ Payment date : 3-months
- ❖ 3 months interest rate : India: 12 % per annum, UK: 5 % per annum

What should the exporter do?

Answer:

- The company has a foreign currency Asset of GBP 5,00,000. The company is likely worried about depreciation of pound. This would lead to depreciation of asset and hence the company is worried about it
- The company can go for money market hedge option to cover the forex exposure of GBP 5,00,000

Particulars	Calculation	Amount
Day 0:		
Identify a foreign currency asset/liability - Foreign currency Asset		GBP 5,00,000
Create a matching liability - we will take a GBP loan which will mature to GBP 5,00,000	$\frac{5,00,000}{1 + 1.25\%}$	GBP 4,93,827
Convert GBP 4,93,827 into INR at spot rate	$4,93,827 \times 56$	INR 2,76,54,312
Invest INR 2,76,54,312 for three months at the rate of 12%		INR 2,76,54,312
Day 90:		
Receive GBP 5,00,000 from customer and repay GBP Loan		GBP 5,00,000
Redeem INR deposit along with interest	$2,76,54,312 + 3\%$	INR 2,84,83,941

- The company will have INR receipt of Rs.2,84,83,941 through Money Market Hedge route

Part X- Exchange Position Versus Cash Position

43. Exchange position versus cash position (May 2013 RTP)

You as a dealer of foreign exchange have the following position in Swiss Francs on October 31, 2009:

	Swiss Francs
Balance in the Nostro Account 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 maintain a credit balance of Swiss Francs 30,000 in the Nostro Account and keep as overbought position on Swiss Francs 10,000?

Answer:

WN 1: Exchange position account (swiss franc):

Particulars	Purchase/ Inflow	Sales/ Outflow
Opening balance	50,000	
Purchase of bill	80,000	
Forward sale		60,000
Cancellation of forward purchase		30,000
Remittance by TT		75,000
Cancellation of demand draft	30,000	
Total	1,60,000	1,65,000
Purchase of swiss franc	5,000	-
Revised total	1,65,000	1,65,000

WN 2: Cash position account (swiss franc):

Particulars	Receipt/ Inflow	Payment/ Outflow
Opening balance	1,00,000	
Remittance by TT		75,000
Total	1,00,000	75,000
Closing balance		25,000

Analysis on exchange position:

- The closing exchange position is zero as inflow and outflow total matches
- The company wants an overbought position of Swiss Franc 10,000. The company can do a forward purchase of Swiss Franc 10,000 to make the overbought position as 10,000

44. Nostro, Vostro and Loro account (May 2019 RTP)

XYZ Bank, Amsterdam, wants to purchase Rs.25 million against GBP for funding their Nostro account and they have credited LORO account with Bank of London, London.

Calculate the amount of GBP credited. Ongoing inter-bank rates are per \$, Rs.61.3625/3700 and per GBP, \$ 1.5260/70

Answer:

- The bank wants to buy Rs.25 million by paying GBP
- Known component = Rs.25 million
- Unknown component = ? GBP

$$\text{GBP} = \text{INR} \times \left(\frac{\text{GBP}}{\text{INR}} \right); \text{GBP} = \text{INR} \times \text{ASK} \left(\frac{\text{GBP}}{\text{INR}} \right); \text{GBP} = \text{INR} \times \text{ASK} \left[\left(\frac{\text{GBP}}{\text{USD}} \right) \times \left(\frac{\text{USD}}{\text{INR}} \right) \right]$$

$$\text{GBP} = 2,50,00,000 \times \left(\frac{1}{1.5260} \right) \times \left(\frac{1}{61.3625} \right) = \text{GBP } 2,66,982$$

Part XI - Currency Futures and Options

Part XII - Currency Swaps

45. Hedging currency exposure (May 2013 RTP, May 2019 RTP)

ABC Limited, a US based company, has won a contract in India for drilling oil field. The project will require an initial investment of Rs.500 Crores. The oil field along with equipments will be sold to Indian Government for Rs.740 crores 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:

- ❖ Construct a swap that will help ABC Limited to reduce the exchange rate risk
- ❖ Assume that Indian Government offers a swap at a spot rate which is 1 USD = Rs.50 in one year, then should the company opt for this option or should it do nothing. The spot rate after one year is expected to be 1 USD = Rs.54. Further you may also assume that the ABC Limited can also take a USD loan at 8% p.a.

Answer:

WN 1: Construction of swap:

Currency swap can be created by following the below steps:

- ABC Limited to borrow USD 10 Crores in USA
- Swap USD 10 Crores with INR 500 Crores on day 0. This swap will be done with Government of India
- Swap back INR 500 Crores with USD 10 Crores on day 365. This will ensure that company is impacted only to the extent of profit

WN 2: Benefit of swap arrangement:

Particulars	Without Swap	With Swap
1. INR receipt on day 365	740 crores	740 crores
2. Equivalent USD	13.7037 Crores	14.4444 Crores
3. USD loan to be repaid	10.80 crores	10.80 crores
4. Net gain	2.9037 Crores	3.6444 Crores

- Company should go ahead with swap arrangement as the same has higher net gain

46. Currency swaps:

Companies A and B face the following interest rates:

Particulars	A	B
US Dollars (Floating rate)	LIBOR + 0.5%	LIBOR + 1.0%
Canadian (Fixed rate)	5.0%	6.5%

Assume that A wants to borrow USD at floating rate of interest and B wants to borrow Canadian dollars at a fixed rate of interest. A financial institution is planning to arrange a swap and requires a 50-basis point spread. If the swap is equally attractive to A and B, what rates of interest will A and B end up paying?

Answer:

WN 1: Identification of interest rate benefit:

Particulars	Calculation	Amount
Total cost of combination 1	LIBOR + 0.5% + 6.5%	LIBOR + 7%

[A (USD) and B (Canadian dollars)]		
Total cost of combination 2	5% + LIBOR + 1%	LIBOR + 6%
[A (CAD) and B (USD)]		

- ❖ Ideal combination as per the above table is combination 2 as the same has lower net cost. Therefore, Company A should borrow in CAD and company B should borrow in USD. However, the actual borrowing requirement is opposite and hence the opportunity for interest rate swap exists
- ❖ Swap will have total gain of 1 percent. The swap intermediary will charge 50 basis point and the balance 50 bps will be shared. Net gain for A Limited is 25 bps and Net gain for B Limited is 25 bps

WN 2: Structuring Interest Rate Swap (IRS):

Particulars	Company A	Company B
Borrow from bank as per ideal combination	CAD 5%	USD LIBOR + 1%
Receive from swap intermediary (receive what is paid to bank)	CAD 5%	USD LIBOR + 1%
Pay to swap intermediary (bal figure)	USD LIBOR + 0.25%	CAD 6.25%
Effective cost (original planned cost - swap gain)	USD LIBOR + 0.25%	CAD 6.25%

- ❖ Net receipt for swap intermediary in USD = USD LIBOR + 0.25% - USD LIBOR + 1% = (USD LIBOR + 0.75%)
- ❖ Net receipt for swap intermediary in CAD = 6.25% - 5% = 1.25%
- ❖ Hence swap intermediary will have net receipt of 1.25 percent in CAD and net payment of 0.75% for USD

47. Currency swap

A Inc. and B Inc. intent to borrow \$ 2,00,000 and \$2,00,000 in JPY respectively for a time horizon of one year. The prevalent interest rates are as follows:

Company	YEN Loan	USD Loan
A Inc	5%	9%
B Inc	8%	10%

The prevalent exchange rate is USD 1 = YEN 120.

They entered in a currency swap under which it is agreed that B Inc will pay A Inc @ 1% over the YEN loan interest rate which the later will have to pay as a result of the agreed currency swap whereas A Inc will reimburse interest to B Inc only to the extent of 9%. Keeping the exchange rate invariant, quantify the opportunity gain or loss component of the ultimate outcome, resulting from the designed currency swap.

Answer:

WN 1: Structuring of swap arrangement:

Particulars	Company A	Company B
Borrow from bank	YEN 5%	USD 10%
B to A	(YEN 6%)	YEN 6%
A to B	USD 9%	(USD 9%)
Effective borrowing cost	USD 9% and negative YEN (1%)	YEN 6% and USD 1%
Effective original borrowing cost	USD 9%	YEN 8%
Net gain in swap arrangement	YEN 1%	YEN 2% but pay USD 1%
Net gain in % terms	1%	1%

WN 2: Cash flows of swap arrangement:

Particulars	Company A	Company B
Payment to bank	YEN 12,00,000 [2,40,00,000 x 5%]	USD 20,000 [2,00,000 x 10%]
B to A	YEN 14,40,000 [2,40,00,000 x 6%]	YEN 14,40,000 [2,40,00,000 x 6%]
A to B	USD 18,000 [2,00,000 x 9%]	USD 18,000 [2,00,000 x 9%]
Effective borrowing cost	Pay USD 18,000 and receipt of YEN 2,40,000	Pay USD 2,000 and YEN 14,40,000

Net Benefit for Company A:

- ❖ Company A is receiving YEN of 2,40,000. The same will be converted into USD 2,000
- ❖ Net borrowing cost for company A is USD 16,000

- ❖ Original borrowing cost as per given rates is USD 18,000 [$2,00,000 \times 9\%$]
- ❖ Net gain of Swap arrangement is USD 2,000 [1%]

Net Benefit for Company B:

- ❖ Company A is paying USD 2,000. The same will be converted into YEN 2,40,000
- ❖ Total borrowing cost is YEN 16,80,000
- ❖ Rate as per original borrowing rate is YEN 19,20,000 [$2,40,00,000 \times 8\%$]
- ❖ Net gain of swap arrangement is YEN 2,40,000 [1%]

Part XIII – Multiple Forex Hedging Strategies**48. Comprehensive (Nov 2015)**

XYZ Limited, a US firm will need GBP 3,00,000 in 180 days. In this connection, the following information is available

Spot rate 1 GBP = USD 2.00
 180 days forward rate 1 GBP = USD 1.96

Interest rates are as follows:

	UK	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

A call option on GBP that expires in 180 days has an exercise price of USD 1.97 and a premium of USD 0.04.

XYZ limited has forecasted the spot rates 180 days hence as below:

Future rate	Probability
USD 1.91	25%
USD 1.95	60%
USD 2.05	15%

Which of the following strategies would be most preferable to XYZ Limited?

- A forward contract
- A money market hedge
- An option contract
- No hedging

Answer:**WN 1: Computation of USD outflow in case of forward contract:**

- 180 days forward rate for 1.96 USD/GBP. The company needs to pay 3,00,000 GBP in 180 days
- **Outflow in USD = $3,00,000 \times 1.96 = \text{USD } 5,88,000$**

WN 2: Computation of USD outflow in case of Money Market Hedge:

- The company has a foreign currency liability of GBP 3,00,000. XYZ Limited should create a matching GBP deposit which will mature to GBP 3,00,000 in 180 days

Particulars	Calculation	Amount
Day 0		
1. Amount of GBP deposit to be created	$3,00,000 / (1 + 2.25\%)$	GBP 2,93,398.53
2. USD loan to be taken on day 0	$2,93,398.53 \times 2$	USD 5,86,797.06
3. Take USD loan and create GBP deposit		
Day 180		
4. Redeem GBP deposit and pay supplier		GBP 3,00,000
5. USD outflow on day 180	$5,86,797.06 + 2.75\%$	USD 6,02,933.98

WN 3: Computation of USD outflow in case of option contract:

Expected rate	Outflow (incl premium)	Probability	Product
USD 1.91	USD 1.95	0.25	0.4875
USD 1.95	USD 1.99	0.60	1.1940
USD 2.05	USD 2.01	0.15	0.3015
Effective rate			1.983

USD outflow on day 180 = $3,00,000 \times 1.983 = \text{USD } 5,94,900$

Note:

- Premium of USD 0.04 is paid on day 0. The company may incur interest on this premium. However, the same has been ignored in the above analysis

WN 4: Computation of USD outflow in case of no hedge:

Expected rate	Probability	Product
USD 1.91	0.25	0.4775
USD 1.95	0.60	1.1700
USD 2.05	0.15	0.3075
Effective rate		1.955

USD outflow on day 180 = 3,00,000 x 1.955 = USD 5,86,500

Conclusion:

The company should opt for no hedge route as USD outflow is lowest in case of no hedge.

49. Comprehensive (Nov 2016 RTP)

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, 2009.

Market information as at June 1, 2009 is:

Exchange rates		Currency futures	Contract size Rs.4,72,000
USD / INR		USD / INR	
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	Rs.10,000	7.50%
September	Rs.15,000	8.00%

On September 1, 2009 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.

- Using forward contract
- Using currency futures
- Not hedging currency risks

It may be assumed that variation in margin would be settled on the maturity of the futures contract.

Answer:**WN 1: Computation of INR inflow in case of forward contract:**

- September 1 forward rate is USD 0.02127/INR. The company will receive 1,00,000 USD on September 1
- Inflow in INR = 1,00,000/0.02127 = INR 47,01,457**

Computation of INR inflow under Futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	USD 1,00,000
2. Amount of exposure in INR (1,00,000/0.02118)	INR 47,21,435
3. Size of one contract	INR 4,72,000
4. No of contracts	10

- The company should enter into 10 contracts of buying INR (selling USD)
- Margin money paid on day 0 = 15,000 x 10 = Rs.1,50,000
- Interest on Margin Money = 1,50,000 x 8% x (3/12) = Rs.3,000**

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
June 1	Original Position	Buy	Sep 01	(USD 0.02118/INR)
Sep 1	Opposite Position	Sell	Sep 01	USD 0.02134/INR
Profit per INR				USD 0.00016/INR
Total Profit (0.00016 x 10 x 4,72,000)				USD 755.20

Note 3: Final Realization:

Particulars	Calculation	Amount
1. Spot realization	1,00,000/0.02133	Rs.46,88,233
2. Futures settlement	755.20/0.02133	Rs.35,406
3. Interest on margin money		(Rs.3,000)
4. Net realization		47,20,639

WN 3: Computation of INR inflow in case of no hedge:

- September 1 spot rate is USD 0.021233/INR. The company will receive 1,00,000 USD on September 1
- Inflow in INR = $1,00,000/0.02133 = \text{Rs.}46,88,233$

Conclusion:

- The company should go ahead with futures contract for hedging

50. Comprehensive

EFD Ltd. is an export oriented business house based in Mumbai. The Company invoices in customers' currency. Its receipt of US \$ 10,000,000 is due on April 1, 2015.

Market information as at Jan 1, 2015 is:

Exchange rates		Currency futures	Contract size Rs.24,816,975
USD /INR		USD/INR	
Spot	0.016667	1 month	0.016519
1 month forward	0.016529	3 month	0.016118
3 months forward	0.016129		

	Initial Margin	Interest rates in India
1 month	Rs.17,500	6.5%
3 months	Rs.22,500	7%

On April 1, 2015 the spot rate US \$Re. is 0.016136 and currency future rate is 0.016134. Comment which of the following methods would be most advantageous for EFD Ltd.

- Using forward contract
- Using currency futures
- Not hedging currency risks

Answer:**WN 1: Computation of INR inflow in case of forward contract:**

- April 1 forward rate is USD 0.016129/INR. The company will receive 10,00,000 USD on September 1
- Inflow in INR = $10,00,000/0.016129 = \text{INR } 62,00,01,240$

Computation of INR inflow under Futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	USD 10,00,000
2. Amount of exposure in INR ($10,00,000/0.016118$)	INR 62,04,24,370
3. Size of one contract	INR 2,48,16,975
4. No of contracts	25

- The company should enter into 25 contracts of buying INR (selling USD)
- Margin money paid on day 0 = $22,500 \times 25 = \text{Rs.}5,62,500$
- Interest on Margin Money = $5,62,500 \times 7\% \times (3/12) = \text{Rs.}9,844$

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
Jan 1	Original Position	Buy	Apr 1	(USD 0.016118/INR)
Apr 1	Opposite Position	Sell	Apr 1	USD 0.016134/INR
Profit per INR				USD 0.000016/INR
Total Profit ($0.000016 \times 25 \times 2,48,16,975$)				USD 9,926.79

Note 3: Final Realization:

Particulars	Calculation	Amount

1. Spot realization	10,00,000/0.016136	61,97,32,276
2. Futures settlement	9,926.79/0.016136	6,15,195
3. Interest on margin money		(9,844)
4. Net realization		62,03,37,627

WN 3: Computation of INR inflow in case of no hedge:

- June 1 spot rate is USD 0. 0.016136/INR. The company will receive 10,00,000 USD on June 1
- Inflow in INR = $10,00,000/0.016136 = \text{Rs.} 61,97,32,276$

Conclusion:

- The company should go ahead with futures contract for hedging

51. Comprehensive (Nov 2016 RTP)

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months time. The relevant spot and forward rates are:

- ❖ Spot rate USD 1.5617-1.5673
- ❖ 6 months' forward rate USD 1.5455 -1.5609

The borrowing rates in U.K. and U.S. are 7% and 6% respectively and the deposit rates are 5.5% and 4.5% respectively. Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD 1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period.

The company has 3 choices:

- Forward cover
- Money market cover and
- Currency option

Which of the alternatives is preferable by the company?

Answer:**WN 1: Computation of GBP outflow in case of forward contract:**

- 6 months forward rate = USD 1.5455 - 1.5609/GBP
- GBP outflow on day 180 = $3,64,897/1.5455 = \text{GBP } 2,36,102.88$

WN 2: Computation of GBP outflow in case of Money Market Hedge:

- The company has foreign currency (USD) liability and hence has to create USD deposit for money market hedge

Particulars	Calculation	Amount
Day 0		
1. Amount of USD deposit to be created	$3,64,897/(1+2.25\%)$	USD 3,56,867.48
2. GBP loan to be taken on day 0	$3,56,867.48 \times (1/1.5617)$	GBP 2,28,512.19
3. Take GBP loan, convert into USD and create USD deposit		
Day 180		
4. Redeem USD deposit and pay supplier		USD 3,64,897
5. GBP outflow after 6 months	$2,28,512.19 + 3.5\%$	GBP 2,36,510.12

WN 3: Computation of GBP outflow in case of Option Contract:

- The strike price of option is USD 1.70/GBP. Product currency is GBP and hence we can buy/sell GBP with option contract
- The company needs to buy USD. This can also be considered as selling GBP.
- The company plans to sell GBP and hence we should opt for Put option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	USD 3,64,897
2. Amount of exposure in GBP ($3,64,897/1.70$)	GBP 2,14,645
3. Size of one contract	GBP 12,500
4. No of contracts ($2,14,645/12,500$)	17.17 ~ 17

Note 2: Computation of premium:

Particulars	Amount
1. Premium per GBP	USD 0.096
2. Premium per contract (12,500 × 0.096)	USD 1,200
3. Premium for 17 contracts (1,200 × 17)	USD 20,400
4. Premium in GBP (20,400/1.5617)	GBP 13,062.69
5. Interest on premium (13,062.69 × 7% × 6/12)	GBP 457.19

Note: It is assumed that A Limited is running a cash deficit and hence interest on premium is considered at borrowing rates.

Note 3: Final outflow:

Particulars	Amount
1. Sale of GBP of 17 contracts (17 × 12,500 × 1.70)	USD 3,61,250
2. GBP outflow for above 3,61,250 USD (17 × 12,500)	GBP 2,12,500
3. Balance USD required (3,64,897 – 3,61,250)	USD 3,647
4. Purchase of above USD using forward rate (3,647/1.5455)	GBP 2,359.75
5. Premium paid	GBP 13,062.69
6. Interest on premium	GBP 457.19
7. Final outflow (2 + 4 + 5 + 6)	GBP 2,28,379.63

Conclusion:

The company should go ahead with option contract for hedging the exposure

52. Comprehensive (Nov 2015 RTP)

Nitrogen Ltd, is in the process of negotiating an order amounting €4 Mln with a large German retailer on 6 months credit. If successful this will be the first time that Nitrogen Ltd has exported goods into highly competitive market. The following three alternatives are being considered for managing the transaction risk before the order is finalized.

- Invoice the German firm in sterling using the current exchange rate to calculate the invoice amount.
- Alternative of invoicing the German firm in € and using a forward foreign exchange contract to hedge the transaction risk.
- Invoice the German first in € and use sufficient 6months sterling future contracts (to the nearly whole number) to hedge the transaction risk.

- ❖ Spot rate € 1.1750-1.1770/£
- ❖ 6 months forward premium 0.60-0.55 Euro cents
- ❖ 6 months future contract is available at €1.1760/£
- ❖ 6 month future contract size is £62500
- ❖ Spot rate and 6 months futures rate €1.1785/£

Required:

- Calculate to the nearest £ the receipt for Nitrogen Ltd. Under each of the three proposals.
- In your opinion, which alternative would you consider to be the most appropriate and thereof

Answer:**WN 1: Hedging through forward contract:**

- Spot rate is EURO 1.1750 – 1.1770/GBP
- 6 months forward premium EURO 0.0060 – 0.0055/GBP [1 cent = 0.01 EURO]
- Swap points are in descending order. However, the question says premium and hence these points need to be added to get forward rate
- 6 months forward rate = EURO 1.1810 – 1.1825/GBP
- Inflow in GBP = 40,00,000/1.1825 = GBP 33,82,664

WN 2: Hedging using futures contract:**Note 1: Computation of no of contracts:**

Particulars	Amount
1. Amount of exposure	EUR 40,00,000
2. Amount of exposure in GBP (40,00,000/1.1760)	GBP 34,01,361
3. Size of one contract	GBP 62,500

4. No of contracts

54 Contracts

Note: The company should enter into 54 contracts of buying pounds (selling EUROS)

Note 2: Futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Buy	Day 180	(EURO 1.1760/GBP)
Day 180	Opposite Position	Sell	Day 180	EURO 1.1785/GBP
Profit per GBP				EURO 0.0025
Total Profit (0.0025 x 62,500 x 54)				EURO 8,437.50

Note 3: Final Realization:

Particulars	Calculation	Amount
1. Spot realization	40,00,000/1.1785	GBP 33,94,145
2. Futures settlement	8,437.50/1.1785	GBP 7,160
3. Total realization		GBP 34,01,305

WN 3: Hedging through Currency invoicing

- Under currency invoicing, the billing will happen in GBP
- It is assumed that Ask rate of EURO 1.1770/GBP is used for finding the amount to be billed
- Amount to be billed = $40,00,000/1.1770 = \text{GBP } 33,98,471$
- Amount realized after 6 months = GBP 33,98,471

Conclusion:

- The company should go ahead with futures contract for hedging as the same has higher GBP inflow

53. Options versus forward contracts (Nov 2013)

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 Financial 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	0.9301	0.9356

Price for a Can\$ / US\$ option on U.S. stock exchange (cents per Can\$, payable on purchase of the option, contract size Can\$ 50000) are as follows:

Strike Price (US \$/ Can \$)	Calls		Puts	
	July	Sept.	July	Sept.
0.93	1.56	2.56	2.56	1.75
0.94	1.02	1.05	NA	NA
0.95	0.65	1.64	1.92	2.34

According to the suggestion of financial 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 be appropriate for the American firm to hedge its foreign exchange risk on two interest payments.

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

Answer:**WN 1: Hedging of exposure of CA\$ 10,10,000 payable on 31st July:****Option 1: Forward Contract:**

- July 31 forward rate = USD 0.9301/CAD
- Outflow in USD = $10,10,000 \times 0.9301 = \text{USD } 9,39,401$

Option 2: Option contract:

- Relevant strike price = USD 0.94/CAD
- Product currency is CAD and this is a contract to buy/sell CAD

- The company has to buy CAD and hence we should go for call option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	CAD 10,10,000
2. Size of one contract	CAD 50,000
3. No of contracts	20

Note 2: Computation of premium:

Particulars	Amount
1. Premium per CAD	USD 0.0102/CAD
2. Premium per contract (50,000 x 0.0102)	USD 510
3. Premium for 20 contracts (510 x 12)	USD 10,200

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Purchase of 10,00,000 CAD using call option [10,00,000 x 0.94]	USD 9,40,000
2. Purchase of balance 10,000 CAD using future spot rate [10,000 x 0.9301]	USD 9,301
3. Premium Paid	USD 10,200
4. Total outflow [1+2+3]	USD 9,59,501

Conclusion:

The company should go ahead with forward contract for hedging the exposure

WN 2: Hedging of exposure of CA\$ 7,05,000 payable on 30th September:**Option 1: Forward Contract:**

- September 30 forward rate = USD 0.9356/CAD
- Outflow in USD = 7,05,000 x 0.9356 = USD 6,59,598

Option 2: Option contract:

- Relevant strike price = USD 0.95/CAD
- Product currency is CAD and this is a contract to buy/sell CAD
- The company has to buy CAD and hence we should go for call option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	CAD 7,05,000
2. Size of one contract	CAD 50,000
3. No of contracts	14

Note 2: Computation of premium:

Particulars	Amount
1. Premium per CAD	USD 0.0164/CAD
2. Premium per contract (50,000 x 0.0164)	USD 820
3. Premium for 14 contracts (820 x 14)	USD 11,480

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Purchase of 7,00,000 CAD using call option [7,00,000 x 0.95]	USD 6,65,000
2. Purchase of balance 5,000 CAD using future spot rate [5,000 x 0.9356]	USD 4,678
3. Premium Paid	USD 11,480
4. Total outflow [1+2+3]	USD 6,81,158

Conclusion:

The company should go ahead with forward contract for hedging the exposure

54. FC versus option (Nov 2015)

XYZ an Indian firm, will need to pay JAPANESE YEN (JY) 5, 00,000 on 30th June. In order to hedge the risk involved in foreign currency transaction, the firm is considering two alternative methods i.e. forward market cover and currency option contract.

On 1st April, following quotations (JY/INR) are made available:

Spot	3 months forward
1.9516/1.9711	1.9726/1.9923

The prices for forex currency option on purchase are as follows:

- ❖ Strike Price JY 2.125
- ❖ Call option (June) JY 0.047
- ❖ Put option (June) JY 0.098

For excess or balance of JY covered, the firm would use forward rate as future spot rate. You are required to recommend cheaper hedging alternative for XYZ.

Answer:**WN 1: Hedging through forward contract:**

- The company needs to pay JPY 5,00,000 on 30th June. The same can be covered through 3-month forward contract

$$\text{INR} = \text{JPY} \times \text{ASK} \left(\frac{\text{INR}}{\text{JPY}} \right); \text{INR} = 5,00,000 \times \frac{1}{1.9726} = \text{RS. } 2,53,472.57$$

WN 2: Hedging through option contract:

- Relevant strike price = JPY 2.125/INR
- Product currency is INR and this is a contract to buy/sell INR
- The company has to sell INR and hence we should go for put option

Note 1: Computation of no of contracts:

Particulars	Amount
1. Amount of exposure	JPY 5,00,000
2. Amount of exposure in INR [5,00,000/2.125]	INR 2,35,294.12
3. Size of one contract	INR 1
4. No of contracts	2,35,294

Note 2: Computation of premium:

Particulars	Amount
1. Premium per INR	JPY 0.098
2. Premium for 2,35,294 contracts (2,35,294 × 0.098)	JPY 23,058.81
3. Premium in INR (JPY 23,058.81/1.9516)	INR 11,815.34

Note: Interest on premium is ignored as the rate of interest is not given in problem

Note 3: Final outflow:

Particulars	Amount
1. Sale of 2,35,294 INR (2,35,294 × 2.125)	JPY 5,00,000.00
2. Outflow in INR for purchase of 5,00,000 JPY	INR 2,35,294.00
3. Premium paid	INR 11,815.34
4. Total Premium (2+3)	INR 2,47,109.34

Conclusion:

The company should go ahead with option contract for hedging the exposure

55. Investment decision (Nov 2013, May 2018 RTP)

Your bank's London office has surplus funds to 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 centers 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 and Euro are as under:

London on New York

- ❖ Spot 1.5350/90
- ❖ 1 month 15/18
- ❖ 2 month 30/35
- ❖ 3 month 80/85

London on Frankfurt

- ❖ Spot 1.8260/90
- ❖ 1 month 60/55
- ❖ 2 month 95/90
- ❖ 3 month 145/140

At which center, will the investment be made & what will be the net gain (to the nearest pound) to the bank on the invested funds?

Answer:

WN 1: Computation of net gain if investment is made in New York (USD):

Particulars	Calculation	Amount
1. Amount of surplus/amount invested		USD 5,00,000
2. Interest earned	$5,00,000 \times 8\% \times (3/12)$	USD 10,000
3. Amount on maturity		USD 5,10,000
4. Amount required to be earned	$5,00,000 + (5,00,000 \times 4\% \times 3/12)$	USD 5,05,000
5. Gain in USD		USD 5,000
6. Gain in GBP	$5,000 \times \frac{1}{1.5475}$	GBP 3,231.02

WN 2: Computation of net gain if investment is made in London (GBP):

Particulars	Calculation	Amount
1. Amount of surplus		USD 5,00,000
2. Surplus in GBP/Amount invested	$5,00,000 \times \frac{1}{1.5390}$	GBP 3,24,886
3. Interest earned	$3,24,886 \times 5\% \times (3/12)$	GBP 4,061
4. Amount on maturity		GBP 3,28,947
5. Less: GBP needed to buy 5,05,000 USD	$5,05,000 \times \frac{1}{1.5430}$	GBP 3,27,285
6. Gain in GBP (4-5)		GBP 1,662

WN 3: Computation of net gain if investment is made in Frankfurt (Euros):

Particulars	Calculation	Amount
1. Amount of surplus		USD 5,00,000
2. Surplus in Euros/Amount invested	$5,00,000 \times 1.8260 \times \frac{1}{1.5390}$	EUR 5,93,242
3. Interest earned	$5,93,242 \times 3\% \times (3/12)$	EUR 4,449
4. Amount on maturity		EUR 5,97,691
5. Less: Euros needed to buy 5,05,000 USD	$5,05,000 \times 1.8150 \times \frac{1}{1.5430}$	EUR 5,94,021
6. Gain in Euros (4-5)		EUR 3,670
7. Gain in GBP	$3,670 \times \frac{1}{1.8150}$	GBP 2,022

Conclusion:

The company should invest the surplus in New York as the same leads to maximum gain in GBP

56. Investment decision (Nov 2018)

The Treasury desk of a global bank incorporated in UK wants to invest GBP 200 million on 1st January 2019 for a period of 6 months and has the following options:

- ❖ 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

- ❖ 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	Jan 1, 2019 (SPOT)	June 30, 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. What would be your decision from a risk perspective. You may ignore taxation.

Answer:

WN 1: Computation of GBP at end of 6 months if investment is made in JPY:

Particulars	Calculation	Amount (in millions)
1. Amount of surplus		GBP 200
2. Surplus in JPY/ Amount invested	200×148.0002	JPY 29600.04
Amount on maturity:		
3. Dividend income		JPY 1,182
4. Stock lending income		JPY 10
5. Value of shares sold	$29,600.04 \times 98\%$	JPY 29,008.04
6. Total amount on maturity (3+4+5)		JPY 30,200.04
7. Amount on maturity (GBP)	$\frac{30,200.04}{150}$	GBP 201.33359

WN 2: Computation of GBP at end of 6 months if investment is made in USD:

Particulars	Calculation	Amount (in millions)
1. Amount of surplus		GBP 200
2. Surplus in USD/ Amount invested	200×1.28000	USD 256
3. Interest earned	$256 \times 5\% \times (6/12)$	USD 6.4
4. Amount on maturity (USD)		USD 262.40
5. Amount on maturity (GBP)	$\frac{262.40}{1.30331}$	GBP 201.33353

- The company should invest in JPY as the same leads to higher GBP at end of 6 months

57. Forward contract versus money market hedge (May 2015 RTP)

Columbus Surgicals Inc. is based in US, has recently imported surgical raw materials from the UK and has been invoiced for GBP 4,80,000, payable in 3 months. It has also exported surgical goods to India and France. The Indian customer has been invoiced for GBP 1,38,000, payable in 3 months, and the French customer has been invoiced for EUR 5,90,000, payable in 4 months.

Current spot and forward rates are as follows:

- ❖ Spot GBP/USD 0.9830-0.9850
- ❖ Three month forward GBP/USD 0.9520-0.9545
- ❖ Spot USD/EUR 1.8890-1.8920
- ❖ Four months forward 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 a 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

Answer:

WN 1: Hedging of payables exposure:

GBP Exposure: Since Columbus has a GBP receipt (1,38,000) and payment of (4,80,000) maturing at the same time, it can match them against each other leaving a net liability of GBP 3,42,000 to be hedged

Option 1- Forward Market Hedge:

$$\text{USD} = \text{GBP} \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right) = 3,42,000 \times \frac{1}{\text{BID} \left(\frac{\text{GBP}}{\text{USD}} \right)} = 3,42,000 \times \left(\frac{1}{0.9520} \right) = \text{USD } 3,59,244$$

Option 2- Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency liability		GBP 3,42,000
Create a matching asset that will mature to 3,42,000 GBP	$\frac{\text{GBP } 3,42,000}{1 + 2.5\%}$	GBP 3,33,659
Borrow USD loan with which we can create GBP deposit of 3,33,659 Known component = GBP 3,33,659; Unknown component = ? $\text{USD} = \text{GBP} \times \text{ASK} \left(\frac{\text{USD}}{\text{GBP}} \right); \text{USD} = 3,33,659 \times \left(\frac{1}{0.9830} \right)$		USD 3,39,429
Borrow USD loan and create GBP deposit		
Day 90		
Redeem GBP deposit along with interest and pay supplier		GBP 3,42,000
USD repayment along with interest @ 3.25%	$3,39,429 \times 1.0325$	USD 3,50,460

Conclusion: The company should go ahead with MMH route for hedging the forex payable of GBP 3,42,000

WN 2: Hedging of receivables exposure:

Foreign exchange exposure = EUR 5,90,000

Option 1 - Forward Market Hedge:

$$\text{USD} = \text{EUR} \times \text{BID} \left(\frac{\text{USD}}{\text{EUR}} \right) = 5,90,000 \times 1.9510 = \text{USD } 11,51,090$$

Option 2 - Money Market Hedge:

Particulars	Calculation	Amount
Day 0:		
Identify foreign currency asset		EUR 5,90,000
Create a matching liability that will mature to 5,90,000 EUR	$\frac{\text{EUR } 5,90,000}{1 + 5.33\%}$	EUR 5,60,144
Borrow EUR 5,60,144 and convert into USD at spot rate Known component = EUR 5,60,144; Unknown component = ? $\text{USD} = \text{EUR} \times \text{BID} \left(\frac{\text{USD}}{\text{EUR}} \right); \text{USD} = 5,60,144 \times 1.8890$		USD 10,58,112
Create USD deposit of 10,58,112 for four months		
Day 90		
Receive EUR 5,90,000 from customer and repay EURO loan		EUR 5,90,000
USD deposit maturity along with interest	$10,58,112 + 3.83\%$	USD 10,98,637

Conclusion: The company should go ahead with Forward Market Hedge route for hedging the receivable of EUR 5,90,000

58. Benefit of netting (Nov 2018 RTP)

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 £75,000 that is not needed for the foreseeable future.

Given the rates below, what is the advantage of swapping Euros and Swiss Francs into Sterling?

- ❖ Spot Rate (€) £0.6858- 0.6869
- ❖ 91 day Pts 0.0037 0.0040
- ❖ Spot Rate (CHF) 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.		
	GBP	EURO	CHF
0 to 1,00,000	1	0.25	0
1,00,001 to 5,00,000	2	1.5	0.25
5,00,001 to 10,00,000	4	2	0.50
Over 10,00,000	5.375	3	1

Answer:

WN 1: Individual investment and then final swapping into GBP:

Currency	Surplus	Interest rate	Interest earned (Amount x rate x 91/365)	Maturity Amount	Conversion rate	GBP Maturity Amount
EURO	7,25,000	2%	3,615.07	7,28,615.07	0.6895 [0.6858 + 0.0037]	5,02,380.09 [7,28,615.07 x 0.6895]
CHF	9,98,077	0.50%	1,244.18	9,99,321.18	2.3098 [2.3326 - 0.0228]	4,32,644.03 [9,99,321.18 / 2.3098]
GBP	75,000	1%	186.99	75,186.99	1	75,186.99
Maturity value at end of day 91						10,10,211.11

WN 2: Immediate swap and investment in GBP:

Currency	Surplus	Conversion rate	GBP on day 0	Interest rate	Interest amount	GBP Maturity Amount
EURO	7,25,000	0.6858	4,97,205 [7,25,000 x 0.6858]			
CHF	9,98,077	2.3326	4,27,881.76 [9,98,077 / 2.3326]			
GBP	75,000	1	75,000			
Total GBP balance			10,00,086.76	5.375	13,401.85 [10,00,086.76 x 5.375% x 91/365]	10,13,488.61

❖ Benefit of swapping = 10,13,488.61 - 10,10,211.11 = GBP 3,277.50

59. Exposure management strategy matrix:

Place the following strategies by different persons in the Exposure Management Strategies Matrix.

Strategy 1: Kuljeet a wholesaler of imported items imports toys from China to sell them in the domestic market to retailers. Being a sole trader, he is always so much involved in the promotion of his trade in domestic market and negotiation with foreign supplier that he never pays attention to hedge his payable in foreign currency and leaves his position unhedged.

Strategy 2: Moni, is in the business of exporting and importing brasswares to USA and European countries. In order to capture the market he invoices the customers in their home currency. Lavi enters into forward contracts to sell the foreign exchange only if he expects some profit out of it other-wise he leaves his position open.

Strategy 3: TSC Ltd. is in the business of software development. The company has both receivables and payables in foreign currency. The Treasury Manager of TSC Ltd. not only enters into forward contracts to hedge the exposure but carries out cancellation and extension of forward contracts on regular basis to earn profit out of the same. As a result management has started looking Treasury Department as Profit Centre.

Strategy 4: DNB Publishers Ltd. in addition to publishing books are also in the business of importing and exporting of books. As a matter of policy the movement company invoices the customer or receives invoice from the supplier immediately covers its position in the Forward or Future markets and hence never leave the exposure open even for a single day.

Answer:

- ❖ **Strategy 1:** This strategy is covered by High Risk: Low Reward category and worst as it leaves all exposures unhedged. Although this strategy does not involve any time and effort, it carries high risk.
- ❖ **Strategy 2:** This strategy covers Low Risk: Reasonable reward category as the exposure is covered wherever there is anticipated profit otherwise it is left.

- ❖ **Strategy 3:** This strategy is covered by High Risk: High Reward category as to earn profit, cancellations and extensions are carried out. Although this strategy leads to high gains but it is also accompanied by high risk.
- ❖ **Strategy 4:** This strategy is covered by Low Risk: Low Reward category as company plays a very safe game.

60. Determination of financing currency (Nov 2018)

An Indian Company obtains the following quotes (Rs./USD):

- ❖ Spot Rate 35.90/36.10
- ❖ 3 months forward rate 36.00/36.25
- ❖ 6 months forward rate 36.10/36.40

The company needs \$ funds for six months. Determine whether the company should borrow in USD or INR. Interest rates are:

- ❖ 3 months interest rate : INR:12%, USD:6%
- ❖ 6 months interest rate : INR:11.50%, USD:5.5%

Also determine what should be the rate of interest after 3-months to make the company indifferent between 3-months borrowing and 6-months borrowing in the case of:

- i. Rupee Borrowing
- ii. Dollar Borrowing

Note: For the purpose of calculation you can take the units of dollar and rupee as 100 each.

Answer:

WN 1: Decision making on borrowing currency:

Computation of outflow if the borrowing is in USD:

Particulars	Calculation	Amount
USD borrowing on day 0		USD 100
Add: Interest for 6 months	$100 \times 5.5\% \times 6/12$	USD 2.75
Total payment on Month 6		USD 102.75
6 month forward rate		36.40
Total outflow in INR	102.75×36.40	Rs.3,740.10

Computation of outflow if borrowing is in INR:

Particulars	Calculation	Amount
USD needed on Day 0		USD 100
INR loan taken on day 0	100×36.10	Rs.3,610
Add: Interest for 6 months	$3,610 \times 11.50\% \times 6/12$	Rs.207.58
Total payment on Month 6		Rs.3,817.58

Conclusion: Since cash outflow is lower in USD borrowing, the company should opt for USD borrowing.

WN 2: Computation of indifferent interest rate for month 3 to month 6 (3x6 FRA):

INR borrowing:

Interest rate for 3 months = 12.00%
Interest rate for 6 months = 11.50%
$(1 + \text{Int rate for 3 months}) \times (1 + \text{Interest rate for 3 to 6}) = (1 + \text{Int rate for 6 months})$
$(1 + 3\%) \times (1 + \text{Interest rate for 3 to 6}) = (1 + 5.75\%)$
$(1 + \text{Interest rate for 3 to 6}) = \frac{(1 + 5.75\%)}{1 + 3\%}$
Interest rate for 3 to 6 = 2.67% for 3 months (or) 10.68% per annum

USD borrowing:

Interest rate for 3 months = 6.00%
Interest rate for 6 months = 5.50%
$(1 + \text{Int rate for 3 months}) \times (1 + \text{Interest rate for 3 to 6}) = (1 + \text{Int rate for 6 months})$
$(1 + 1.5\%) \times (1 + \text{Interest rate for 3 to 6}) = (1 + 2.75\%)$
$(1 + \text{Interest rate for 3 to 6}) = \frac{(1 + 2.75\%)}{1 + 1.5\%}$
Interest rate for 3 to 6 = 1.23% for 3 months (or) 4.92% per annum

61. Investment decision (Nov 2019)

KGF Bank's Sydney branch has surplus funds of USD \$ 7,00,000 for a period of 2 months. Cost of funds to the bank is 6% p.a. They propose to invest these funds in Sydney, New York or Tokyo 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 for a period of 2 Months.

- ❖ Sydney 7.5%p.a.
- ❖ New York 8%p.a.
- ❖ Tokyo 4%p.a.

The market rates in Australia for US Dollars and Yen are as under:

Sydney on New York:

- ❖ Spot 0.7100/0.7300
- ❖ 1 Months 10/20
- ❖ 2 Months 25/30

Sydney on Tokyo:

- Spot 79.0900/79.2000
- 1 Months 40/30
- 2 Months 55/50

At which centre, will the investment be made & what will be the net gain to the bank on the invested funds?

Answer:

WN 1: Computation of net gain if the investment is made in Sydney:

Particulars	Calculation	Amount
Surplus funds		USD 7,00,000
Investment in Sydney (Aus \$)	$\frac{7,00,000}{0.73}$	A \$ 9,58,904
Add: Interest in Sydney	$9,58,904 \times 7.5\% \times (2/12)$	A \$ 11,986
Total amount at end of Month 2		A \$ 9,70,890
Target funds in USD at end of Month 2	$7,00,000 + (7,00,000 \times 6\% \times 2/12)$	USD 7,07,000
Target funds in A \$ at end of Month 2	$7,07,000 / 0.7125$	A \$ 9,92,281
Net loss	$9,70,890 - 9,92,281$	A \$ 21,391

WN 2: Computation of net gain if investment is made in New York:

Particulars	Calculation	Amount
Surplus funds		USD 7,00,000
Add: Interest in New York	$7,00,000 \times 8\% \times 2/12$	USD 9,333.33
Total amount at end of Month 2		USD 7,09,333.33
Target funds in USD at end of Month 2	$7,00,000 + (7,00,000 \times 6\% \times 2/12)$	USD 7,07,000
Net gain		USD 2,333.33
Net gain in A \$	$2,333.33 / 0.7330$	A \$ 3,183

WN 3: Computation of net gain if investment is made in Tokyo:

Particulars	Calculation	Amount
Surplus funds in USD		USD 7,00,000
Surplus funds in JPY (Note 1)		JPY 7,58,39,726
Add: Interest in Tokyo	$7,58,39,726 \times 4\% \times 2/12$	JPY 5,05,598
Total amount at end of Month 2		JPY 7,63,45,324
Total amount at end of Month 2 in AUD (Note 2)		AUD 9,64,017
Target funds in A \$ at end of Month 2 (WN 1)		A \$ 9,92,281
Net loss in A \$	$9,64,017 - 9,92,281$	A \$ 28,264

Note 1: Computation of surplus funds in JPY:

$$\text{JPY} = \text{USD} \times \text{BID} \left(\frac{\text{JPY}}{\text{USD}} \right); \text{JPY} = \text{USD} \times \text{BID} \left(\frac{\text{JPY}}{\text{AUD}} \times \frac{\text{AUD}}{\text{USD}} \right)$$

$$\text{JPY} = 7,00,000 \times (79.0900 \times \frac{1}{0.73}) = \text{JPY } 7,58,39,726$$

Note 2: Computation of maturity funds in AUD:

$$\text{AUD} = \text{JPY} \times \text{BID} \left(\frac{\text{AUD}}{\text{JPY}} \right); \text{AUD} = 7,63,45,324 \times \left(\frac{1}{79.1950} \right); \text{AUD} = 9,64,017$$

Conclusion: The investment should be made in New York as the company makes gain while investing in New York.

62. Money Market Hedge Versus Forward Contract (Nov 2019 Exam):

H Ltd. is an Indian firm exporting handicrafts to North America. All the exports are invoiced in US\$. The firm is considering the use of money market or forward market to cover the receivable of \$50,000 expected to be realized in 3 months time and has the following information from its banker:

Particulars	Exchange Rate
Spot	Rs.72.65/73
3-month forward	Rs.72.95/73.40

The borrowing rates in US and India are 6 % and 12% p.a. and the deposit rates are 4% and 9% p.a. respectively.

(i) Which option is better for H Ltd. ?

(ii) Assume that H Ltd. anticipates the spot exchange rate in 3-months time to be equal to the current 3-months forward rate. After 3-months the spot exchange rate turned out to be Rs./\$: 73/73.42. What is the foreign exchange exposure and risk of H Ltd.?

Answer:

WN 1: Computation of inflow under forward contract:

- 3 months forward rate = Rs.72.95/73.40 per USD
- INR inflow at end of M3 = 50,000 x 72.95 = Rs.36,47,500

WN 2: Computation of inflow in case of Money Market Hedge:

- The company has foreign currency (USD) asset and hence has to create USD loan for money market hedge

Particulars	Calculation	Amount
Day 0		
6. Amount of USD loan to be taken	$\frac{50,000}{1 + 1.5\%}$	USD 49,261.08
7. Conversion of USD into INR	$49,261.08 \times 72.65$	INR 35,78,817
8. Create INR deposit for 3 months at 9% per annum		INR 35,78,817
Month 3		
9. Receive money from customer and repay loan		USD 50,000
10. Redeem INR deposit with interest	$35,78,817 + 2.25\%$	INR 36,59,340

Conclusion: The company should go with money market hedge option as the inflow is higher under MMH.

WN 3: Computation of foreign exchange exposure risk:

Particulars	Calculation
Expected realization considering future spot rate (50,000 x 72.95)	36,47,500
Actual realization considering actual spot rate (50,000 x 73)	36,50,000
Gain due to foreign exchange risk	2,500

Chapter 10 – International Financial Management**Theory to Solve Problems****Inflation:**

- ❖ Inflation means “rise in prices”
- ❖ If cash flow includes inflation they are said to be in money terms and if it excludes inflation they are said to be in real terms
- ❖ If discount rate include inflation it is said to be in money term and if it exclude inflation then it is said to be in real terms

Particulars	Cash flow	Discount rate
Money	Include inflation	Include inflation
Real	Exclude inflation	Exclude inflation

- ❖ Real terms does not mean that they are PV

- ❖ We can move from money cash flow to real cash flow by discounting it at inflation rate
- ❖ We can move from real cash flow to present value by discounting it at real discount rate
- ❖ We can move from money cash flow to present value by discounting it at money discount rate
- ❖ Real cash flow and present value are not same because RCF eliminates only inflation and not risk while present value exclude both inflation and risk
- ❖ $(1 + \text{MDR}) = (1 + \text{RDR}) * (1 + \text{Inflation rate})$
- ❖ If the problem is silent with regard to nature of cash flow and discount rate then they are said to be in **money terms**

International capital budgeting

- ❖ Host country is the country in which investment is made. Home country is the country which is making the investment
- ❖ Example: If China invests in Japan, then Japan is the host country and China is the home country
- ❖ Home currency refers to the currency of the home country and host currency is the currency of the host country
- ❖ Home currency approach means computing NPV in home currency
- ❖ Host currency approach means computing NPV in host currency
- ❖ All cash flows in steps 1,2 and 3 should consistently be either in home currency or the host currency
- ❖ The appropriate discount rate is the home currency discount rate if the home currency approach is used
- ❖ The appropriate discount rate is the host currency discount rate if the host currency approach is used

$$(1 + \text{Risky rate}) = (1 + \text{Risk free rate}) * (1 + \text{Risk Premium})$$

- ❖ The link between the host currency NPV and home currency NPV is the spot rate

$$\text{Home currency NPV} = \text{Host currency NPV} * \text{Spot rate}$$

Practical Problems**Overview:**

- Part I – Inflation in capital budgeting
- Part II – International Capital Budgeting

Part I – Inflation in capital budgeting**1. Inflation**

Shashi Co. Limited has projected the following cash flows from a project under evaluation:

Year	0	1	2	3
Cash flow	(72)	30	40	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%. State how the viability of the project is to be evaluated.

Answer:

- Cash flows given in the question is after recognizing inflation and hence given cash flows are in money terms.

- It is assumed that discount rate given in the question is real discount rate. We are converting the same into money discount rate as under:
- $(1 + \text{MDR}) = (1 + \text{RDR}) \times (1 + \text{Inflation})$
- $(1 + \text{MDR}) = (1 + 5\%) \times (1 + 10\%)$
- $(1 + \text{MDR}) = 1.155$
- $\text{MDR} = 0.155$ (or) 15.50%

Year	CF	PVF @ 15.5%	DCF
0	-72.00	1.000	-72.00
1	30.00	0.866	25.98
2	40.00	0.750	30.00
3	30.00	0.649	19.47
NPV			3.45

Conclusion:

- The company should go ahead with the project as the same has resulted in positive NPV of Rs.3.45

2. Inflation

XYZ Ltd. requires Rs.8,00,000 for a new project. Useful life of project - 4 years. Salvage value -Nil. Depreciation Charge Rs.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

If applicable Tax Rate is 60% and cost of capital is 10% then 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%

Answer:**WN 1: Computation of inflation adjusted revenues:**

- It is assumed that cost of capital given in the question is nominal discount rate. Cash flows given in the question are real cash flows and hence we should convert the same into nominal cash flows by compounding at inflation rate

Year	Cash flow	Inflation rate	Calculation	Inflation adjusted cash flows
1	6,00,000	10%	$6,00,000 \times (1+10\%)$	6,60,000
2	7,00,000	9%	$7,00,000 \times (1+10\%) \times (1+9\%)$	8,39,300
3	8,00,000	8%	$8,00,000 \times (1+10\%) \times (1+9\%) \times (1+8\%)$	10,35,936
4	8,00,000	7%	$8,00,000 \times (1+10\%) \times (1+9\%) \times (1+8\%) \times (1+7\%)$	11,08,452

WN 2: Computation of inflation adjusted outflows:

Year	Cash flow	Inflation rate	Calculation	Inflation adjusted outflows
1	3,00,000	12%	$3,00,000 \times (1+12\%)$	3,36,000
2	4,00,000	10%	$4,00,000 \times (1+12\%) \times (1+10\%)$	4,92,800
3	4,00,000	9%	$4,00,000 \times (1+12\%) \times (1+10\%) \times (1+9\%)$	5,37,152
4	4,00,000	8%	$4,00,000 \times (1+12\%) \times (1+10\%) \times (1+9\%) \times (1+8\%)$	5,80,124

WN 3: Computation of cash flows after tax:

Particulars	Year 1	Year 2	Year 3	Year 4
Revenues	6,60,000	8,39,300	10,35,936	11,08,452
Less: Costs	-3,36,000	-4,92,800	-5,37,152	-5,80,124
PBDT	3,24,000	3,46,500	4,98,784	5,28,328

Less: Depreciation	-2,00,000	-2,00,000	-2,00,000	-2,00,000
PBT	1,24,000	1,46,500	2,98,784	3,28,328
Less: Tax	-74,400	-87,900	-1,79,270	-1,96,997
PAT	49,600	58,600	1,19,514	1,31,331
Add: Depreciation	2,00,000	2,00,000	2,00,000	2,00,000
CFAT	2,49,600	2,58,600	3,19,514	3,31,331

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 10%	DCF
0	-8,00,000	1.000	-8,00,000
1	2,49,600	0.909	2,26,886
2	2,58,600	0.826	2,13,604
3	3,19,514	0.751	2,39,955
4	3,31,331	0.683	2,26,299
NPV			1,06,744

Part II – International Capital Budgeting**3. International capital budgeting (May 2013 RTP)**

ABC Ltd. is considering a project in US, which will involve an initial investment of USD1,10,00,000. The project will have 5 years of life. Current spot exchange rate is Rs.48 per US \$. The risk-free rate in US is 8% and the same in India is 12%. Cash inflow from the project is as follows:

Year	Cash inflow
1	US\$20,00,000
2	US\$25,00,000
3	US\$30,00,000
4	US\$40,00,000
5	US\$50,00,000

Required rate of return on this project is 14%.

- ❖ Calculate the NPV of the project using foreign currency approach.
- ❖ Re-calculate the NPV of the project using home currency approach

Answer:**WN 1: Computation of required rate of return in USD:**

- It is assumed that required rate of return of 14% is INR return
- Risk premium of the project is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.12) \times (1 + \text{risk premium}) = (1 + 0.14)$$

$$(1 + \text{risk premium}) = \frac{1.14}{1.12} = 1.0179; \text{Risk premium} = 0.0179 \text{ (or) } 1.79\%$$

- Required return in USD is computed as under:

$$(1 + R_f) \times (1 + \text{risk premium}) = (1 + \text{risky rate})$$

$$(1 + 0.08) \times (1 + 0.0179) = (1 + \text{risky rate})$$

$$(1 + \text{risky rate}) = 1.0993; \text{Risky rate} = 0.0993 \text{ (or) } 9.93\%$$

- Hence the required return for USD cash flows is 9.93% and return for INR cash flows is 14%

WN 2: Computation of NPV using foreign currency approach:

- ABC Limited is assumed to be based out of India and hence foreign currency is USD

Year	Cash flow	PVF @ 9.93%	DCF
0	-1,10,00,000	1.000	-1,10,00,000
1	20,00,000	0.910	18,20,000
2	25,00,000	0.827	20,67,500
3	30,00,000	0.753	22,59,000
4	40,00,000	0.685	27,40,000
5	50,00,000	0.623	31,15,000
NPV in USD			10,01,500

WN 3: Computation of NPV using home currency approach:

- We need to convert USD cash flows into INR and then discount the cash flows at discount rate of 14%

Computation of forward rate using IRPT:

Year	Calculation	Rate
0		48.00
1	48.00×1.12 $\frac{1.08}{1.08}$	49.78
2	49.78×1.12 $\frac{1.08}{1.08}$	51.62
3	51.62×1.12 $\frac{1.08}{1.08}$	53.53
4	53.53×1.12 $\frac{1.08}{1.08}$	55.51
5	55.51×1.12 $\frac{1.08}{1.08}$	57.57

NPV Computation:

(in lacs)

Year	USD CF	Ex Rate	INR CF	PVF @ 14%	DCF
0	-110	48.00	-5,280.00	1.000	-5,280.00
1	20	49.78	995.60	0.877	873.14
2	25	51.62	1,290.50	0.769	992.39
3	30	53.53	1,605.90	0.675	1,083.98
4	40	55.51	2,220.40	0.592	1,314.48
5	50	57.57	2,878.50	0.519	1,493.94
NPV in INR					477.93

4. International capital budgeting (Nov 2015)

XYZ Ltd., a company based in India, manufactures very high quality modern furniture and sells to a small number of retail outlets in India and Nepal. It is facing tough competition. Recent studies on marketability of products have clearly indicated that the customer is now more interested in variety and choice rather than exclusively and exceptional quality. Since the cost of quality wood in India is very high, the company is reviewing the proposal for import of woods in bulk from Nepalese Supplier.

The estimate of net Indian (Rs) and Nepalese Currency (NC) cash flows for this proposal is shown below:

Net cash Flows (in millions)

Year	0	1	2	3
NC	-25.000	2.600	3.800	4.100
INR	0	2.869	4.200	4.600

The following information is relevant:

- XYZ Ltd evaluates all investments by using a discount rate of 9% p.a All Nepalese customers are involved in NC. NC cash flows are converted to Indian (Rs) at the forward rate and discounted at the Indian rate.
- (ii) Inflation rates in Nepal and India are expected to be 9% and 8% p.a respectively. The current exchange rate is Rs. =NC 1.6

Assuming that you are the finance manager of XYZ Ltd. Calculate the net present value (NPV) and modified internal rate of return (MIRR) of the proposal.

Answer:**WN 1: Computation of forward rates using PPT:**

Year	Calculation	Rate
0		NC 1.6000/INR
1	1.60×1.09 $\frac{1.08}{1.08}$	NC 1.6148/INR
2	1.6148×1.09 $\frac{1.08}{1.08}$	NC 1.6298/INR

3	$\frac{1.6298 \times 1.09}{1.08}$	NC 1.6449/INR

WN 2: Computation of project cash flows in INR:

Year	INR CF	NCF	ER	Equivalent INR CF	Total INR CF
0	-	-2,50,00,000	1.6000	-1,56,25,000	-1,56,25,000
1	28,69,000	26,00,000	1.6148	16,10,107	44,79,107
2	42,00,000	38,00,000	1.6298	23,31,574	65,31,574
3	46,00,000	41,00,000	1.6449	24,92,553	70,92,553

WN 3: Computation of NPV in INR:

Year	Cash flow	PVF	DCF
0	-1,56,25,000	1.000	-1,56,25,000
1	44,79,107	0.917	41,07,341
2	65,31,574	0.842	54,99,585
3	70,92,553	0.772	54,75,451
Project NPV in INR			-5,42,623

WN 4: Computation of modified IRR:**Part 1: Calculation of maturity cash flow with reinvestment rate of 9% (cost of capital):**

Year	Cash flow	Reinvestment period	FVF @ 9%	Maturity cash flow
1	44,79,107	2	1.1881	53,21,627
2	65,31,574	1	1.0900	71,19,416
3	70,92,553	0	1.0000	70,92,553
Maturity Cash Flow				1,95,33,596

Part 2: Computation of Modified IRR:

Year	Cash flow	PVF @ 8%	DCF	PVF @ 7%	DCF
0	-1,56,25,000	1.000	-1,56,25,000	1.000	-1,56,25,000
3	1,95,33,596	0.794	1,55,09,675	0.816	1,59,39,414
NPV			-1,15,325		3,14,414

- Project gives positive NPV at discount rate of 7 percent and negative NPV at discount rate of 8%

$$\text{Modified IRR} = L_1 + \frac{\text{NPV at } L_1}{\text{NPV at } L_1 - \text{NPV at } L_2} \times (L_2 - L_1)$$

$$\text{Modified IRR} = 7 + \frac{3,14,414}{3,14,414 - (-1,15,325)} \times (8 - 7) = 7 + 0.73 = 7.73\%$$

- Modified IRR = 7.73%**

5. International capital budgeting (Nov 2012 RTP)

A USA based company is planning to set up a software developing unit in India. Software development at the Indian unit will be bought back by the US parent at a transfer price of US \$ 10 million. The unit will remain in existence in India for one year; the software is expected to get developed within this time frame. The US based company will be subjected to corporate tax of 30 per cent and with – holding tax of 10% in India and will not be eligible for tax credit in the US. The software developed will be sold in the US market for US \$ 12.0 million. Other establishments are as follows

Rent for fully furnished unit with necessary hard ware in India	Rs.15,00,000
Man power cost (80 software professional will be working for 10 hours each day)	Rs. 400 per man hour
Administrative and other costs	Rs. 12,00,000

Advise the US Company on financial viability of the project. The rupee-dollar rate is Rs.48/\$.

Answer:**Computation of cost of Developing the Project:**

Particulars	Calculation	Amount (in lacs)

Revenues	100 x 48	4,800.00
Less: Costs		
Rent		-15.00
Manpower cost	$(365 \times 10 \times 400 \times 80)/1,00,000$	-1,168.00
Admin cost		-12.00
Profit before tax		3,605.00
Less: Tax @ 30%	$3,605 \times 30\%$	-1,081.50
Profit after tax		2,523.50
Less: Withholding tax @ 10%	$2,523.50 \times 10\%$	-252.35
Amount repatriated		2,271.15
Cost of development	Amount paid - amount repatriated 4,800.00 - 2,271.15	2,528.85
Cost of development (USD)	$2,528.85/48$	52.6844

- The cost of development is therefore USD 5.26844 million and the same would be sold for USD 12 million. Hence the project is financially viable

6. International capital budgeting (Nov 2015 RTP)

XY Limited is engaged in large retail business in India. It is contemplating for expansion into a country of Africa by acquiring a group of stores having the same line of operation as that of India. The exchange rate for the currency of the proposed African country is extremely volatile. Rate of inflation is presently 40% a year. Inflation in India is currently 10% a year. Management of XY Limited expects these rates likely to continue for the foreseeable future. Estimated projected cash flows, in real terms, in India as well as African country for the first three years of the project are as follows:

Particulars	Year -0	Year-1	Year-2	Year-3
Cash flows in INR ('000s)	-50,000	-1,500	-2,000	-2,500
Cash flows in African Rands ('000s)	-2,00,000	+50,000	+70,000	+90,000

XY Ltd. Assumes the year 3 nominal cash flows will continue to be earned each year indefinitely. It evaluates all investments using nominal cash flows and a nominal discounting rate. The present exchange rate is African Rand 6 to Rs. 1. You are required to calculate the net present value of the proposed investment considering the following:

African Rand cash flows are converted into rupees and discounted at a risk adjusted rate. All cash flows for these projects will be discounted at a rate of 20% to reflect its high risk.

Answer:

WN 1: Computation of forward rates using PPT:

Year	Calculation	Rate
0		Rand 6.00/INR
1	$\frac{6.00 \times 1.40}{1.10}$	Rand 7.64/INR
2	$\frac{7.64 \times 1.40}{1.10}$	Rand 9.72/INR
3	$\frac{9.72 \times 1.40}{1.10}$	Rand 12.37/INR

WN 2: Computation of nominal cash flows by compounding at inflation rate:

(in '000s)

Year	African Rand (40%)		INR (10%)	
	Real	Nominal	Real	Nominal
0	-2,00,000	-2,00,000	-50,000	-50,000
1	50,000	70,000	-1,500	-1,650
2	70,000	1,37,200	-2,000	-2,420
3	90,000	2,46,960	-2,500	-3,328

Nominal Cash flow = Real cash flow x $(1 + \text{Inflation rate})^n$

WN 3: Computation of project cash flows in INR:

Year	INR CF	Rand CF	ER	Equivalent INR CF	Total INR CF
0	-50,000	-2,00,000	6.00	-33,333	-83,333
1	-1,650	70,000	7.64	9,162	7,512

2	-2,420	1,37,200	9.72	14,115	11,695
3	-3,328	2,46,960	12.37	19,964	16,636

$$\text{Valuation of perpetuity (Y3)} = \frac{\text{Y4 cash flow}}{K_o - \text{Growth}} = \frac{16,636}{20\% - 0\%} = \text{Rs. 83,180}$$

WN 4: Computation of NPV in INR:

Year	Cash flow	PVF @ 20%	DCF
0	-83,333	1.000	-83,333
1	7,512	0.833	6,257
2	11,695	0.694	8,116
3	99,816	0.579	57,793
Project NPV in INR			-11,167

- Project will get rejected as the same has negative NPV

7. International capital budgeting (May 2017 RTP, Nov 2018 RTP)

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 and other data in respect of proposed project:

- ❖ Variable operating cost will be US \$ 20 per unit of production;
- ❖ 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;
- ❖ Production capacity of the proposed project in India will be 5 million units;
- ❖ Expected useful life of the proposed plant is five years with no salvage value
- ❖ Existing working capital investment for production & sale of two million units through exports was US \$ 15 million;
- ❖ 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;
- ❖ Applicable Corporate Income Tax rate is 35%, and
- ❖ 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.

Answer:

WN 1: Initial outflow:

Particulars	Amount (million USD)
Capital expenditure	-500.00
Working capital (50 - 15)	-35.00
Initial outflow	-535.00

WN 2: In-between cash flows (million USD)

Particulars	Existing	Revised
Units sold	1.50	5.00
Revenues	120	400
Less: Variable cost	-60	-100
Less: Fixed cost	0	-30
PBDT	60	270
Less: Depreciation	0	-100
PBT	60	170
Less: Tax @ 35%	-21	-59.50

PAT	39	110.50
Add: Depreciation	0	100.00
CFAT	39	210.50

- Incremental CFAT = 210.50 - 39 = USD 171.50 million

WN 3: Terminal Cash flow:

Particulars	Amount (million USD)
Net salvage value	0.00
Recapture of working capital (50 - 15)	35.00
Terminal flow	35.00

WN 4: Computation of NPV:

Year	Cash flow	PVF @ 12%	DCF
0	-535.00	1.000	-535.00
1 to 5	171.50	3.605	618.26
5	35.00	0.567	19.85
Project NPV			103.11

- The company should go ahead with the project as the same has resulted in positive NPV of USD 103.11 million

8. Valuation of share (May 2019 RTP)

The directors of Implant Inc. wishes to make an equity issue to finance a \$10 m (million) expansion scheme which has an excepted Net Present Value of \$2.2m and to re-finance an existing \$6 m 15% Bonds due for maturity in 5 years time. For early redemption of these bonds there is a \$3,50,000 penalty charges. The Co. has also obtained approval to suspend these pre-emptive rights and make a \$15 m placement of shares which will be at a price of \$0.5 per share. The floatation cost of issue will be 4% of Gross proceeds. Any surplus funds from issue will be invested in IDRs which is currently yielding 10% per year. The Present capital structure of Co. is as under:

Particulars	'000
Ordinary share (USD 1 per share)	7,000
Share premium	10,500
Free reserves	25,500
Total equity	43,000
15% term bonds	6,000
11% debentures (2012 - 2020)	8,000
Total capital	57,000

Current share price is \$2 per share and debenture price is \$ 103 per debenture. Cost of capital of Co. is 10%. It may be further presumed that stock market is semi -strong form efficient and no information about the proposed use of funds from the issue has been made available to the public. You are required to calculate expected share price of company once full details of the placement and to which the finance is to be put, are announced.

Answer:**Computation of expected share price:**

Particulars	Calculation	Amount (in '000s)
Existing Networkth	7,000 x 2	14,000
New issue made		15,000
Less: Issue expenses	15,000 x 4%	-600
NPV of new project		2,200
NPV of bond refunding	Note 1	787.90
Expected Networkth (A)		31,387.90
No of shares (B)	7,000 + (15,000/0.50)	37,000
Expected price (A/B)		0.8483

Note 1: Computation of NPV of bond refunding:

Year	Cash flow	PVF @ 10%	DCF
0	-6,350	1.000	-6,350.00
1 to 5	900	3.791	3,411.90
5	6,000	0.621	3,726.00
NPV of bond refunding			787.90

- The company will have to pay 6,350 today for bond refunding (6 million + 3,50,000)
- The company will save interest of 900 for a period of 5 years and will save principal payment of 6,000 at end of five years
- Cost of capital is 10%

9. Computation of effective borrowing rate (May 2019)

K Ltd. currently operates from 4 different buildings and wants to consolidate its operations into one building which is expected to cost Rs. 90 crores. The Board of K Ltd. had approved the above plan and to fund the above cost, agreed to avail an External Commercial Borrowing (ECB) of GBP 10 m from G Bank Ltd. on the following conditions:

- The Loan will be availed on 1st April, 2019 with interest payable on half yearly rest.
- Average Loan Maturity life will be 3.4 years with an overall tenure of 5 years.
- Upfront Fee of 1.20%.
- Interest Cost is GBP 6 months LIBOR + Margin of 2.50%.
- The 6 month LIBOR is expected to be 1.05%.

K Ltd. also entered into a GBP-INR hedge at 1 GBP = INR 90 to cover the exposure on account of the above ECB Loan and the cost of the hedge is coming to 4.00% p.a. As a Finance Manager, given the above information and taking the 1 GBP = INR 90:

(i) Calculate the overall cost both in percentage and rupee terms on an annual basis.

(ii) What is the cost of hedging in rupee terms?

(iii) If K Ltd. wants to pursue an aggressive approach, what would be the net gain/loss for K Ltd. if the INR depreciates/appreciates against GBP by 10% at the end of the 5 years assuming that the loan is repaid in GBP at the end of 5 years?

Ignore time value and taxes and calculate to two decimals.

Answer:

WN 1: Computation of overall cost both in percentage and rupee terms:

Particulars	Calculation	Amount
Upfront premium	10 million × 1.20%	GBP 0.12 million
Interest cost	10 million × 3.35% × 3.4 years	GBP 1.207 million
Hedging cost	10 million × 4% × 3.4 years	GBP 1.36 million
Total cost for 3.4 years		GBP 2.687 million
Total cost for 1 year	2.687/3.4	GBP 0.7903 million
Loan Taken		GBP 10 million
Effective rate (%)	(0.7903/10) × 100	7.903%
Effective cost (INR) for 3.4 years	2.687 × 90	INR 241.83 million
Effective cost (INR) per annum	241.83/3.4 years	INR 71.127 million

WN 2: Computation of cost of hedging in rupee terms:

- Hedging cost for 3.4 years = GBP 1.36 million
- Hedging cost in INR = 1.36 million × 90 = INR 122.40 million
- Hedging cost per year = GBP 10 million × 4% × 90 = INR 36 million

WN 3: Gain/loss if INR depreciates by 10%

- The company has taken a loan in GBP. They have taken an aggressive approach and this would mean that hedging is not done.
- Liability of company is in GBP. INR has depreciated and hence GBP has appreciated by 10%. This would increase the loan liability to Rs.99 Crores.
- Loss due to currency movement = Rs.9 crores
- The company has not hedged the loan exposure and hence they will save hedging cost of Rs.12.24 crores (WN 2)
- Net gain = 12.24 crores - 9 Crores = Rs.3.24 crores

WN 4: Gain/loss if INR appreciates by 10%:

- The company has taken a loan in GBP. They have taken an aggressive approach and this would mean that hedging is not done.
- Liability of company is in GBP. INR has appreciated and hence GBP has depreciated by 10%. This would reduce the loan liability to Rs.81 Crores.
- Gain due to currency movement = Rs.9 crores
- The company has not hedged the loan exposure and hence they will save hedging cost of Rs.12.24 crores (WN 2)
- Total gain = 12.24 crores + 9 Crores = Rs.21.24 crores

10. International capital budgeting

Opus Technologies Ltd., an Indian IT company is planning to make an investment through a wholly owned subsidiary in a software project in China with a shelf life of two years. The inflation in China is estimated as 8 percent. Operating cash flows are received at the year end.

For the project an initial investment of Chinese Yuan (CN¥) 30,00,000 will be in a piece of land. The land will be sold after the completion of project at estimated value of CN¥ 35,00,000. The project also requires an office complex at cost of CN¥ 15,00,000 payable at the beginning of project. The complex will be depreciated on straight-line basis over two years to a zero salvage value. This complex is expected to fetch CN¥ 5,00,000 at the end of project.

The company is planning to raise the required funds through GDR issue in Mauritius. Each GDR will have 5 common equity shares of the company as underlying security which are currently trading at Rs. 200 per share (Face Value = Rs. 10) in the domestic market. The company has currently paid a dividend of 25% which is expected to grow at 10% p.a. The total issue cost is estimated to be 1 percent of issue size.

The annual sales is expected to be 10,000 units at the rate of CN¥ 500 per unit. The price of unit is expected to rise at the rate of inflation. Variable operating costs are 40 percent of sales. Current Fixed Operating costs is CN¥ 22,00,000 per year which is expected to rise at the rate of inflation.

The tax rate applicable in China for business income and capital gain is 25 percent and as per GOI Policy no further tax shall be payable in India. The current spot rate of CN¥ 1 is Rs. 9.50. The nominal interest rate in India and China is 12% and 10% respectively and the international parity conditions hold.

You are required to

- Identify expected future cash flows in China and determine NPV of the project in CN¥.
- Determine whether Opus Technologies should go for the project or not, assuming that there neither there is any restriction nor any charges/taxes payable on the transfer of funds from China to India.

Answer:**WN 1: Computation of initial outflow:**

Particulars	Amount (CN¥)
Land	30,00,000
Office Complex	15,00,000
Total Outflow	45,00,000

WN 2: In-between cash flows:

Particulars	Year 1	Year 2
Annual units	10,000	10,000
Selling price	540.00	583.20
Sales	54,00,000	58,32,000
Less: Variable cost (40%)	(21,60,000)	(23,32,800)
Less: Depreciation (15,00,000/2)	(7,50,000)	(7,50,000)
Less: Fixed Cost	(23,76,000)	(25,66,080)
Profit before tax	1,14,000	1,83,120
Less: Tax @ 25%	(28,500)	(45,780)
Profit After Tax	85,500	1,37,340
Add: Depreciation	7,50,000	7,50,000

CFAT	8,35,500	8,87,340

WN 3: Terminal Cash Flow:

Particulars	Land	Building
Sale value	35,00,000	5,00,000
Less: Book value	(30,00,000)	0
Capital gain	5,00,000	5,00,000
Tax paid @ 25%	1,25,000	1,25,000
Net salvage value	33,75,000	3,75,000

WN 4: Computation of cost of capital:

$$K_e = \left(\frac{D_1}{P_0 - F} \right) + \text{Growth rate}$$

$$K_e = \left(\frac{2.75 \times 5}{1,000 - 10} \right) + 0.10 = 0.1139 \text{ (or) } 11.39\%$$

WN 5: Computation of NPV in CNY:

Year	Cash flow	PVF @ 11.39%	DCF
0	(45,00,000)	1	(45,00,000)
1	8,35,500	0.898	7,50,279
2	46,37,340 [8,87,340+33,75,000+3,75,000]	0.806	37,37,696
NPV in CNY			(12,025)

Conclusion: The project should not be accepted as the project has negative NPV.

WN 6: Analysis of NPV in INR:**Note 1: Computation of Exchange Rate:**

Year	Calculation	Rate
1	$9.50 \times \frac{1.12}{1.10}$	9.67
2	$9.67 \times \frac{1.12}{1.10}$	9.85

Note 2: Computation of INR Discount rate:**CNY rate analysis:**

$$(1 + R_f) \times (1 + R_p) = (1 + \text{Risky Rate})$$

$$(1 + 10\%) \times (1 + R_p) = (1 + 11.39\%)$$

$$(1 + R_p) = \frac{1 + 11.39\%}{1 + 10\%}; 1 + R_p = 1.0126; \text{Risk Premium} = 1.26\%$$

INR Rate Analysis:

$$(1 + 12\%) \times (1 + R_p) = (1 + \text{Risky Rate})$$

$$(1 + 12\%) \times (1 + 1.26\%) = (1 + \text{Risky Rate})$$

$$1 + \text{Risky Rate} = 1.1341; \text{Risky Rate} = 13.41\%$$

Note 3: Computation of NPV in INR:**Option 1: Cash flows in CNY are repatriated in the same year:**

Year	CNY CF	Exchange rate	INR CF	PVF @ 13.41%	DCF
0	(45,00,000)	9.50	(4,27,50,000)	1	(4,27,50,000)
1	8,35,500	9.67	80,79,285	0.882	71,25,929
2	46,37,340	9.85	4,56,77,799	0.777	3,54,91,650
Project NPV					(1,32,421)

Conclusion: The company should not go ahead with project as the project has negative NPV of Rs.1,32,421

Option 2: Cash flows in CNY are repatriated at end of the project:

Year	CNY CF	Exchange rate	INR CF	PVF @ 13.41%	DCF
0	(45,00,000)	9.50	(4,27,50,000)	1	(4,27,50,000)
1		9.67		0.882	

2	54,72,840	9.85	5,39,07,474	0.777	4,18,86,107
Project NPV					(8,63,893)

Conclusion: The company should not go ahead with project as the project has negative NPV of Rs.8,63,893

11. International financial management:

An MNC company in USA has surplus funds to the tune of USD 10 million for six months. The finance director of the company is interested in investing in EURO for higher returns. There is DTAA in force between USA and Germany. The company received the following information from London:

Particulars	Amount
EURO/USD Spot	0.4040/41
6 months forward	67/65
Rate of interest for 6 months (p.a.)	5.95%-6.15%
Withholding tax applicable for interest income	22%
Tax as per DTAA	10%

If the company invests in EUR, what is the gain for the company?

Answer:

Computation of net gain for the company:

Particulars	Calculation	Amount
Surplus in USD		1,00,00,000 USD
Euro investment	$1,00,00,000 \times 0.4040$	40,40,000 EUR
Interest earned	$40,40,000 \times 5.95\% \times 6/12$	1,20,190 EUR
Less: Withholding tax as per DTAA	$1,20,190 \times 10\%$	-12,109 EUR
Net interest earned		1,08,171 EUR
Net amount available for repatriation	$40,40,000 + 1,08,171$	41,48,171 EUR
Amount converted into USD at forward rate	$\frac{41,48,171}{0.3976}$	1,04,33,026 USD
Amount earned in USD		4,33,026 USD

Chapter 11 – Interest rate risk Management**Theory to solve problems****Interest rate options:**

Interest rate caps	❖ Buyer of an interest rate cap pays the seller a premium for the right to receive the difference in the interest cost on some notional principal amount if the market interest rate goes above a stipulated “cap” rate ❖ Cap resembles an option that it represents a right rather than an obligation to the buyer
Interest rate floors	❖ A derivative instrument which protects the buyer of the floor from losses arising from decrease in interest rates ❖ The seller of the floor compensates the buyer with a payoff when the interest rate falls below the strike rate of the floor
Interest rate collars	❖ Buyer of an interest rate collar purchases an interest rate cap while selling a floor indexed to the same interest rate ❖ Collar = Cap + Floor. This enables the borrower to restrict the maximum interest outflow. However the buyer cannot benefit from significant fall in interest rates as the minimum floor rate is to be paid ❖ Collar versus Cap: Cap and collar both restrict the maximum interest outflow. However the minimum interest outflow is restricted in case of collar. However investor may prefer buying a collar due to lower premium outflow as compared to a cap

Note: Option Premium for every reset period is calculated using the below formula:

(Rate of Premium / PVAF (Fixed rate of interest, Number of periods)) * Notional amount

Forward Rate Agreement (FRA):

- ❖ A forward rate agreement involves entering into an agreement with the bank under which the bank will give loan at a specified interest rate on a specified future date
- ❖ When a bank quotes a FRA it will give the rate at which it will borrow money and the rate at which it will lend money
- ❖ **Example:** Bank quotes FRA at 4%-5%. This would mean that the bank will pay 4 percent interest in future and will receive 5 percent interest in case it lends money
- ❖ 3 X 9 FRA means a customer has entered into an agreement that he would borrow/lend money after 3 months for month 4 to month 9 (6 months)
- ❖ FRA is settled on net-basis. A bank which sells an FRA agrees to pay the buyer the increased interest cost on some notional principal amount if some specified maturity of LIBOR is above stipulated forward rate on the settlement date. Conversely the buyer agrees to pay the seller any decrease in interest cost if market interest rates fall below the forward rate
- ❖ The net settlement of FRA is calculated using the below formula:

$$\frac{\text{Notional Principal} * (\text{Actual rate} - \text{FRA rate}) * (\text{Days}/360 \text{ or } 365) * 100}{(1 + \text{Actual rate})}$$
- ❖ The differential interest amount in the FRA is discounted at actual interest rate as the FRA is settled in the beginning of the period and not at the end.

FRA versus Interest rate Futures:

- ❖ FRA is an OTC derivative instrument whereas the interest rate futures is traded in the exchange. Both instruments help in fixing the interest rate for a future period
- ❖ Interest rate futures are quoted as 100 – Interest rate. Hence interest rate futures quote of 94 would mean that the future interest rate is 6%
- ❖ No. of contracts = $\frac{\text{Amount of borrowing} * \text{Duration of loan}}{\text{Contract Size} * \text{Duration of futures}}$

Interest rate / currency swaps:

- An interest rate swap is an agreement between two parties who exchange interest payments based on a notional principal amount, over an agreed period of time.

Pre-requisites for a swap transaction:

- One party should be stronger than the other. This would mean that it enjoys lower borrowing rates than the other.
- The two parties should have opposite views about the direction of the movement of the interest rates.

Steps in effective swap:

- Step 1: Identify the rates – This involves tabulating the rates applicable to the two companies.
- Step 2: Compute the net differential
 - Difference in fixed rates
 - Difference in floating rates
 - Net differential
- Step 3: Split the net differential between two companies
- Step 4: Identify the sequence of operations.

S.No	STRONGER Company wants floating rate	STRONGER Company wants a fixed rate
Operations from view point of strong company		
1.	Pays bank at fixed rate	Pays bank at floating rate
2.	Receives from counter party fixed rate as per sequence 1 plus strong company's share of gain	Receives from counter party floating rate as per sequence A plus strong company's share of gain
3	Pays counter party the floating rate which strong company is entitled to from the market	Pays counterparty the fixed rate which strong is entitled to from the market
4	Aggregate after correctly considering the signs. This will be STRONG Company's revised floating rate.	Aggregate after correctly considering the signs. This will be STRONG company's revised fixed rate
Operations from view point of weaker company		
5	Pays bank at floating rate	Pays bank at fixed rate
6	Pays the fixed rate identified in sequence 2 above to the counter party	Pays the floating rate identified in sequence 2 above to the counter party
7	Receives the floating rate identified in sequence 3 above from the counter party	Receives the fixed rate identified in sequence 3 above from the counter party
8	Aggregate after correctly considering the signs. This will be WEAK's revised fixed rate	Aggregate after correctly considering the signs. This will be WEAK's revised floating rate

Calculation of fixed rate under swap

Step 1	❖ Calculate forward rates under the floating rate mechanism. The forward rates can either be calculated using expectation theory or on the basis of non-compounded rates ❖ Example: Interest rate for 3 months = 8%; Interest rate for 6 months = 9% ❖ Expectation theory: ○ FVF for 3 months = 1.02 ○ FVF for 6 months = 1.045 ○ FVF for 3 to 6 months = $1.045/1.02 = 1.02451$ ○ Interest rate for 3 to 6 months = 2.45% or 10.17% per annum ❖ Non-compounded rates: ○ Interest rate for 3 months = 2% ○ Interest rate for 6 months = 4.5% ○ Interest rate for 3 to 6 months = 2.5% or 10% per annum
Step 2	Calculate the PVF for every reset period ❖ $PVF \text{ for reset period } 1 = 1/(1 + \text{Forward rate for period } 1)$ ❖ $PVF \text{ for reset period } 2 = PVF \text{ for period } 1 / (1 + \text{Forward rate for period } 2)$ ❖ $PVF \text{ for reset period } 3 = PVF \text{ for period } 2 / (1 + \text{Forward rate for period } 3)$
Step 3	Calculate the fixed rate: ❖ Get the year and cash flow structure of the bond. The interest will be assumed as X ❖ Discounting has to be done with the PVF as calculated above ❖ Equate the cumulative DCF with the today's value of bond and get the value of X ❖ Get the effective fixed interest rate with the help of X

Valuation of Swap:

Step 1	❖ Calculate the future interest payable for every reset period. Interest is to be calculated both for fixed leg and floating leg
Step 2	❖ Calculate the net interest amount and discount the same using PVF calculated while getting the value of fixed rate ❖ The total of the discounted net interest amount is the value of swap

Conventions for calculation of interest:

Interest on a money market instrument is paid on March 31 and September 30. Interest for the period April 1 to June 20 is to be calculated under the following conventions.

Conventions	Numerator days	Denominator days
30/360 basis	April and May will be taken as 30 days irrespective of the number of days. Hence the numerator will be taken as 79 days (19 clean days in June)	Denominator will be taken as 180 (360/2)
Actual days/ 360	April = 30 days ; May = 31 days; June = 19 days Denominator = 80 days	Denominator will be taken as 180 (360/2)
Actual days/ reference period	April = 30 days; May = 31 days; June = 19 days. Denominator = 80 days	April = 30 days; May = 31 days; June = 30 days; July = 31 days; August = 31 days; September = 30 days Denominator = 183 days

Practical Problems**Overview:**

- Part I – Interest rate futures and options
- Part II – Forward Rate Agreements
- Part III – Interest Rate Swaps

Part I – Interest rate futures and options**1. Interest rate caps and floors (May 2013 RTP)**

Suppose that a 1-year cap has a cap rate of 8% and a notional amount of Rs.100 Crores. The frequency of settlement is quarterly and the reference rate is 3-months MIBOR. Assume that 3-month MIBOR for the next four quarters is shown below:

Quarters	3-months MIBOR
1	8.70
2	8.00
3	7.80
4	8.20

You are required to compute payoff for each quarter

Answer:

- Cap option restricts the maximum interest outflow and will be exercised if the actual interest rate is higher than strike rate

Quarter	Interest rate	Exercise	Pay-off
1	8.70	Yes	17,50,000 (100,00,00,000 × 0.70% × 3/12)
2	8.00	No	0
3	7.80	No	0
4	8.20	Yes	5,00,000 (100,00,00,000 × 0.20% × 3/12)

2. Interest rate caps and floors (May 2013 RTP)

Suppose that a 1-year floor has a floor rate of 4% and a notional amount of Rs.100 Crores. The frequency of settlement is quarterly and the reference rate is 3-months MIBOR. Assume that 3-month MIBOR for the next four quarters is shown below:

Quarters	3-months MIBOR
1	4.70
2	4.40

3	3.80
4	3.40

You are required to compute payoff for each quarter

Answer:

- Floor option provided for minimum interest inflow and will be exercised if the actual interest rate is lower than the strike rate

Quarter	Interest rate	Exercise	Pay-off
1	4.70	No	0
2	4.40	No	0
3	3.80	Yes	5,00,000 (100,00,00,000 × 0.20% × 3/12)
4	3.40	Yes	15,00,000 (100,00,00,000 × 0.60% × 3/12)

3. Interest rate caps and floors (May 2014 RTP)

XYZ Limited issues a GBP 10 million floating rate loan on July 1, 2013 with resetting of coupon rate every 6 months equal to LIBOR + 0.50%. XYZ is interested in a collar strategy by selling a floor and buying a cap. XYZ buys 3 years cap and sell 3 years floor as per the following details on July 1, 2013.

- ❖ Notional principal amount : USD 10 million
- ❖ Reference rate : 6 months LIBOR
- ❖ Strike rate : 4% for floor and 7% for cap
- ❖ Premium : 0 as premium paid on cap is compensated by premium receive on floor

Using the following data you are required to determine:

- ❖ Effective interest paid out at each reset date
- ❖ The average overall effective rate of interest

Reset Date	LIBOR (%)
31-12-2013	6.00
30-06-2014	7.00
31-12-2014	5.00
30-06-2015	3.75
31-12-2015	3.25
30-06-2016	4.25

Answer:

- Buying a cap will restrict maximum interest outflow and selling a floor will provide for minimum interest inflow.
- It is assumed that strike rate of 4% and 7% is on LIBOR + 0.50%. We can either assume this on LIBOR or our borrowing rate (LIBOR + 0.50%)
- Collar strategy will ensure that interest outflow for all reset periods will be between 4 to 7%

Interest outflow for every reset period:

Reset date	No of days	LIBOR	Int outflow	Cap receipt	Floor payment	Total cost
31-Dec-13	184	6.00	3,27,671	0	0	3,27,671
30-Jun-14	181	7.00	3,71,918	-24,795	0	3,47,123
31-Dec-14	184	5.00	2,77,260	0	0	2,77,260
30-Jun-15	181	3.75	2,10,753	0	0	2,10,753
31-Dec-15	184	3.25	1,88,525	0	12,568	2,01,093
30-Jun-16	182	4.25	2,36,202	0	0	2,36,202
Total	1,096					16,00,103

Note:

- No of days = Current reset date – Earlier reset date. For example ,184 days for December 31, 2013 is time gap between June 30, 2013 and December 31, 2013
- Interest outflow = 1,00,00,000 × (LIBOR + 0.50%) × (No of days/365 or 366). For last two reset periods denominator will be taken as 366 as the same is of leap year

- Cap receipt is applicable when LIBOR + 0.50% exceed 7%. This is breached for June 2014 and we have a cap receipt as $1,00,00,000 \times 0.50\% \times (181/365)$
- Floor payment is applicable when LIBOR + 0.50% is below 4%. This is breached for December 2015 and we will have floor payment as $1,00,00,000 \times 0.25\% \times (184/366)$
- Total cost = Interest outflow – cap receipt + Floor Payment

Computation of overall effective rate of interest:

$$\text{Overall effective rate of interest} = \left(\frac{16,00,103}{1,00,00,000} \right) \times \left(\frac{365}{1,096} \right) \times 100 = 5.33\%$$

4. Caps (November 2016 RTP)

XYZ Limited borrows £ 15 Million of six months LIBOR + 10.00% for a period of 24 months. The company anticipates a rise in LIBOR, 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 is 7.00% per annum. The actual position of LIBOR during the forthcoming reset period is as under:

Reset Period	LIBOR
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.

Answer:

WN 1: Computation of premium:

Lump-sum Premium = $1,50,00,000 \times 1\% = \text{GBP } 1,50,000$
Premium per reset period = $\frac{\text{Total premium}}{\text{PVAF}(r, n)} = \frac{1,50,000}{\text{PVAF}(3.5\%, 4)} = \frac{1,50,000}{3.673} = 40,839$

Note:

- Premium will be amortized based on the fixed rate of interest. Fixed rate of interest is 7% per annum and the same will be 3.5% per half-year (reset period). Reset period is taken as six months as the borrowing is at six-month LIBOR
- Option is for a period of 24 months and hence the same will have 4 reset periods of 6 months

WN 2: Computation of interest outflow:

- It is assumed that strike rate of 8 percent is on LIBOR and not on effective borrowing rate of LIBOR + 10%

Period	LIBOR	Int paid to bank	Cap receipt	Premium	Net Payment
I	9.00%	14,25,000	75,000	40,839	13,90,839
II	9.50%	14,62,500	1,12,500	40,839	13,90,839
III	10.00%	15,00,000	1,50,000	40,839	13,90,839
		43,87,500	3,37,500	1,22,517	41,72,517

- Interest paid to Bank = $1,50,00,000 \times (\text{LIBOR} + 10\%) \times (6/12)$
- Cap receipt is applicable if the LIBOR rate is higher than 8%. LIBOR is higher than 8% for all reset periods and the difference between 8% and LIBOR is cap receipt
- Net payment = Interest paid to Bank + Premium – Cap receipt

Conclusion:

- The company would have paid extra interest of 3,37,500 (cap receipt) due to increase in interest rates. However due to cap receipt the interest payout for a reset period does not exceed 18% (LIBOR (8%) + 10%). However, in order to save this 3,37,500 the company has pay premium of 1,22,517
- Hence, the company is able to reduce the interest rate risk amount by 2,14,893 by using cap option

5. FRA (November 2018 RTP)

M/s. Parker & Co. is contemplating to borrow an amount of Rs.60 crores for a period of 3 months in the coming 6 month's time from now. The current rate of interest is 9% p.a., but it may go up in 6 month's 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. 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.?

Answer:

WN 1: Computation of FRA settlement if actual rate of interest is 9.60%:

Date	Position	Action	Reference Date	Rate
Day 0	Original	Borrow	Day 180	-9.30%
Day 180	Opposite	Invest	Day 180	9.60%
Profit in %				0.30%
Settlement in INR $(50,00,00,000 \times 0.30\% \times 3/12)$				4,50,000
Discounted FRA Settlement on Date of borrowing $\left(\frac{4,50,000}{1 + (9.60\% \times \frac{3}{12})} \right)$				4,39,453

Note:

- FRA settlement happens on the date of borrowing whereas actual interest is paid on last day of borrowing. Hence FRA settlement of Rs.4,50,000 need to be discounted at actual interest rate of 9.60%
- Amount to be received by Parker and co = Rs.4,39,453
- The company will borrow at higher rate of 9.6%. However, receipt of Rs.4,39,453 as part of FRA settlement will lower the cost of borrowing and effective borrowing cost will be 9.30%

WN 2: Computation of FRA settlement if actual rate of interest is 8.80%:

Date	Position	Action	Reference Date	Rate
Day 0	Original	Borrow	Day 180	-9.30%
Day 180	Opposite	Invest	Day 180	8.80%
Loss in %				0.50%
Settlement in INR $(50,00,00,000 \times 0.50\% \times 3/12)$				7,50,000
Discounted FRA Settlement on Date of borrowing $\left(\frac{7,50,000}{1 + (8.80\% \times \frac{3}{12})} \right)$				7,33,855

Note:

- Amount to be paid by Parker and Co = Rs.7,33,855
- The company will borrow at lower rate of 8.80%. However, they will have to pay additional Rs.7,33,855 as part of FRA settlement and hence the effective borrowing cost will increase to 9.30%

6. FRA (May 2017 RTP)

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%

Forward Rate Agreement (FRA) for Yen is 0.25%.

- What should be 3 months FRA rate at 3 months forward?
- The 6 & 12 months LIBORS are 5% and 6.5% respectively. A bank is quoting 6/12 USD FRA at 6.50 - 6.75%. Is any arbitrage opportunity available?

Answer:

WN 1: Computation of FRA rate:

- The company wants 3 months FRA rate at 3 months forward. This would technically mean 3x6 FRA

$$3 \times 6 \text{ FRA} = \frac{\text{Future value factor for 6 months}}{\text{Future value factor for 3 months}} - 1$$

$$3 \times 6 \text{ FRA} = \frac{1 + 2.50\%}{1 + 1.125\%} - 1 = 1.0136 - 1 = 1.36\% \text{ per 3 months (or) } 5.44\% \text{ per annum}$$

WN 2: Computation of 6X12 FRA rate:

- We have been given 6 months and 12 months rate as 5% and 6.5%. We can use these rates and calculate 6X12 FRA rate

$$6 \times 12 \text{ FRA} = \frac{\text{Future value factor for 12 months}}{\text{Future value factor for 6 months}} - 1$$

$$6 \times 12 \text{ FRA} = \frac{1 + 6.50\%}{1 + 2.50\%} - 1 = 1.0390 - 1 = 3.90\% \text{ per 6 months (or) } 7.80\% \text{ per annum}$$

Creation of arbitrage:

- Fair FRA rate for month 6 to 12 is 7.80% per annum. Actual FRA rate is 6.50% - 6.75%.
- Actual FRA indicates that borrowing can be made at 6.75% and deposit can be created at 6.50% for month 6 to 12
- Actual borrowing rates are lower than Fair FRA rates and hence we should borrow money from month 6 to 12
- Arbitrage Mechanism:**
 - Borrow 1,00,000 USD for first 6 months
 - Create 1,00,000 USD deposit for 12 months
 - Borrow from M6 to M12 using FRA rate

Arbitrage steps:

Particulars	Calculation	Amount
Day 0		
1. Borrow 1,00,000 USD for 6 months @ 5%		1,00,000
2. Create 12-month deposit @ 6.50%		1,00,000
3. Enter into FRA to borrow money from M6 to M12 @ 6.75%		
Day 180		
4. Repay 6-month loan with fresh borrowing @ 6.75% as per FRA	$1,00,000 + (1,00,000 \times 5\% \times 6/12)$	1,02,500
Day 365:		
5. Maturity value of 12-month deposit	$1,00,000 + (1,00,000 \times 6.5\%)$	1,06,500
6. Repay loan along with interest	$1,02,500 + (1,02,500 \times 6.75\% \times 6/12)$	1,05,959
7. Arbitrage gain	$1,06,500 - 1,05,959$	541

7. FRA (November 2014 RTP, May 2019 RTP)

Two companies ABC Limited and XYZ Limited approach DEF Bank for FRA (Forward Rate Agreement). They want to borrow Rs.100 Crores after 2 years for a period of 1 year. Bank has calculated yield curve of both companies as follows:

Year	XYZ Limited	ABC Limited
1	3.86	4.12
2	4.20	5.48
3	4.48	5.78

- You are required to calculate the rate of interest DEF Bank would quote under 2v3 FRA, using the company's yield information as quoted above
- 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 Limited if interest in 2 years turns out to be
 - 4.50%
 - 5.50%

Answer:**WN 1: Computation of FRA rate:**

- The company wants to borrow after 2 years for a period of 1 year. The company therefore is looking at getting 2x3 FRA rate

XYZ Limited:

$$2x3FRA = \frac{\text{Future value factor for 3 years}}{\text{Future value factor for 2 years}} - 1 = \frac{(1 + 4.48\%)^3}{(1 + 4.20\%)^2} - 1 = 5.04\%$$

ABC Limited:

$$2x3FRA = \frac{\text{Future value factor for 3 years}}{\text{Future value factor for 2 years}} - 1 = \frac{(1 + 5.78\%)^3}{(1 + 5.48\%)^2} - 1 = 6.38\%$$

WN 2: Computation of actual interest with interest rate guarantee:

- Interest rate guarantee is either a cap or floor option depending on whether we are borrower or lender
- XYZ Limited is borrower and they would want to restrict the maximum interest outflow
- It is assumed that strike rate of option is equal to fair FRA rate of 5.04%

Actual interest rate is 4.50%

- XYZ Limited will pay 4.50% and their overall cost will be 4.60% including premium

Actual interest rate is 5.50%

- XYZ Limited will pay 5.04% and their overall cost will be 5.14% including premium

8. FRA (May 2014 RTP)

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 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:

- ❖ How a FRA, shall be useful if the actual interest rate after 6 months turnout to be:
 - 4.5%
 - 6.5%
- ❖ How 3 months Future contract shall be useful for company if interest rate turns out as mentioned in part (a) above.

Answer:**WN 1: Effect of FRA:**

- The company wants to borrow after 3 months for entire slack season of 6 months. This would mean borrowing from M3 to M9.
- The company should enter into 3x9 FRA to hedge interest rate risk
- Relevant 3x9 FRA borrowing rate is 5.94%**

Particulars	Actual rate of 4.50%	Actual rate of 6.50%
1. Payment to original lender	4.50%	6.50%
2. Payment by Electraspace to bank (FRA settlement)	1.44%	-
3. Receipt by Electraspace from Bank (FRA settlement)	-	(0.56%)
4. Net borrowing cost	5.94%	5.94%

WN 2: Hedging through interest rate futures:

- The company wants to borrow 50 million for 6 months. Futures contracts are available only for 3 months and hence we should adjust the value of futures contract
- Borrowing 50 million for 6 months is similar to borrowing 100 million for 3 months

$$\text{No of futures contracts} = \frac{\text{Amount to be hedged}}{\text{Size of one contract}} = \frac{100 \text{ million}}{50,000} = 2,000 \text{ Contracts}$$

Actual interest rate is 4.50%

Particulars	Calculation	Amount
1. Interest to be paid on original loan	50 million x 4.50% x 6/12	11,25,000
2. Futures settlement (Note 1)		3,37,500
3. Total outflow		14,62,500
4. Effective borrowing cost	$\frac{14,62,500}{50 \text{ million}} \times \left(\frac{12}{6}\right) \times 100$	5.85%

Note 1: Computation of futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Borrow	Day 90	5.85%
Day 90	Opposite Position	Lend	Day 90	4.50%
Loss in %				1.35%
Loss in rupees (100 million x 1.35% x $\left(\frac{3}{12}\right)$)				3,37,500

Actual interest rate is 6.50%

Particulars	Calculation	Amount
1. Interest to be paid on original loan	50 million x 6.50% x 6/12	16,25,000
2. Futures settlement (Note 1)		(1,62,500)
3. Total outflow		14,62,500
4. Effective borrowing cost	$\frac{14,62,500}{50 \text{ million}} \times \left(\frac{12}{6}\right) \times 100$	5.85%

Note 1: Computation of futures settlement:

Date	Position	Action	Reference Date	Rate
Day 0	Original Position	Borrow	Day 90	5.85%
Day 90	Opposite Position	Lend	Day 90	6.50%
Profit in %				0.65%
Profit in rupees (100 million x 0.65% x $\left(\frac{3}{12}\right)$)				1,62,500

9. Forward Rate Agreements (Nov 2019 Exam):

P Ltd. is contemplating to borrow an amount of Rs. 50 crores for a period of 3 months in the coming 6 months time from now. The current rate of interest is 8% per annum 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 8.30% per annum.

Compute the effect of FRA and actual rate of interest cost to the company, if the actual rate of interest during consideration period happens to be (i) 8.60% p.a., or (ii) 7.80% p.a.

(Show your workings on the basis of months)

Answer:

WN 1: Computation of FRA settlement if rate of interest is 8.60% per annum:

- The company had entered into FRA agreement to borrow at the rate of 8.30%
- The borrowing rate has increased to 8.60% and they will have to borrow at higher rate. However this would be compensated by FRA settlement of 0.30%

$$\text{FRA Settlement before discounting} = 50 \text{ Crores} \times 0.30\% \times \left(\frac{3}{12}\right) = \text{Rs. } 3,75,000$$

$$\text{Net FRA Settlement post discounting} = \frac{3,75,000}{1 + 2.15\%} = \text{Rs. } 3,67,107$$

Banker will pay Rs.3,67,107 to P Limited

Net interest outflow if rate is 8.60%:

Particulars	Calculation	Amount
Interest on loan at 8.60%	50 crores x 8.60% x (3/12)	1,07,50,000

Less: FRA settlement		(3,67,107)
Net Amount		1,03,82,893
Effective borrowing rate	$\left(\frac{1,03,82,893}{50,00,00,000}\right) \times \left(\frac{12}{3}\right) \times 100$	8.31%

WN 2: Computation of FRA Settlement if rate of interest is 7.80% per annum:

- The company had entered into FRA agreement to borrow at the rate of 8.30%
- The borrowing rate has decreased to 7.80% and they will have to borrow at lower rate. However, rate would increase due to FRA settlement of 0.50%

FRA Settlement before discounting = 50 Crores $\times$ 0.50% $\times$ $\left(\frac{3}{12}\right)$ = Rs. 6,25,000

Net FRA Settlement post discounting = $\frac{6,25,000}{1 + 1.95\%} = \text{Rs. 6,13,046}$

P Limited will have to pay Rs.6,13,046 to Banker.

Net interest outflow if rate is 8.60%:

Particulars	Calculation	Amount
Interest on loan at 7.80%	50 crores $\times$ 7.80% $\times$ (3/12)	97,50,000
Add: FRA settlement		6,13,046
Net Amount		1,03,63,046
Effective borrowing rate	$\left(\frac{1,03,63,046}{50,00,00,000}\right) \times \left(\frac{12}{3}\right) \times 100$	8.29%

Part III – Interest Rate Swaps**10. Interest rate swap**

Grades Limited enjoys a high credit rating and is capable of raising term funds either at a fixed rate of 10% p.a. or at a floating rate of 40 basis points over MIBOR. Level Limited enjoys a relatively lower credit rating and is able to borrow either at 80 basis points over MIBOR or at affixed rate of 10.5%. Level limited wants to borrow at fixed rate whereas Grades would like to enjoy a floating rate. Structure a swap arrangement such that Grades gains 2/3rd of the total gain. Assume that there are no intermediaries. What action would follow if Grades apprehends that interest rates will harden while Level believes that interest rates will soften?

Answer:**WN 1: Structure of interest rates:**

Particulars	Fixed rate	Floating rate
Grades Limited	10%	MIBOR + 0.40%
Level Limited	10.50%	MIBOR + 0.80%

- Total interest rate of combination 1 [Grades limited (fixed) & Level Limited (Floating)] = 10% + MIBOR + 0.8% = MIBOR + 10.80%
- Total interest rate of combination 2 [Grades limited (floating) & Level Limited (fixed)] = 10.50% + MIBOR + 0.40% = MIBOR + 10.90%
- Ideal combination = Combination 1; This would mean that Grades Limited should borrow at fixed rate and Level Limited should borrow at floating rate
- Actual scenario:** Grades Limited plans to borrow at floating rate and Level Limited plans to borrow at fixed rate
- Scope for Interest rate swap exist as the ideal and actual scenario does not match
- Swap gain = Difference in total interest of combination 1 & 2 = 0.10%
- Share of swap gain (2:1):**
 - Grades Limited = 0.07%
 - Level Limited = 0.03%

WN 2: IRS structuring:

Particulars	Grades Limited	Level Limited
1. Pay to banker as per ideal rate	10%	MIBOR + 0.80%
2. Grades Limited to Level Limited	MIBOR	(MIBOR)
3. Level Limited to Grades Limited (bal figure)	(9.67%)	9.67%
4. Effective borrowing rate	MIBOR + 0.33%	10.47%

Rework scenario:

- Grades Limited believes that interest rates will harden (go up) and hence they would opt for fixed rate loan. Level Limited believes that interest rates will soften (come down) and hence they would opt for floating rate loan
- The above scenario is in line with ideal combination and hence no scope for IRS exist

11. Interest rate swap (November 2016 RTP)

Suppose a dealer quotes 'All-in-cost' for a generic swap at 8% against six months LIBOR flat. If the notion principal amount of swap is Rs.5,00,000.

- Calculate semi-annual fixed payment
- Find the first floating rate payment for above if the six month period from the effective date of swap to the settlement date comprise of 181 days and that the corresponding LIBOR was 6% on the effective date of swap
- In (ii) above, if the settlement is on 'Net' basis, how much the fixed rate payer would pay to the floating rate payer? Generic swap is based on 30/360 days basis.

Answer:

$$\text{Semi - annual fixed payment} = 5,00,000 \times 8\% \times \left(\frac{1}{2}\right) = 20,000$$

$$\text{Floating payment} = 5,00,000 \times 6\% \times \left(\frac{181}{360}\right) = 15,083$$

$$\text{Net payment by fixed rate payer to floating rate payer} = 20,000 - 15,083 = \text{Rs. } 4,917$$

12. Evaluation of interest swap arrangement (November 2015 RTP)

NoBank offers a variety of services to both individuals as well as corporate customers. NoBank generates funds for lending by accepting deposits from customers who are paid interest at PLR which keeps on changing.

NoBank is also in the business of acting as intermediary for interest rate swaps. Since it is difficult to identify matching client, NoBank acts counterparty to any party of swap. Sleepless approaches NoBank who already have Rs. 50 crore outstanding and paying interest @PLR+80bp p.a. The duration of loan left is 4 years. Since Sleepless is expecting increase in PLR in coming year, he asked NoBank for arrangement of interest of interest rate swap that will give a fixed rate of interest.

As per the terms of agreement of swap NoBank will borrow Rs.50 crore from Sleepless at PLR+80bp per annum and will lend Rs. 50 crore to Sleepless at fixed rate of 10% p.a. The settlement shall be made at the net amount due from each other. For this services NoBank will charge commission @0.2% p.a. if the loan amount. The present PLR is 8.2%.

You as a financial consultant of NoBank have been asked to carry out scenario analysis of this arrangement. Three possible scenarios of interest rates expected to remain in coming 4 years are as follows:

	Year 1	Year 2	Year 3	Year 4
Scenario 1	10.25	10.50	10.75	11.00
Scenario 2	8.75	8.85	8.85	8.85
Scenario 3	7.20	7.40	7.60	7.70

Assuming that cost of capital is 10%, whether this arrangement should be accepted or not.

Answer:**WN 1: Computation of NPV of scenario 1:**

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	10.25%	5,52,50,000	5,10,00,000	(42,50,000)	0.909	(38,63,250)
2	10.50%	5,65,00,000	5,10,00,000	(55,00,000)	0.826	(45,43,000)
3	10.75%	5,77,50,000	5,10,00,000	(67,50,000)	0.751	(50,69,250)
4	11.00%	5,90,00,000	5,10,00,000	(80,00,000)	0.683	(54,64,000)
NPV of scenario 1						(1,89,39,500)

WN 2: Computation of NPV of scenario 2:

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	8.75%	4,77,50,000	5,10,00,000	32,50,000	0.909	29,54,250
2	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.826	22,71,500
3	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.751	20,65,250
4	8.85%	4,82,50,000	5,10,00,000	27,50,000	0.683	18,78,250
NPV of scenario 2						91,69,250

WN 3: Computation of NPV of scenario 3:

Year	PLR	Payment by Nobank PLR + 0.80%	Receipt by nobank 10.20%	Net payment/ receipt	PVF @ 10%	DCF
1	7.20%	4,00,00,000	5,10,00,000	1,10,00,000	0.909	99,99,000
2	7.40%	4,10,00,000	5,10,00,000	1,00,00,000	0.826	82,60,000
3	7.60%	4,20,00,000	5,10,00,000	90,00,000	0.751	67,59,000
4	7.70%	4,25,00,000	5,10,00,000	85,00,000	0.683	58,05,500
NPV of scenario 3						3,08,23,500

Conclusion:

- Nobank should go ahead with IRS if they believe Scenario 2/3 is likely scenario. However, if they believe scenario 1 will happen they should avoid IRS

13. Interest rate swap (Nov 2019)

IM is an American firm having its subsidiary in Japan and JI is a Japanese firm having its subsidiary in USA. They face the following interest rates

Particulars	IM	JI
USD floating rate	LIBOR + 0.5%	LIBOR + 2.5%
JPY Fixed rate	4%	4.25%

IM wishes to borrow USD at floating rate and JI JY at fixed rate. The amount required by both the companies is same at the current exchange rate. A financial institution requires 75 basis points as commission for arranging swap. The companies agree to share the benefit/loss equally.

You are required to find out

- Whether a beneficial swap can be arranged?
- What rate of interest for both IM and JI?

Answer:**WN 1: Structure of interest rates:**

Particulars	Fixed rate	Floating rate
IM	4%	LIBOR + 0.50%
JI	4.25%	LIBOR + 2.5%

- Total interest rate of combination 1 [IM limited (fixed) & JI Limited (Floating)] = 4% + LIBOR + 2.5% = LIBOR + 6.5%
- Total interest rate of combination 2 [IM limited (floating) & JI Limited (fixed)] = LIBOR + 0.5% + 4.25% = LIBOR + 4.75%
- Ideal combination = Combination 2; This would mean that IM Limited should borrow at floating rate and JI Limited should borrow at fixed rate
- Actual scenario:** IM Limited plans to borrow at floating rate and JI Limited plans to borrow at fixed rate
- Scope for IRS does not exist as the actual scenario is in line with ideal scenario
- Effective borrowing rate for IM = LIBOR + 0.5%
- Effective borrowing rate for JI = 4.25%

14. Calculation of interest rate (May 2012 RTP)

Derivative Bank entered into a plain vanilla swap through on OIS (Overnight Index Swap) on a principal of Rs. 10 crores and agreed to receive MIBOR overnight floating rate for a fixed payment on the principal. The swap was entered into on Monday, 2 August, 2010 and was to commence on 3 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 Rs. 317 net on settlement, calculate Fixed rate and interest under both legs.
Notes:

- ❖ Sunday is Holiday.
- ❖ Work in rounded rupees and avoid decimal working.

Answer:

WN 1: Computation of interest to be paid by floating rate payer:

Date	ROI	Opening balance	Interest	Closing balance
August 3 (Tuesday)	7.75%	10,00,00,000	21,233	10,00,21,233
August 4 (Wednesday)	8.15%	10,00,21,233	22,334	10,00,43,567
August 5 (Thursday)	8.12%	10,00,43,567	22,256	10,00,65,823
August 6 (Friday)	7.95%	10,00,65,823	21,795	10,00,87,618
August 7 (Saturday)	7.98%	10,00,87,618	43,764	10,01,31,382
August 9 (Monday)	8.15%	10,01,31,382	22,358	10,01,53,740
Total			1,53,740	

- Interest under floating leg = Rs.1,53,740
- Derivative bank is paying fixed rate and receiving floating rate. Under net settlement they are receiving Rs.317. This is possible if interest under fixed leg is lower than interest under floating leg
- Interest under fixed leg = 1,53,740 - 317 = 1,53,423

Computation of fixed rate:

$$\text{Interest under fixed leg} = 10 \text{ Crores} \times \text{ROI} \times \left(\frac{7}{365}\right) = 1,53,423$$

$$\text{ROI} = 1,53,423 \times \left(\frac{365}{7}\right) \times \left(\frac{1}{10 \text{ Crores}}\right) = 0.079999 \text{ (or) } 8\%$$

15. Interest rate swap (November 2017 RTP)

A textile manufacturer has taken floating interest rate loan of Rs. 40,00,000 on 1st April, 2012. The rate of interest at the inception of loan is 8.5% p.a. interest is to be paid every year on 31st March, and the duration of loan is four years. In the month of October 2012, the Central bank of the country releases following projections about the interest rates likely to prevail in future.

(i) On 31st March, 2013, at 8.75%; on 31st March, 2014 at 10% on 31st March, 2015 at 10.5% and on 31st March, 2016 at 7.75%. Show how this borrowing can hedge the risk 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, 2012 and the actual rate of interest on the respective due dates happens to be as: on 31st March, 2013 at 10.2%; on 31st March, 2014 at 11.5%; on 31st March, 2015 at 9.25%; on 31st March, 2016 at 8.25%. Show how the settlement will be executed on the perspective interest due dates.

Answer:

WN 1: Hedging interest rate risk:

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:

- National Principal : Rs. 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 2016
- 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 Rs. 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.

The premium to be paid on 1st October 2012 is 30,000/- (Rs. 40,00,000 × 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

WN 2: Settlement on respective interest rates:

Date	Actual Rate	Settlement %	Settlement Amount
31 st March 2013	10.20%	1.70%	68,000
31 st March 2014	11.50%	3.00%	1,20,000
31 st March 2015	9.25%	0.75%	30,000
31 st March 2016	8.25%	-	-

16. Selection of source of funding (Nov 2019 exam):

A German subsidiary of an US based MNC has to mobilize 1,00,000 Euro's working capital for the next 12 months. It has the following options:

Loan from German Bank	5% per annum
Loan from US Parent Bank	4% per annum
Loan from Swiss Bank	3% per annum

Banks in Germany charge an additional 0.25% p.a. towards loan servicing. Loans from outside Germany attract withholding tax of 8% on interest payments. If the interest rates given above are market determined, examine which loan is the most attractive using interest rate differential.

Answer:

Computation of net cost under each of the options:

Cost in Germany	Borrowing rate + Loan servicing cost 5% + 0.25%	5.25%
Cost in USA	Borrowing rate ± Premium/Discount (4%) $\frac{1.05}{1 - 0.08} + 0.96\%$ 4.35% + 0.96%	5.31%
Cost in Switzerland	Borrowing rate ± Premium/Discount (3%) $\frac{1.05}{1 - 0.08} + 1.94\%$ 3.26% + 1.94%	5.20%

Conclusion:

- German Subsidiary should borrow money from Swiss Bank as the effective cost is lowest

Computation of exchange rate premium in USA and Switzerland:

Premium in USA:

$$(1 + \text{Home Currency Rate}) = (1 + \text{Foreign Currency Rate}) \times (1 + \text{Premium})$$

$$(1 + 5\%) = (1 + 4\%) \times (1 + \text{Premium})$$

$$(1 + \text{Premium}) = \frac{1.05}{1.04}; (1 + \text{Premium}) = 1.0096$$

$$\text{Premium} = 0.0096 \text{ (or) } 0.96\%$$

Premium in Switzerland:

$$(1 + \text{Home Currency Rate}) = (1 + \text{Foreign Currency Rate}) \times (1 + \text{Premium})$$

$$(1 + 5\%) = (1 + 3\%) \times (1 + \text{Premium})$$

$$(1 + \text{Premium}) = \frac{1.05}{1.03}; (1 + \text{Premium}) = 1.0194$$

$$\text{Premium} = 0.0194 \text{ (or) } 1.94\%$$

Chapter 12 - Corporate Valuation**Theory to solve problems****Economic Value Added (EVA):**

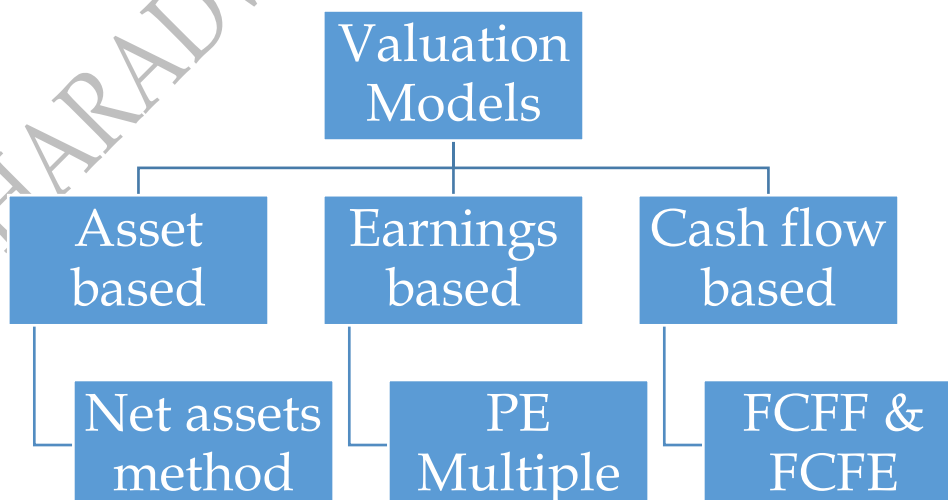
- ❖ EVA is a measure of a company's financial performance based on the residual wealth calculated by deducting its cost of capital from its operating profit, adjusted for taxes. EVA can also be referred to as economic profit and it attempts to capture the true economic profit of a company
- ❖ The purpose of EVA is to assess company and management performance. EVA champions the idea a business is only profitable when it creates wealth and returns for shareholders, and requires performance above a company's cost of capital
- ❖ $EVA = \{EBIT * (1 - \text{Tax rate})\} - \{\text{Invested capital} * WACC\}$
- ❖ EBIT has to be adjusted for non-recurring items, extra-ordinary items such as one-time advertisement expenditure, write-off of bad debts, loss due to fire among others
- ❖ Capital employed has to be ascertained on replacement cost basis and not on book value
- ❖ **EVA versus market value added:** EVA is calculated from earnings point of view whereas market value added represents the difference between market value of equity and book value of equity.

Adjustments to NOPAT and capital Employed:

- ❖ **For Advertising, Research and Development Items expensed, Staff Training**
 - **Impact on Profit:** Increase CY's profit, deduct economic depreciation on PY's EVA adjustment.
 - **Impact on Capital Employed:** Increase capital employed at the end of the year, increase capital employed in respect of similar add backs of PY's investments not treated as such in financial statements (net of economic depreciation)
- ❖ **For Depreciation**
 - **Impact on Profit:** Add accounting depreciation and subtract economic depreciation.
 - **Impact on Capital Employed:** Alter value of non-current assets (and capital employed) to reflect economic depreciation not accounting depreciation.
- ❖ **For Non- Cash Expenses**
 - **Impact on Profit:** Add back to profit.
 - **Impact on Capital Employed:** Add to retained profits at the end of the year.
- ❖ **For tax charge,** this will be based on 'cash taxes' rather than the accruals based methods used in financial reporting.

Note:

- ❖ EVA is calculated on the basis of current year NOPAT and opening capital employed. Hence any current year adjustments are made only to NOPAT and not to capital employed
- ❖ WACC is computed based on post-tax cost of debt

**Free cash flow to firm versus free cash flow to equity:**

Free Cash Flow to Firm (FCFF)

Free Cash Flow to Equity (FCFE)

FCFF is the cash available to all of the firm's investors, including stockholders and bondholders.	FCFE is the amount of FCFF left after the firm has met all its obligations to its other investors such as bondholders
Value of the firm can be calculated by discounting FCFF at weighted average cost of capital (WACC)	Value of the equity can be calculated by discounting FCFE at cost of equity

FCFF can be calculated using the following items:

From Net Income	Net Income + Non-cash charges + Interest * (1 - Tax rate) - Fixed capital investment - working capital investment
From EBIT	EBIT * (1 - Tax rate) + Non-cash charges - Fixed capital investment - working capital investment
From EBITDA	EBITDA * (1 - Tax rate) + (Depreciation * Tax rate) - Fixed capital investment - working capital investment
From cash flow from operations (CFO)	CFO + Interest * (1 - Tax rate) - Fixed capital investment

FCFE can be calculated using the following items:

From FCFF	FCFF - Interest * (1 - Tax rate) + Net borrowing
From Net Income	Net Income + Non-cash charges - Fixed capital investment - working capital investment + Net borrowing
From CFO	CFO - Fixed capital investment + Net borrowing

Market Value Added (MVA), Economic Value Added (EVA) and Shareholder Value Added (SVA):

EVA	[EBIT * (1 - Tax rate)] - [WACC * Invested capital]
MVA	Market value of firm - Book value of firm
SVA	SVA approach is based on future cash flows and it is used for calculating intrinsic value of equity

How to compute Shareholder Value Added?

- ❖ **Step 1:** Compute the future cash flows of the firm and discount the same at cost of capital. The sum of the values of step 1 will be the intrinsic value of firm
- ❖ **Step 2:** Intrinsic value of equity = Intrinsic value of Firm + Market value of non-core assets - Value of debt

Practical Problems**Overview:**

- Part I - Economic Value Added
- Part II - Valuation of Business
- Part III - Market Value Added and Shareholder Value Added

Part I - Economic Value Added**1. Calculation of EVA (May 2012 RTP)**

The following figures pertain to ABC Limited as on December 31, 2010

Particulars	Amount (in lacs)
Income from consultancy	935.00
EBIT	180.00
Less: Interest on loan	18.00
EBT	162.00
Tax @ 35%	56.70
EAT	105.30

Balance sheet as on December 31, 2010

Liabilities	Amount	Assets	Amount
Equity share capital of Rs.10 each	100	Land and Building	200
Reserves & Surplus	325	Computer & software	295
Loans	180	Current assets	290
Current liabilities	180		

	785		785

With the above information and following assumption you are required to compute:

- Economic value added
- Market value added

Assuming that:

- WACC is 12%
- The share of the company is currently quoted at Rs.50 each

Answer:

WN 1: Computation of Economic Value Added:

- $EVA = [EBIT \times (1 - \text{Tax rate})] - (\text{Capital employed} \times \text{WACC})$
- $EVA = [180 \times (1 - 35\%)] - [(100 + 325 + 180) \times 12\%]$
- $EVA = 117 - 72.60$
- **EVA = 44.40 lacs**

WN 2: Computation of market value added:

- Market value added = Market value of firm - Book value of firm
- $MVA = [(10 \times 50 + 180)] - [100 + 325 + 180]$
- **MVA = Rs.75 lacs**

Note:

- **Value of Firm = Value of equity + Value of debt + Value of preference**

2. Calculation of EVA (May 2015 RTP)

ABC Limited has divisions A, B & C. The Division C has recently reported an annual operating profit of Rs.2020 lacs. This figure arrived at after charging Rs.300 lacs full cost of advertisement expenditure for launching a new product. The benefits of this expenditure is expected to be lasted for 3 years. The cost of capital of Division C is 11% and cost of debt is 8%. The Net Assets (Invested capital) of Division C as per latest Balance Sheet is Rs.6000 lacs, but replacement cost of these assets is estimated at Rs.8400 lacs. You are required to compute EVA of Division C.

Answer:

Computation of Economic Value Added:

- $EVA = [EBIT \times (1 - \text{Tax rate})] - (\text{Capital employed} \times \text{WACC})$
- $EVA = [2,220 \times (1 - 25\%)] - [8,400 \times 11\%]$
- $EVA = 1,665 - 924$
- **EVA = Rs.741 lacs**

Note 1: Computation of Adjusted EBIT:

Particulars	Amount
Reported EBIT	2,020
Add: Full Advertisement expenditure	300
Less: Annual advertisement charge (300/3)	-100
Adjusted EBIT	2,220

Note 2: Tax rates:

- It is assumed that tax rates are 25%

3. Concept of EVA dividend (Nov 2015 RTP)

Delta Limited's current financial year's income statement reports its net income as Rs.15 lacs. Delta's marginal tax rate is 40% and its interest expense for the year was Rs.15 lacs. The company has Rs.100 lacs of invested capital, of which 60% is debt. In addition, Delta Limited tries to maintain a WACC of 12.6%.

- Compute the operating income or EBIT earned by Delta Limited in the current year
- What is Delta Limited EVA for the current year
- Delta Limited has 2,50,000 equity shares outstanding. According to the EVA you computed in (ii), how much can Delta pay in dividend per share before the value of the company would start to decrease? If Delta Limited does not pay any dividends what would happen to value of the company.

Answer:

WN 1: Computation of operating income (EBIT)

Particulars	Calculation	Amount

Net income (PAT)		15,00,000
Income tax		10,00,000
Profit before tax	15,00,000	25,00,000
	1 - 0.4	
Add: Interest		15,00,000
Earnings before interest and taxes		40,00,000

WN 2: Computation of Economic Value Added:

- EVA = [EBIT × (1 - Tax rate)] - (Capital employed × WACC)
- EVA = [40,00,000 × (1 - 40%)] - [1,00,00,000 × 12.60%]
- EVA = 24,00,000 - 12,60,000
- EVA = Rs.11,40,000**

WN 3: Computation of amount of dividend payment:

- The company has reported economic value added (excess earnings) of Rs.11,40,000. This entire EVA will go to the equity shareholders
- EVA per share = (11,40,000 / 2,50,000) = Rs.4.56 per share
- Therefore, the company can pay dividend of Rs.4.56 per share without any impact on the value of the company. If the company does not pay dividends then the share price will increase by Rs.4.56 per share

4. Calculation of EVA (Nov 2013 RTP)

Consider the following operating information gathered from 3 companies that are identical except for capital structures

Particulars	P Limited	Q Limited	R Limited
Total invested capital	100,000	100,000	100,000
Debt/assets ratio	0.80	0.50	0.20
Shares outstanding	6,100	8,300	10,000
Before-tax cost of debt	14%	12%	10%
Cost of equity	26%	22%	20%
Operating income	25,000	25,000	25,000
Net income	8,970	12,350	14,950
Tax rate	35%	35%	35%

- Compute the weighted average cost of capital for each company
- Compute the EVA for each company
- Based on the results of your computation in part b, which company would be considered as best investment and why?
- Assume the industry P/E ratio generally is 15x. Using the industry norm, estimate the price for each share
- What factors would cause you to adjust the PE ratio value used in part d so that it is more appropriate?

Answer:**WN 1: Computation of weighted average cost of capital:****P Limited:**

Source	Cost	Weight	Product
Equity	26	0.2	5.2
Debt	9.1	0.8	7.28
WACC			12.48

- Cost of debt = 14% × (1 - 35%) = 9.10%

Q Limited:

Source	Cost	Weight	Product
Equity	22	0.5	11
Debt	7.8	0.5	3.9
WACC			14.9

- Cost of debt = $12\% \times (1 - 35\%) = 7.80\%$

R Limited:

Source	Cost	Weight	Product
Equity	20	0.8	16
Debt	6.5	0.2	1.3
WACC			17.3

- Cost of debt = $10\% \times (1 - 35\%) = 6.50\%$

WN 2: Computation of Economic value added:

EVA = [EBIT x (1 - Tax rate)] - (Capital employed x WACC)

Particulars	Company P	Company Q	Company R
EBIT (operating income)	25,000	25,000	25,000
EBIT x (1 - Tax rate) (A)	16,250	16,250	16,250
Capital employed	1,00,000	1,00,000	1,00,000
WACC	12.48	14.90	17.30
Cost of capital employed (WACC x Capital employed) (B)	12,480	14,900	17,300
EVA (A - B)	3,770	1,350	-1,050

- Company P would be considered as the best investment since the EVA of the company is highest and its weighted average cost of capital is the lowest

WN 3: Computation of Market price per share:

Particulars	Company P	Company Q	Company R
Net income (PAT)	8,970	12,350	14,950
No of shares	6,100	8,300	10,000
Earnings per share	1.4705	1.4880	1.495
PE Multiple	15	15	15
MPS (EPS x PE Multiple)	22.06	22.32	22.43

Comment on PE Multiple:

- The PE ratio can be adjusted for the change in capital structure of 3 companies. P Limited has a highly leverage capital structure. This will be considered as a risky company and hence will have lower PE Multiple
- R Limited has a better capital structure and hence it will be considered as less risky. This company will therefore have a higher PE Multiple

5. Computation of EVA (May 2019)

Compute Economic value Added (EVA) of Good Luck Limited from the following information:

Particulars	Amount in lacs
Revenue from operations	2000
Direct expenses	800
Indirect expenses	400
Profit before interest and tax	800
Interest	30
Profit before tax	770
Tax	231
Profit after tax	539
Balance sheet	
Shareholder funds	
Equity share capital	1000
Reserves and surplus	600
Long term borrowings	200
Current Liabilities	800
Total liabilities	2600
Assets	
Non-current assets	2000

Current assets	600

Other information:

- Cost of debts is 15%
- Cost of equity (Shareholder's expected return) is 12%
- Tax rate is 30%
- Bad debts provision of Rs.40 lacs is included in indirect expenses and Rs.40 lacs reduced from receivables in current assets.

Answer:

WN 1: Computation of NOPAT:

Particulars	Calculation	Amount (in lacs)
Profit after tax		539
Add: Interest		30
Add: Non-cash expenses		40
NOPAT		609

- EVA adjustments state that non-cash expenses (bad debt provision) need to be added back to profit
- Tax expense will be based on 'cash taxes' rather than accruals-based tax used in financial reporting. It is assumed that Rs.231 lac is the actual tax outflow and hence no adjustment is made for the same

WN 2: Computation of WACC:

Source	Cost	Weight	Product
Debt	10.50 (15% x 70%)	200	2,100
Equity	12.00	1,640	19,680
Total		1,840	21,780

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{21,780}{1,840} = 11.84\%$$

Note:

- It is assumed that cost of debt given in the question is pre-tax cost of debt
- Equity has been adjusted to give effect to the bad debt provision. Any non-cash item will be added to profits and will also finally get added to the equity of the company

WN 3: Computation of EVA:

- $\text{EVA} = \text{NOPAT} - (\text{Capital employed} \times \text{WACC})$
- $\text{EVA} = 609 \text{ lacs} - (1,840 \times 11.84\%)$
- $\text{EVA} = 609 \text{ lacs} - 217.86 \text{ lacs}$
- **EVA = Rs.391.14 lacs**

6. Computation of EVA (Nov 2012)

With the help of the following information of Jatayu Limited compute the Economic value Added:

Capital structure	Equity capital – Rs.160 lacs Reserves and surplus – Rs.140 lacs 10% debentures – Rs.400 lacs
Cost of equity	14%
Financial leverage	1.5 times
Income tax rate	30%

Answer:

Note 1: Computation of EBIT:

Financial leverage	=	$\frac{\text{EBIT}}{\text{EBIT} - \text{Interest}}$
1.5	=	$\frac{\text{EBIT}}{\text{EBIT} - 40 \text{ lacs}}$
$1.5\text{EBIT} - 60 \text{ lacs}$	=	EBIT
0.5 EBIT	=	60 lacs
EBIT	=	120 lacs

Note 2: Computation of WACC:

Source	Cost	Weight	Product

Equity	14%	300	42
Debt	7%	400	28
Total	10%	700	70

- ❖ Cost of debt should be post-tax cost of debt and the same would be $10\% \times (1 - 30\%) = 7\%$
- ❖ WACC = Sum of product/Sum of weights = $70/700 = 10\%$

Note 3: Computation of EVA:

EVA	=	EBIT $\times$ (1 - Tax rate) - (WACC $\times$ Invested capital)
EVA	=	120 lacs $\times$ (1 - 0.3) - (10% $\times$ 700)
EVA	=	84 lacs - 70 lacs
EVA	=	14 lacs

7. WACC and EVA computation (May 2014)

RST Limited's current financial year's income statement reported its net income as Rs.25,00,000. The applicable income tax rate is 30%. Following is the capital structure of RST Limited at the end of current financial year:

Particulars	Amount
Debt (Coupon rate = 11%)	40 lacs
Equity (Share capital + Reserves and Surplus)	125 lacs
Invested capital	165 lacs

Following data is given to estimate the cost of equity capital:

Particulars	Amount
Beta of RST Limited	1.36 Times
Risk-free rate	8.5%
Average market risk premium	9%

Required:

- Estimate weighted average cost of capital (WACC) of RST Limited and
- Estimate Economic Value Added (EVA) of RST Limited

Answer:**WN 1: Computation of WACC:**

Source	Cost	Weight	Product
Equity	20.74%	125	25.925
Debt	7.7%	40	3.08
Total	17.58%	165	29,005

Note:

- ❖ Cost of equity = $R_f + \text{Beta} \times (R_m - R_f)$
- ❖ Cost of equity = $8.5\% + 1.36 \times 9\% = 20.74\%$

WN 2: Computation of EVA:

EVA	=	EBIT $\times$ (1 - Tax rate) - (WACC $\times$ Invested capital)
EVA	=	40,11,429 $\times$ (1-0.3) - (17.58% $\times$ 1,65,00,000)
EVA	=	28,08,000 - 29,00,700
EVA	=	-92,700

Note: Computation of EBIT:

Net Income/PAT	=	25,00,000
PBT	=	$\frac{PAT}{1 - \text{Tax rate}} = \frac{25,00,000}{1 - 0.3} = 35,71,429$
EBIT	=	PBT + Interest
EBIT	=	35,71,429 + 4,40,000 = 40,11,429

8. EVA calculation (May 2018)

Constant Engineering Ltd. has developed a high tech product which has reduced the Carbon emission from the burning of the fossil fuel. The product is in high demand. The product has been patented and has a market value of Rs. 100 Crore, which is not recorded in the books. The Net Worth (NW) of Constant Engineering Ltd. is Rs. 200 Crore. Long term debt is Rs. 400 Crore. The product generates a revenue of Rs. 84 Crore. The rate on 365 days Government bond is 10 percent per annum. Bond portfolio generates a return of 12 percent

per annum. The stock of the company moves in tandem with the market. Calculate Economic Value added of the company

Answer:

Computation of WACC:

Source	Cost	Weight	Product
Equity	12%	300	36
Debt	10%	400	40
Total	10.86%	700	76

Note:

- ❖ The rate of Government Bond is given as 10 percent per annum. It is assumed that cost of debt is equal to risk-free rate. There is no information on tax rate and hence no adjustment for the same is made
- ❖ Company's stock moves in line with market and hence cost of equity would be equal to return of market. Bond portfolio gives return of 12% and hence K_e would be equal to 12%
- ❖ Networth of the company is currently 200 crores. Patent has not been recorded in books. The networth will increase to Rs.300 crores post recording of patent

Computation of EVA:

EVA	=	EBIT $\times$ (1 - Tax rate) - (WACC $\times$ Invested capital)
EVA	=	84 crores - (10.86% $\times$ 700 crores)
EVA	=	84 crores - 76 crores
EVA	=	8 crores

Note:

- ❖ It is assumed that revenues given in the question as EBIT of the product. Tax information is not given in the question and hence no adjustment for the same

9. Computation of EVA (May 2018)

Herbal World is a small, but profitable producer of beauty cosmetics using the plant Aloe Vera. Though it is not a high-tech business, yet Herbal's earnings have averaged around Rs. 18.5 lakh after tax, mainly on the strength of its patented beauty cream to remove the pimples. The patent has nine years to run, and Herbal has been offered Rs. 50 lakhs for the patent rights. Herbal's assets include Rs. 50 lakhs of property, plant and equipment and Rs. 25 lakhs of working capital. However, the patent is not shown in the books of Herbal World. Assuming Herbal's cost of capital being 14 percent, calculate its Economic Value Added (EVA)

Answer:

EVA	=	EBIT $\times$ (1 - Tax rate) - (WACC $\times$ Invested capital)
EVA	=	18.5 lacs - (14% $\times$ 125 lacs)
EVA	=	18.5 lacs - 17.5 lacs
EVA	=	1 lac

Note:

- ❖ Capital employed = Fixed assets + Working capital + Patent = 50 lacs + 25 lacs + 50 lacs = 125 lacs
- ❖ Tax adjustment is not needed for earnings as the given information is post-tax

Part II - Valuation of Business

10. Valuation of business

Following information's are available in respect of Intellect design arena 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 - Rs. 2,000 crores
- ❖ EBIT - Rs. 300 crores
- ❖ Capital expenditure - Rs. 280 crores
- ❖ Depreciation - Rs. 200 crores

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

Particulars	High Growth	Stable Growth
Growth in revenues and EBIT	20%	10%
Growth in capital expenditure and depreciation	20%	Capex 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?

Answer:

WN 1: Computation of cash flows:

- Value of firm is the present value of free cash flow to firm (FCFF) discounted at cost of capital
- We will not be deducting interest cost while computing FCFF
- High growth phase will last for four years and growth will stabilize 5th year onwards. We should compute cash flows till the first year of stabilization phase (Year 5)

(in crores)

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	2,400.00	2,880.00	3,456.00	4,147.20	4,561.92
EBIT	360.00	432.00	518.40	622.08	684.29
Tax	-108.00	-129.60	-155.52	-186.62	-205.29
PAT	252.00	302.40	362.88	435.46	479.00
Working capital increase	-100.00	-120.00	-144.00	-172.80	-103.68
Net capex	-96.00	-115.20	-138.24	-165.89	-
Free cash flow	56.00	67.20	80.64	96.77	375.32

Note:

- Revenues = Previous year revenues + Growth rate
- EBIT = Previous year EBIT + Growth rate
- Net capex = Capital expenditure - Depreciation
- Net capex of previous year = 280 crores - 200 crores = Rs.80 crores
- Capex of year 1 = 80 crores + 20% = Rs.96 crores. Capex is computed in similar manner for balance years
- Increase in working capital = Current year working capital - Previous year working capital
- WC increase for year 1 = (2,400 × 25%) - (2,000 × 25%). WC increase is computed in similar manner for other years

WN 2: Computation of WACC for high-growth and normal phase:

High-growth phase:

Source	Cost	Weight	Product
Debt	9.10 (13 × 70%)	1	9.10
Equity	16.90	1	16.90
Total		2	26.00

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{26}{2} = 13.00\%$$

Note:

- Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 10 + (1.15 \times 6) = 10 + 6.90 = 16.90\%$
- Discount rate will be taken as 13 percent for the cash flows from year 1 to 4 (High growth phase)

Normal phase:

Source	Cost	Weight	Product
Debt	9.00 (12.86 × 70%)	2	18.00
Equity	14	3	42.00
Total		5	60.00

$$\text{WACC} = \frac{\text{Sum of Products}}{\text{Sum of weights}} = \frac{60}{5} = 12.00\%$$

Note:

- Cost of equity = $R_f + \text{Beta} \times (R_m - R_f) = 9 + (1 \times 5) = 14\%$
- Discount rate will be taken as 14 percent for the cash flows from year 5 onwards (normal phase)

WN 3: Computation of value of firm:

Year	Cash flow	PVF	DCF
1	56.00	0.885	49.56
2	67.20	0.783	52.62
3	80.64	0.693	55.88
4	96.77	0.613	59.32
4	18,766.00	0.613	11,503.56
Value of Firm			11,720.94

Note:

- Growth rate stabilizes at 10 percent from year 5 onwards. This would therefore take the character of growing perpetuity. We can value the cash flows from year 5 onwards using Gordon model

$$\text{Year 4 value} = \frac{\text{CF}_5}{\text{Cost of capital} - \text{Growth rate}} = \frac{375.32}{12\% - 10\%} = \text{Rs. 18,766 Crores}$$

11. Valuation of strategy (May 2017 RTP)

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

Particulars	Amount (in '000s)
Sales	20,000
Gross margin (20%)	4,000
Accounting, Administration and Distribution expenses (10%)	2,000
Profit before tax	2,000
Tax at 30%	600
Profit after tax	1,400
Balance Sheet Information	
Fixed assets	8,000
Current assets	4,000
Equity	12,000

As per the new strategy, sales will grow at 20 percent per year for the next three years. The gross margin ratio, assets turnover ratio, capital structure and income tax rate will remain unchanged. Depreciation is to be at 10 percent on the value of the net fixed assets at the beginning of the year. Company's target rate of return is 15%. Determine if the strategy is financially viable.

Answer:**WN 1: Valuation of firm with new strategy:****Part 1: Computation of cash flows:**

- The firm will grow at 20 percent for first three years and thereafter revenues is expected to remain same
- Growth stabilizes from year 4 onwards and hence we should compute cash flows till year 4

(in '000s)

Particulars	Year 1	Year 2	Year 3	Year 4
Sales	24,000.00	28,800.00	34,560.00	34,560.00
Gross margin (20%)	4,800.00	5,760.00	6,912.00	6,912.00
Less: Admin expense (10%)	-2,400.00	-2,880.00	-3,456.00	-3,456.00
PBT	2,400.00	2,880.00	3,456.00	3,456.00
Less: Tax @30%	-720.00	-864.00	-1,036.80	-1,036.80
PAT	1,680.00	2,016.00	2,419.20	2,419.20
WC change	-800.00	-960.00	-1,152.00	-
Net capex	-1,600.00	-1,920.00	-2,304.00	-
FCFF	-720.00	-864.00	-1,036.80	2,419.20

Note:

- Revenues = Previous year revenues + Growth rate

- Gross margin = 20 percent of revenues
- PBT = 10 percent of revenues
- Asset turnover ratio will remain same. This would mean that if revenues increase by 20 percent, net fixed assets and working capital will also increase by 20%. Hence net increase in fixed assets would be equal to net capex.
- Net capex of year 1 = $(8,000 + 20\%) - 8,000 = 1,600$ Crores. Net capex for balance years is computed in same manner
- Increase in working capital = Current year working capital - Previous year working capital
- WC increase for year 1 = $(4,000 + 20\%) - (4,000) = 800$ crores. WC increase is computed in similar manner for other years

Part 2: Valuation of firm:

Year	Cash flow	PVF @ 15%	DCF
1	-720.00	0.870	-626.40
2	-864.00	0.756	-653.18
3	-1,036.80	0.658	-682.21
3	16,128.00	0.658	10,612.22
Value with strategy			8,650.43

(in '000s)

Note:

- The cash flows will remain stable at Rs.2,419.20 from year 4 onwards. This would take the character of perpetuity and the same is valued as under:

$$\text{Year 3 value} = \frac{\text{CF}_4}{\text{Cost of capital} - \text{Growth rate}} = \frac{2,419.20}{15\% - 0\%} = \text{Rs. } 16,128$$

WN 2: Valuation of firm without strategy:

- Cash flow = PAT + Depreciation - Capital expenditure
- The company is not going to grow and hence net fixed assets would remain stable at Rs.8,000. This would mean that depreciation would be offset by the amount of capital expenditure
- Cash flow = $1,400 + (10\% \times 8,000) - 800 = \text{Rs. } 1,400$
- The cash flow will remain stable at Rs.1,400 for all years and hence this would take the character of perpetuity. The same is valued as under:

$$\text{Year 0 value} = \frac{\text{CF}_1}{\text{Cost of capital} - \text{Growth rate}} = \frac{1,400}{15\% - 0\%} = \text{Rs. } 9,333.33$$

Conclusion:

- Strategy is not financially viable as the value of the firm falls to Rs.8,650.43 thousands from Rs.9,333.33 thousands
- Value of strategy = $8,650.43 - 9,333.33 = -682.90$ thousands

12. Valuation of firm (Nov 2020 RTP):

Following information is given in respect of WXY Ltd., which is expected to grow at a rate of 20% p.a. for the next three years, after which the growth rate will stabilize at 8% p.a. normal level, in perpetuity.

Particulars	For the year ended March 31, 2014
Revenues	Rs.7,500 Crores
COGS	Rs.3,000 crores
Operating expenses	Rs.2,250 Crores
Capital expenditure	Rs.750 Crores
Depreciation (included in operating expenses)	Rs.600 Crores

During high growth period, revenues & Earnings before Interest & Tax (EBIT) will grow at 20% p.a. and capital expenditure net of depreciation will grow at 15% p.a. From year 4 onwards, i.e. normal growth period revenues and EBIT will grow at 8% p.a. and incremental capital expenditure will be offset by the depreciation. During both high growth & normal growth period, net working capital requirement will be 25% of revenues. The Weighted Average Cost of Capital (WACC) of WXY Ltd. is 15%. Corporate Income Tax rate will be 30%. Required:

Estimate the value of WXY Ltd. using Free Cash Flows to Firm (FCFF) & WACC methodology.

Answer:

WN 1: Computation of free cash flows for year 1 to year 4:

Particulars	Year 1	Year 2	Year 3	Year 4
Revenues	9,000.00	10,800.00	12,960.00	13,996.00
COGS	-3,600.00	-4,320.00	-5,184.00	-5,598.72
Operating expenses (other than depreciation)	-1,980.00	-2,376.00	-2,851.20	-3,079.30
Depreciation	-720.00	-864.00	-1,036.80	-1,119.74
EBIT	2,700.00	3,240.00	3,888.00	4,199.04
Tax @ 30%	-810.00	-972.00	-1,166.40	-1,259.71
EAT	1,890.00	2,268.00	2,721.60	2,939.33
Less: Net capex (capex – depreciation)	-172.50	-198.38	-228.13	-
Less: Increase in working capital (increase in revenues x 25%)	-375.00	-450.00	-540.00	-259.20
Free cash flow (FCFF)	1,342.50	1,619.62	1,953.47	2,680.13

WN 2: Valuation of WXY Limited:

Year	Cash flow	PVF @ 15%	DCF
1	1,342.50	0.8686	1,167.44
2	1,619.62	0.7561	1,224.59
3	1,953.47	0.6575	1,284.41
3	38,287.57	0.6575	24,174.08
Value with strategy			28,850.52

Note:

- The cash flows will remain be Rs.2,680.13 crores in year 4 and grow at the rate of 8%. This would take the character of growing perpetuity and the same is valued as under:

$$\text{Year 3 value} = \frac{\text{CF}_4}{\text{Cost of capital} - \text{Growth rate}} = \frac{2,680.13}{15\% - 8\%} = \text{Rs. } 38,287.57 \text{ Crores}$$

13. Range of business valuation (Nov 2016 RTP)

ABC, a large business house is planning to sell its wholly owned subsidiary KLM. Another large business entity XYZ has expressed its interest in making a bid for KLM. XYZ expects that after acquisition the annual earning of KLM will increase by 10%. Following information, ignoring any potential synergistic benefits arising out of possible acquisitions, are available:

- Profit after tax for KLM for the financial year which has just ended is estimated to be Rs.10 crore.
- KLM's after tax profit has an increasing trend of 7% each year and the same is expected to continue.
- Estimated post tax market return is 10% and risk free rate is 4%. These rates are expected to continue.
- Corporate tax rate is 30%.

	XYZ	ABC	Proxy entity
No of shares	100 lakhs	80 lakhs	
Current share price	Rs.287	Rs.375	
Dividend payout	40%	50%	50%
Debt: Equity at market values	1:2	1:3	1:4
PE ratio	10	13	12
Equity beta	1	1.1	1.1

Assume gearing level of KLM to be the same as for ABC and a debt beta of zero. You are required to calculate:

- ❖ Appropriate cost of equity for KLM based on the data available for the proxy entity.
- ❖ A range of values for KLM both before and after any potential synergistic benefits to XYZ of the acquisition.

Answer:**WN 1: Computation of cost of equity of KLM based on proxy entity:**

- Beta of two companies operating in similar business would remain the same, irrespective of the capital structure
- In this question, we will first compute Beta of proxy entity and the same would be equated to Beta of KLM

Beta of Proxy Entity:

Source	Beta	Weight	Product
Debt	0	0.7	0
Equity	1.1	4	4.4
Total		4.7	4.4

$$\text{Beta of proxy entity} = \frac{\text{Sum of Product}}{\text{Sum of weights}} = \frac{4.4}{4.7} = \mathbf{0.9362 \text{ Times}}$$

- Weight for debt should be equal to weight $\times (1 - \text{Tax rate})$. Weights for debt and equity given in the question is 1:4.
- Weight for debt for Beta computation is 0.7 (1×0.7)

Equity Beta of KLM:

Source	Beta	Weight	Product
Debt	0	0.70	0
Equity	1.1546	3.00	3.4639
Total	0.9362	3.70	3.4639

- Beta of proxy entity is 0.9362 Times and hence the Beta of KLM would also be 0.9362 Times
- Total of product of KLM = $0.9362 \times 3.70 = 3.4639$
- Product of equity will be balancing figure and the same would be 3.4639

$$\text{Equity Beta} = \frac{3.4639}{3} = 1.1546 \text{ Times}$$

Cost of equity of KLM:

$$\text{Cost of equity} = R_f + \text{Beta} \times (R_m - R_f)$$

$$\text{Cost of equity} = 4 + 1.1546 \times (10 - 4)$$

$$\text{Cost of equity} = 4 + 6.93 = \mathbf{10.93\%}$$

WN 2: Valuation of company before and after synergy benefits:

Particulars	Pre-acquisition		Post-acquisition	
	Calculation	Amount (Crores)	Calculation	Amount (Crores)
Based on PE Multiple Approach:				
Proxy company PE Multiple	10 crores $\times$ 12	120.00	11 crores $\times$ 12	132.00
ABC's PE Multiple	10 crores $\times$ 13	130.00	11 crores $\times$ 13	143.00
XYZ's PE Multiple	10 crores $\times$ 10	100.00	11 crores $\times$ 10	110.00
Based on Dividend-Payout Ratio:				
40% Payout	10.7 $\times$ 40%	108.91	11 $\times$ 1.07 $\times$ 40%	119.80
	10.93% - 7%		10.93% - 7%	
50% Payout	10.7 $\times$ 50%	136.13	11 $\times$ 1.07 $\times$ 50%	149.75
	10.93% - 7%		10.93% - 7%	

Note:

- Current earnings of the company is Rs.10 Crores and it is assumed that same will increase to Rs.11 Crores due to acquisition. Growth of 7 percentage is then applied on the base of this Rs.10 or Rs.11 Crores
- ICAI solution has assumed that growth rate will remain same at 7 percent in both scenarios

Conclusion:

- Range of pre-synergy valuation = Rs.100 Crores to Rs.136.13 Crores
- Range of post-synergy valuation = Rs.110 Crores to Rs.149.75 Crores

14. Break-up value approach (May 2018 RTP)

Using the chop-shop approach (or Break-up value approach), assign a value for Cranberry Ltd. whose stock is currently trading at a total market price of €4 million. For Cranberry Ltd, the accounting data set forth three business segments: consumer wholesale, retail and general centers. Data for the firm's three segments are as follows:

Business segment	Segment sales	Segment assets	Segment Operating Income

Wholesale	2,25,000	6,00,000	75,000
Retail	7,20,000	5,00,000	1,50,000
General	25,00,000	40,00,000	7,00,000

Industry data for "pure-play" firms have been compiled and are summarized as follows:

Business segment	Capitalization / Sales	Capitalization / Assets	Capitalization / Operating income
Wholesale	0.85	0.7	9
Retail	1.2	0.7	8
General	0.8	0.7	4

Answer:

WN 1: Valuation of company on basis of capitalization/sales multiple:

Segment	Sales	Multiple	Capitalization
Wholesale	2,25,000	0.85	1,91,250
Retail	7,20,000	1.20	8,64,000
General	25,00,000	0.80	20,00,000
Value of company			30,55,250

WN 2: Valuation of company on the basis of capitalization/assets multiple:

Segment	Sales	Multiple	Capitalization
Wholesale	6,00,000	0.70	4,20,000
Retail	5,00,000	0.70	3,50,000
General	40,00,000	0.70	28,00,000
Value of company			35,70,000

WN 3: Valuation of company on the basis of capitalization/operating income multiple:

Segment	Sales	Multiple	Capitalization
Wholesale	75,000	9.00	6,75,000
Retail	1,50,000	8.00	12,00,000
General	7,00,000	4.00	28,00,000
Value of company			46,75,000

WN 4: Final valuation:

Value of Firm = Average values of three approaches

$$\text{Value of Firm} = \frac{30,55,250 + 35,70,000 + 46,75,000}{3} = \text{Rs. 37, 66, 750}$$

15. Net assets valuations and earnings capitalization (Nov 2012)

H limited agrees to buy over the business of B Limited effective 1st April, 2012. The summarized Balance Sheets of H Limited and B Limited as on 31st March 2012 are as follows: Balance Sheet as at 31st March, 2012 (In Crores of Rupees)

Liabilities	H Limited	B Limited
Equity Shares of Rs 100 each	350.00	
Equity Shares of Rs 10 each		6.50
Reserves & Surplus	950.00	25.00
Total liabilities	1,300.00	31.50
Assets:		
Net fixed assets	220.00	0.50
Net current assets	1,020.00	29.00
Deferred tax assets	60.00	2.00
Total	1,300.00	31.50

H Limited proposes to buy out B Limited and the following information is provided to you as part of the scheme of buying:

- The weighted average post tax maintainable profits of H Limited and B Limited for the last 4 years are Rs.300 crores and 10 crores respectively.
- Both the companies envisage a capitalization rate of 8%.
- H Limited has a contingent liability of Rs.300 crores as on 31st March, 2012.

- d) H Limited to issue shares of Rs.100 each to the shareholders of B Limited in terms of the exchange ratio as arrived on a Fair Value basis. (Please consider weights of 1 and 3 for the value of shares arrived on Net Asset basis and Earnings capitalization method respectively for both H Limited and B Limited)

You are required to arrive at the value of the shares of both H Ltd. and B Ltd. under:

- (i) Net Asset Value Method
 (ii) Earnings Capitalization Method
 (iii) Exchange ratio of shares of H Limited to be issued to the shareholders of B Limited. On a Fair value basis (taking into consideration the assumption mentioned in point 4 above)

Answer:

WN 1: Valuation of share as per net assets method:

(in crores)

Particulars	H Limited	B Limited
Value of assets	1,300	31.50
Less: Liabilities (Note)	-300	-0
Net assets	1,000	31.50
No of shares	3.50	0.65
Value per share	285.71	48.46

Note:

- It is assumed that entire contingent liability will crystallize into actual liability

WN 2: Valuation of share as per Earnings capitalization method:

Particulars	H Limited	B Limited
Future maintainable profit	300	10
Capitalization rate	8%	8%
Value of company (FMP/Capitalization rate)	3,750	125
No of shares	3.50	0.65
Value per share	1,071.43	192.31

WN 3: Computation of fair value:

$$\text{Fair value} = \frac{(\text{Price as per Net assets method} \times 1) + (\text{Price as per Earnings method} \times 3)}{1 + 3}$$

$$\text{H Limited} = \frac{(285.71 \times 1) + (1,071.43 \times 3)}{1 + 3} = \text{Rs. 875 per share}$$

$$\text{B Limited} = \frac{(48.46 \times 1) + (192.31 \times 3)}{1 + 3} = \text{Rs. 156.35 per share}$$

WN 4: Exchange ratio on the basis of fair value:

Basis of exchange ratio		Fair Value
Base values	H Ltd: B Ltd	875: 156.35
Exchange ratio		156.35:875 (or) 0.1787:1

16. Net assets method and earnings capitalization method (May 2017 RTP)

Given below is the balance sheet of S Limited as on March 31, 2008:

Liabilities	Rs. in lacs	Assets	Rs. in lacs
Share capital (of Rs.10 each)	100	Land and building	40
Reserves and surplus	40	Plant and machinery	80
Long term debts	30	Investments	10
		Stock	20
		Debtors	15
		Cash at Bank	5
	170		170

You are required to work out the value of the company's shares on the basis of Net Assets Method and Profit-earning capacity (capitalization) method and arrive at the fair price of the shares, by considering the following information:

- ❖ Profit for the current year Rs.64 lacs includes Rs.4 lacs extraordinary income and Rs.1 lac income from investments of surplus funds; such surplus funds are unlikely to recur
- ❖ In subsequent years, additional advertisement expenses of Rs.5 lacs are expected to be incurred each year
- ❖ Market value of Land and Building and Plant and Machinery has been ascertained at Rs.96 lacs and Rs.100 lacs respectively. This will entail additional depreciation of Rs.6 lacs each year
- ❖ Effective income tax rate is 30%
- ❖ The capitalization rate applicable to similar businesses is 15%

Answer:

WN 1: Valuation of company on the basis of net assets method:

Particulars	Amount (in lacs)
Value of assets:	
Land and building	96.00
Plant and machinery	100.00
Investments	10.00
Stock	20.00
Debtors	15.00
Cash at bank	5.00
Total value of assets	246.00
Less: Long term debt	-30.00
Value of net assets	216.00
No of shares	10
Value per share (216/10)	21.60

WN 2: Valuation of company on the basis of earnings capitalization method:

Particulars	Amount (in lacs)
Profit before tax	64.00
Less: Extraordinary income	-4.00
Less: Investment income	-1.00
Less: Additional advertisement	-5.00
Less: Additional depreciation	-6.00
Future maintainable PBT	48.00
Less: Tax @ 30%	-14.40
Future maintainable PAT	33.60
Capitalization rate	15%
Value of firm (33.60/15%)	224.00
Less: Debt	-30.00
Value of equity (33.60/15%)	194.00
No of shares	10.00
Value per share (224/10)	19.40

- It is assumed that profit given in the question is profit before tax
- ICAI has considered Rs.224 lacs as value of firm and deducted the value of debt to get the value of equity. However, this approach is not logical as PAT belongs entirely to equity shareholders. But we have considered the answer in line with ICAI solution.

WN 3: Computation of fair value:

$$\text{Fair value} = \frac{21.60 + 19.40}{2} = \text{Rs. 20.50 per share}$$

17. Business valuation (Nov 2014 RTP, Nov 2018 RTP)

Yes Limited wants to acquire No Limited and the cash flows of Yes Limited and the merged entity are given below: (in lakhs)

Year	1	2	3	4	5
Yes Limited	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 Limited for each share of No Limited

You are required to:

- Compute the Value of Yes Limited before and after merger.
- Value of Acquisition and
- Gains to shareholders of Yes Limited

Answer:

WN 1: Valuation of Yes Limited before merger and after merger:

Year	Cash flow		PVF @ 15%	DCF	
	Before	After		Before	After
1	175.00	400.00	0.870	152.25	348.00
2	200.00	450.00	0.756	151.20	340.20
3	320.00	525.00	0.658	210.56	345.45
4	340.00	590.00	0.572	194.48	337.48
5	350.00	620.00	0.497	173.95	308.14
5	3,675.00	7,302.22	0.497	1,826.48	3,629.20
Value of Yes Limited				2,708.92	5,308.47

Note:

Valuation of perpetuity for cash flows after year 5:

$$\text{Before merger } P_5 = \frac{CF_6}{K_0 - G} = \frac{350 \times 1.05}{15\% - 5\%} = \text{Rs. 3,675 lacs}$$

$$\text{After merger } P_5 = \frac{CF_6}{K_0 - G} = \frac{620 \times 1.06}{15\% - 6\%} = \text{Rs. 7,302.22 lacs}$$

WN 2: Solution for Part (i) and (ii):

Particulars	Calculation	Amount (in lacs)
Value of Yes Limited before merger		2,708.92
Value of Yes Limited after merger		5,308.47
Value of acquisition	5,308.47 - 2,708.92	2,599.55

WN 3: Computation of gains to shareholders of Yes Limited:

- Number of shares in both companies are same. Let us assume that number of shares is 100 in Yes and No Limited before acquisition

Particulars	Calculation	Amount
Shares in Yes Limited		
Existing shareholders of Yes Limited		100
Shares allotted to shareholders of No Limited		50
Total shares post-merger		150
Price per share post-merger	$\frac{5,308.47}{150}$	35.3898
Consideration paid to No Limited	50 shares x 35.3898	1,769.49
Benefit of acquisition/value of acquisition		2,599.55
Gain to shareholders of Yes Limited		830.06

- Yes Limited is acquiring a company worth Rs.2,599.55 lacs. However, they are paying consideration of only Rs.1,769.49 lacs. Hence the gain to shareholders of Yes Limited out of merger is Rs.830.06 lacs

18. Calculation of purchase consideration (Nov 2018)

T Limited and E Limited 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:

Particulars	T Limited	E Limited
Rs.10 equity shares outstanding	12 lakhs	6 lakhs
Debt:		
10% Debentures (Rs. Lakhs)	580	
12.5% Institutional loan (Rs. Lakhs)		240

Earnings before interest, depreciation and tax (EBIDAT) Rs. Lakhs	400.86	115.71
Market price per share	220	110

T Limited plans to offer a price for E Limited, business as a whole which will be 7 times EBIDAT reduced by outstanding debt, to be discharged by own shares at market price. E Limited is planning to seek one share in T Limited for every 2 shares in E Limited 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 Limited's offer and E Limited's plan:

- ❖ Net consideration payable.
- ❖ No. of shares to be issued by T Limited
- ❖ EPS of T Limited after acquisition.
- ❖ Expected market price per share of T Limited after acquisition.
- ❖ State briefly the advantages to T Limited from the acquisition.

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

Answer:

Analysis of T Limited's offer and E Limited's plan:

(in lacs)

Particulars	T Limited's offer	E Limited's plan
Net consideration	(7 x EBIDAT) – Debt (7 x 115.71) – 240 = 569.97	(6 lacs x 0.5) x 220 = 660 lacs
Issue price	220	220
No of shares issued	$\frac{569.97}{220} = 2.59$	$\frac{660}{220} = 3.00$
EPS post-merger:		
EBIDAT post-merger (400.86 + 115.71)	516.57	516.57
Less: Interest (580 x 10% + 240 x 12.5%)	-88.00	-88.00
EBT	428.57	428.57
Less: Tax @ 30%	-128.57	-128.57
EAT	300.00	300.00
No of shares (12 + new shares issued)	14.59	15.00
EPS (EAT/No of shares)	20.56	20.00
MPS post-merger:		
EPS	20.56	20.00
PE Multiple (Note 1)	11.00	11.00
MPS	226.16	220.00

Advantages of Acquisition:

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.

Note 1: PE Multiple:

- Post-merger PE Multiple will be taken as same as per-merger PE Multiple
- PAT before merger = (400.86 – 58.00) x 70% = 240 lacs
- EPS before merger = (240 lacs/12 lacs) = Rs.20
- PE Multiple before merger = 220/20 = 11 Times

19. Valuation based on WACC (Nov 2013)

M/S Tiger Limited wants to acquire M/S Leopard Limited. The balance sheet of Leopard Limited as on 31st March 2012 is as follows:

Liabilities	Amount	Assets	Amount
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 and equipment	13,00,000
	16,20,000		16,20,000

- ❖ Shareholders of Leopard Ltd. will get one share in Tiger Ltd. for every two shares. External liabilities are expected to be settled at Rs. 5,00,000. Shares of Tiger Ltd. would be issued at its

current price of Rs. 15 per share. Debentureholders will get 13% convertible debentures in the purchasing company for the same amount. Debtors and inventories are expected to realize Rs. 2,00,000.

- ❖ 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 Rs. 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 Rs. 2,00,000.
- ❖ 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.

Answer:

WN 1: Computation of (Initial Outflow):

Particulars	Calculation	Amount
Shares allotted	35,000 shares x 15	5,25,000
Debentures allotted		3,00,000
Settlement of creditors		5,00,000
Less: Realization of debtors and inventory		-2,00,000
Less: Cash		-50,000
Net outflow		10,75,000

WN 2: Computation of NPV:

Year	Cash flow	PVF @ 16%	DCF
0	-10,75,000	1.000	-10,75,000
1	5,00,000	0.862	4,31,000
2	5,00,000	0.743	3,71,500
3	5,00,000	0.641	3,20,500
4	5,00,000	0.552	2,76,000
5	5,00,000	0.476	2,38,000
6	7,00,000	0.410	2,87,000
			8,49,000

Conclusion:

- The company should go ahead with the project as the same results in positive NPV of Rs.8,49,000

20. Consideration for promoters (May 2014)

The equity shares of XYZ Ltd. are currently being traded at Rs. 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 present value of these synergies is Rs. 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 Rs. 4,00,000 p.a. Top management with their families are promoters of XYZ Ltd. Present value of these savings would add Rs. 30,00,000 in value to the acquisition.

Following additional information is available regarding PQR Ltd.:

- ❖ Earnings per share = Rs.4
- ❖ Total number of equity shares outstanding = 15,00,000
- ❖ Market price of equity share = Rs.40

Required:

- ❖ What is the maximum price per equity share which PQR Ltd. can offer to pay for XYZ Ltd.?
- ❖ What is the minimum price per equity share at which the management of XYZ Ltd. will be willing to offer their controlling interest?

Answer:

WN 1: Computation of maximum price to be paid by PQR Limited:

Particulars	Calculation	Amount
Current value of XYZ Limited	(10 lacs x 24)	2,40,00,000
Synergy benefits		80,00,000
Savings in top management salaries		30,00,000
Potential value of XYZ Limited		3,50,00,000

No of shares		10,00,000
Maximum price per share		Rs.35

WN 2: Computation of minimum price per share at which promoters will offer controlling interest:

Particulars	Calculation	Amount
Current value of holding	$(10 \text{ lacs} \times 24) \times 40\%$	96,00,000
Loss of higher salaries		30,00,000
Total value of holding		1,26,00,000
No of shares		4,00,000
Minimum price per share	126 lacs/4 lacs	31.50

- Promoters would lose the benefit of higher salaries once they offer their controlling interest and hence, they would want to get compensation for that as well. Hence Rs.30,00,000 have been added in computing minimum price per share

21. Valuation of firm and valuation of equity (Nov 2012 RTP)

BRS Inc deals in computer and IT hardwares and peripherals. The expected revenue for the next 8 years is as follows:

Years	Sales Revenue (USD Million)
1	8
2	10
3	15
4	22
5	30
6	26
7	23
8	20

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

Liabilities	Amount (USD Million)	Assets	Amount (USD Million)
Equity stocks	12	Fixed assets	17
12% bonds	8	Current assets	3
Total	20	20	

Additional information:

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

Period	Amount (USD Million)
1 to 4 years	1.6
5 to 8 years	2

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

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

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

(d) The company has planned additional capital expenditure (in the beginning of each year) for the coming 8 years as follows:

Period	Amount (USD 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

Answer:

WN 1: Computation of FCFF:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Sales	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
VC	-3.20	-4.00	-6.00	-8.80	-12.00	-10.40	-9.20	-8.00
FC	-1.60	-1.60	-1.60	-1.60	-2.00	-2.00	-2.00	-2.00
Advertisement	-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
Profit before Tax	0.07	0.55	3.60	6.27	10.50	8.10	8.45	6.85
Less: Tax	-0.02	-0.17	-1.08	-1.88	-3.15	-2.43	-2.54	-2.06
Profit after Tax	0.05	0.38	2.52	4.39	7.35	5.67	5.91	4.79
Add: Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Cash flow after Tax	2.68	2.73	4.82	6.72	9.85	8.17	8.26	6.94
Capex	-0.80	-2.00	-2.50	-3.50	-2.50	-1.50	-1.00	
Change in Work cap	1.40	-0.40	-1.00	-1.40	-1.60	0.80	0.60	0.60
FCFF	3.28	0.33	1.32	1.82	5.75	7.47	7.86	7.54

Note:

- Variable cost = 40% of revenues
- Advertisement and fixed cost are as per data given in question
- Depreciation has been taken as per below statement:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Opening Value	17.00	14.87	13.32	13.02	13.19	14.19	14.19	13.34
Addition	0.50	0.80	2.00	2.50	3.50	2.50	1.50	1.00
Depreciation	2.63	2.35	2.30	2.33	2.50	2.50	2.35	2.15
Closing value	14.87	13.32	13.02	13.19	14.19	14.19	13.34	12.19

- Depreciation = (Opening value + Addition) $\times$ 15%; Closing value = Opening value + Addition - Depreciation
- Capital expenditure is made at the beginning of the year. Hence, capex of year 2 has been taken as year 1 ending capex and for other years in similar manner. Alternatively, we can take capex in the same year with the assumption that payment for capex is made at the end of the year
- Working capital change has been computed as per below statement:

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Revenues	8.00	10.00	15.00	22.00	30.00	26.00	23.00	20.00
WC investment @ 20%	1.60	2.00	3.00	4.40	6.00	5.20	4.60	4.00
Opening WC	3.00	1.60	2.00	3.00	4.40	6.00	5.20	4.60
Inc/decrease in WC	-1.40	0.40	1.00	1.40	1.60	-0.80	-0.60	-0.60

- Increase in working capital is an outflow and decrease in working capital will be an inflow

WN 2: Computation of WACC:

Source	Cost	Weight	Product
Debt	8.40	8.00	0.672
Equity	16.00	12.00	1.920
	12.96	20.00	2.592

- Post-tax cost of debt = $12 \times (1 - 30\%) = 8.40\%$
- WACC = $(2.592 \text{ lacs}/20 \text{ lacs}) \times 100 = 12.96\%$

WN 3: Computation of value of firm:

Year	Cash flow	PVF@ 12.96%	DCF
0	-0.50	1.000	-0.50
1	3.28	0.885	2.90
2	0.33	0.784	0.26
3	1.32	0.694	0.92
4	1.82	0.614	1.12
5	5.75	0.544	3.13
6	7.47	0.481	3.59
7	7.86	0.426	3.35
8	7.54	0.377	2.84
8	99.46	0.377	37.50
Value of Firm			55.10

- Cash flow of year 0 = Capex of 0.50 lacs at beginning of year 1

$$\text{Year 8 growing perpetuity} = \frac{7.54 \times 1.05}{12.96\% - 5\%} = \text{Rs. 99.46 lacs}$$

- Value of firm = Rs.55.10 lacs
- Value of equity = Rs.55.10 lacs – Rs.8 lacs (debt) = Rs.47.10 lacs

22. Valuation of company with floor value (May 2019)

R Limited and S Limited operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. R Limited's management is interested in acquisition of S Limited due to its excess plant capacity. Share of S Limited is trading in market at Rs.3.20 each. Other data relating to S Limited is as follows:

Liabilities	Amount	Assets	Amount
Current Liabilities	1,59,80,000	Current Assets	2,48,75,000
Long term liabilities	1,28,00,000	Other assets	94,00,000
Reserves and surplus	2,79,95,000	Property Plants and equipments	3,45,00,000
Share capital (80 lacs shares)	1,20,00,000		
Total	6,87,75,000	Total	6,87,75,000

Particulars	R Limited	S Limited	Combined Entity
Profit after tax	86,50,000	49,72,000	1,21,85,000
Residual net cash flows per year	90,10,000	54,87,000	1,85,00,000
Required return on equity	13.75%	13.05%	12.50%

You are required to compute the following:

- Minimum price per share S Limited should accept from R Limited
- Maximum price per share R Limited shall be willing to offer to S Limited
- Floor value of per share of S Limited,. Whether it shall play any role in decision for its acquisition by R Limited

Answer:

WN 1: Valuation of company:

Particulars	R Limited	S Limited	Combined entity
Residual net cash flow	90,10,000	54,87,000	1,85,00,000
Cost of equity	13.75%	13.05%	12.50%
Growth rate	0%	0%	0%
Value of company $\left[\frac{\text{Net cash flow}}{K_e - G} \right]$	6,55,27,273	4,20,45,977	14,80,00,000

WN 2: Minimum price per share S Limited should accept from R Limited:

Minimum price per share should be lower of the following:

- ❖ **Cash flow based:** Total consideration of Rs.4,20,45,977 (or) Rs.5.26 per share (4,20,45,977/80,00,000)
- ❖ **Book-value based:** Total consideration of Rs.3,99,95,000 (or) Rs. 5 per share (3,99,95,000/80,00,000)

Hence minimum price per share to be paid is Rs.5 per share

WN 3: Computation of maximum price per share:

- ❖ Maximum consideration = Post-merger value – Pre-merger value
- ❖ Maximum consideration = 14,80,00,000 – 6,55,27,273
- ❖ Maximum consideration = Rs. 8,24,72,727
- ❖ Maximum price per share = Rs.10.31 (8,24,72,727/80,00,000)

WN 4: Relevance of floor value:

- Floor value of per share of S Ltd shall be Rs.3.20 (current market price) and it shall not play any role in decision for the acquisition of S Ltd. as it is lower than its current book value.

23. Corporate restructuring (Nov 2014 RTP, Nov 2018 RTP)

The following is the Balance-sheet of Grape Fruit Company Limited as at March 31, 2011:

Liabilities	Amount (in lacs)	Assets	Amount in lacs
Equity shares of Rs.100 each	600	Land and Building	200
14% preference shares of Rs.100 each	200	Plant and Machinery	300
13% debentures	200	Furniture and fixtures	50
Debenture interest accrued and payable	26	Inventory	150
Loan from bank	74	Sundry debtors	70
Trade creditors	340	Cash at Bank	130
		Preliminary expenses	10
		Cost of issue of debentures	5
		Profit and Loss account	525
	1440		1440

The Company did not perform well and has suffered sizable losses during the last few years. However, it is felt the company could be nursed back to health by proper financial restructuring. Consequently the following scheme of reconstruction has been drawn up :

- (i) Equity shares are to be reduced to Rs. 25/- per share, fully paid up;
- (ii) Preference shares are to be reduced (with coupon rate of 10%) to equal number of shares of Rs. 50 each, fully paid up.
- (iii) Debenture holders have agreed to forgo the accrued interest due to them. In the future, the rate of interest on debentures is to be reduced to 9 percent.
- (iv) Trade creditors will forego 25 percent of the amount due to them.
- (v) The company issues 6 lakh of equity shares at Rs. 25 each and the entire sum was to be paid on application. The entire amount was fully subscribed by promoters.
- (vi) Land and Building was to be revalued at Rs. 450 lakhs, Plant and Machinery was to be written down by Rs. 120 lakhs and a provision of Rs.15 lakhs had to be made for bad and doubtful debts.

Required:

- (i) Show the impact of financial restructuring on the company's activities.
- (ii) Prepare the fresh balance sheet after the reconstructions is completed on the basis of the above proposals.

Answer:**WN 1: Computation of Capital reserve:**

Particulars	Calculation	Amount in lacs
Benefits to Grape Fruit company:		
Reduction in equity share capital	6 lacs x 75	450
Reduction in preference share capital	2 lacs x 50	100
Waiver of outstanding debenture interest		26
Waiver from trade creditors	340 lacs x 25%	85
Appreciation of land and building	450 lacs – 200 lacs	250
Total Benefits		911
Less: Assets written off		
Writing off P&L Account		525
Cost of issue of debentures		5
Preliminary expenses		10
Provision for bad and doubtful debts		15
Revaluation of P&M		120
Total assets written off		675
Capital reserve		236

WN 2: Balance Sheet of Grape Fruit company as at 31st March 2016 (after reconstruction)**(in lacs)**

Liabilities	Amount	Assets	Amount
12 lacs equity shares of Rs.25 each	300	Land and building	450
10% preference shares of Rs.50 each	100	Plant and machinery	180
Capital reserve	236	Furniture and fixtures	50
9% debentures	200	Inventory	150
Loan from Bank	74	Sundry debtors	55
Trade creditors (340 – 85)	255	Cash at Bank [130 + 150]	280
Total	815	Total	815

24. Impact of wrong WACC on valuation (Nov 2014, Nov 2018)

The valuation of Hansel Limited has been done by an investment analyst. Based on an expected free cash flow of Rs. 54 lakhs for the following year and an expected growth rate of 9 percent, the analyst has estimated the value of Hansel Limited to be Rs. 1800 lakhs. However, he committed a mistake of using the book values of debt and equity. The book value weights employed by the analyst are not known, but you know that Hansel Limited has a cost of equity of 20 percent and post tax cost of debt of 10 percent. The value of equity is thrice its book value, whereas the market value of its debt is nine-tenths of its book value. What is the correct value of Hansel Ltd?

Answer:**WN 1: Computation of wrong WACC used by the analyst:**

$$\text{Value of Firm} = \frac{FCF_1}{K_o - \text{Growth}}$$

$$1,800 \text{ lacs} = \frac{54 \text{ lacs}}{K_o - 0.09}; K_o - 0.09 = \frac{54}{1,800}; K_o = 0.03 + 0.09 = 0.12 \text{ (or) } 12\%$$

WN 2: Computation weighted used by the analyst:

Let us assume weight of equity to be X and weight of debt will be 1-X

Source	cost	Weight	Product
Equity	20	X	20X
Debt	10	1-X	10-10X
Total	12	1	20X+10-10X = 12

$$20X + 10 - 10X = 12; 10X = 2; X = 0.2 \text{ Times}$$

- Hence the weight of equity is 20% and weight of debt is 80%

WN 3: Computation of correct WACC with correct weights:

- Weight of equity = $0.20 \times 3 = 0.60$ Times
- Weight of debt = $0.80 \times (9/10) = 0.72$ Times

Source	cost	Weight	Product
Equity	20	0.60	12.00
Debt	10	0.72	7.20
Total		1.32	19.20

$$\text{WACC} = \frac{19.20}{1.32} = 14.55\%$$

WN 4: Correct valuation of Hansel Limited:

$$\text{Value of Firm} = \frac{FCF_1}{K_o - \text{Growth}} = \frac{54}{14.55\% - 9\%} = \text{Rs. 972. 97 lacs}$$

25. Valuation of business (Nov 2018 RTP, May 2019 RTP)

Eagle Limited reported a profit of Rs.77 lacs after 30% tax for the financial year 2011-12. An analysis of the accounts revealed that the income included extraordinary items of Rs.8 lacs and an extraordinary loss of Rs.10 lacs. 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:

Particulars	Amount (in lacs)

Sales	70
Material costs	20
Labour costs	12
Fixed costs	10

You are required to:

- Calculate the value of the business, given that the capitalization rate is 14%
- Determine the market price per equity share, with Eagle Limited's share capital being comprised of 1,00,000 13% preference shares of Rs.100 each and 50,00,000 equity shares of Rs.10 each and the P/E ratio being 10 times.

Answer:

WN 1: Computation of value of business:

Particulars	Calculation	Amount (in lacs)
Existing PAT		77
Existing PBT	77 lacs/(1-0.3)	110
Less: Extraordinary income		(8)
Add: Extraordinary loss		10
Profit from new product	70 - 20 - 12 - 10	28
Future maintainable PBT		140
Less: Tax @ 30%		(42)
Future maintainable PAT		98
Capitalization factor		0.14
Value of business	98/0.14	700

WN 2: Valuation of equity share:

Particulars	Calculation	Amount (in lacs)
Future maintainable PAT		98
Less: Preference dividend	1,00,000 × 13	(13)
Earnings available to equity shareholders		85
No of shares		50
EPS		1.7
P/E Multiple		10
Market price per equity share		17

Note: EPS and MPS can alternatively be computed based on existing profits

26. Range of valuation (May 2013)

ABC Limited is considering acquisition of DEF Limited which has 3.10 crore shares issued and outstanding. The market price per share is Rs.440.00 at present. ABC Limited's average cost of capital is 12%. The cash inflows of DEF Limited for next three years are as under:

Year	Amount in crores
1	460.00
2	600.00
3	740.00

You are required to calculate the range of valuation that ABC Limited has to consider.

Answer:

WN 1: Valuation based on current market price:

❖ Value of Firm = No of shares × current market price = 3.10 crores × 440 = Rs.1,364 Crores

WN 2: Valuation based on discounted cash flows:

Year	Cash flow	PVF@ 12%	DCF
1	460	0.893	410.78
2	600	0.797	478.20
3	740	0.712	526.88
Value of business			1,415.86

Summary:

Range of valuation:

Particulars	Per share	Total
Minimum	440.00	1,364.00

Maximum	456.73	1,415.86
	[1,415.86/3.10]	

27. Internal reconstruction (May 2017)

The following is the Balance Sheet of XYZ Limited as at 31st March, 2016:

Liabilities	Rs. In lacs	Assets	Rs. In lacs
Equity shares of Rs.10 each	500	Land and Buildings	150
11% preference shares of Rs.10 each	100	Plant and Machinery	200
12% debentures	100	Furniture and Fixtures	60
Debenture interest accrued and payable	12	Inventory	60
Loan from Bank	60	Sundry Debtors	50
Trade creditors	300	Cash at Bank	50
		Preliminary expenses	15
		Cost of issue of debentures	7
		Profit and Loss Account	480
Total	1,072	Total	1,072

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

- Equity shares are to be reduced to Rs. 2/- per share, fully paid up;
- Preference shares are to be reduced (with coupon rate of 9%) to equal number of shares of Rs. 5 each, fully paid up.
- Debenture holders have agreed to forgo the accrued interest due to them. In the future, the rate of interest on debentures is to be reduced to 10 percent.
- Trade creditors will forego 20% of the amount due to them
- The company issues 50 lakh of equity shares at Rs. 2 each and the entire sum was to be paid on application. The entire amount was fully subscribed by promoters.
- Land and Building was to be revalued at Rs. 350 lakhs, Plant and Machinery was to be written down by Rs. 150 lakhs and a provision of Rs.5 lakhs had to be made for bad and doubtful debts.

Required:

- Show the impact of financial restructuring on the company's activities.
- Prepare the fresh balance sheet after the reconstructions is completed on the basis of the above proposals.

Answer:**WN 1: Computation of Capital reserve:**

Particulars	Calculation	Amount in lacs
Benefits to XYZ Limited		
Reduction in equity share capital	50 lacs x 8	400
Reduction in preference share capital	10 lacs x 5	50
Waiver of outstanding debenture interest		12
Waiver from trade creditors	300 lacs x 20%	60
Appreciation of land and building	350 lacs – 150 lacs	60
Total Benefits		722
Less: Assets written off		
Writing off P&L Account		480
Cost of issue of debentures		7
Preliminary expenses		15
Provision for bad and doubtful debts		5
Revaluation of P&M	200 lacs – 150 lacs	50
Total assets written off		557
Capital reserve		165

WN 2: Balance Sheet of XYZ Limited as at 31st March 2016 (after reconstruction)**(in lacs)**

Liabilities	Amount	Assets	Amount
100 lacs equity shares of Rs.2 each	200	Land and building	350
9% preference shares of Rs.5 each	50	Plant and machinery	150
Capital reserve	165	Furniture and fixtures	60

10% debentures	100	Inventory	60
Loan from Bank	60	Sundry debtors	45
Trade creditors (300 – 60)	240	Cash at Bank [50 + 100]	150
Total	815	Total	815

28. Computation of minimum price, maximum price and floor value (May 2015 RTP)

M Plc and C Plc operating in same industry are not experiencing any rapid growth but providing a steady stream of earnings. M Plc's management is interested in acquisition of C Plc due to its excess plant capacity. Share of C Plc is trading in market at GBP 4 each. Other data relating to C Plc is as follows:

Particulars	M Plc	C Plc	Combined entity
Profit after tax	48,00,000	30,00,000	92,00,000
Residual net cash flow per year	60,00,000	40,00,000	1,20,00,000
Required return on equity	12.5%	11.25%	12.00%

Balance Sheet of C PLC

Assets	Amount	Liabilities	Amount
Current Assets	2,73,00,000	Current Liabilities	1,34,50,000
Other Assets	55,00,000	Long term liabilities	1,11,00,000
Property Plants and Equipments	2,15,00,000	Reserves and Surplus	2,47,50,000
		Share capital (5 million common shares of GBP 1 each)	50,00,000
Total	5,43,00,000	Total	5,43,00,000

You are required to compute:

- Minimum price per share C Plc should accept from M Plc
- Maximum price per share M plc should be willing to offer to C Plc
- Floor value of per share of C Plc. Whether it shall play any role in decision for its acquisition by M Plc.

Answer:

WN 1: Valuation of company:

Particulars	C PLC	M PLC	Combined entity
Residual net cash flow	40,00,000	60,00,000	1,20,00,000
Cost of equity	11.25%	12.50%	12.00%
Growth rate	0%	0%	0%
Value of company $\left[\frac{\text{Net cash flow}}{K_e - G} \right]$	3,55,55,556	4,80,00,000	10,00,00,000

WN 2: Minimum price per share C PLC should accept from M PLC:

Minimum price per share should be lower of the following:

- ❖ **Cash flow based:** Total consideration of GBP 3,55,55,556 (or) GBP 7.11 per share (3,55,55,556/50,00,000)
- ❖ **Assets based:** Total consideration of GBP 2,97,50,000 (or) GBP 5.95 per share (2,97,50,000/50,00,000)

Hence minimum price per share to be paid is GBP 5.95.

WN 3: Computation of maximum price per share:

- ❖ Maximum consideration = Value of M PLC post merger – Value of M PLC pre merger
- ❖ Maximum consideration = 10,00,00,000 – 4,80,00,000
- ❖ Maximum consideration = GBP 5,20,00,000
- ❖ Maximum price per share = GBP 10.40 (5,20,00,000/50,00,000)

WN 4: Relevant of floor value:

Floor value of per share of C PLC shall be GBP 4 (current market price) and it shall not play any role in decision for the acquisition of C PLC as it is lower than its current book value.

29. Valuation of company (Nov 2017 RTP, Nov 2018 RTP)

T Ltd. Recently made a profit of Rs. 50 crore and paid out Rs. 40 crore (slightly higher than the average paid in the industry to which it pertains). The average PE ratio of this industry is 9. As per Balance Sheet of T Ltd., the shareholder's fund is Rs. 225 crore and number of shares is 10 crore. In case company is liquidated,

building would fetch Rs. 100 crore more than book value and stock would realize Rs. 25 crore less. The other data for the industry is as follows:

❖ Projected Dividend Growth	=	4%
❖ Risk Free Rate of Return	=	6%
❖ Market Rate of Return	=	11%
❖ Average Dividend Yield	=	6%

The estimated beta of T Ltd. is 1.2.

You are required to calculate valuation of T Ltd. using

- (i) P/E Ratio
- (ii) Dividend Yield
- (iii) Valuation as per:
 - a. Dividend Growth Model
 - b. Book Value
 - c. Net Realizable Value

Answer:

WN 1: Valuation of company as per different methods:

Particulars	Calculation	Amount
PE Multiple based	50 crores x 9	Rs.450.00 crores
Dividend yield	$\frac{40 \text{ crores}}{6\%}$	Rs.666.70 Crores
Dividend growth model (Note below)	$\frac{40 \text{ crores} \times 1.04}{12\% - 4\%}$	Rs.520 Crores
Book value	Shareholder funds	Rs.225 Crores
Net realizable value	225 Cr + 100 Cr - 25 Cr	Rs.300 Crores

Note:

$$\text{❖ Cost of equity} = R_f + \text{Beta} \times (R_m - R_f) = 6\% + 1.2 \times (11\% - 6\%) = 12\%$$

30. Computation of maximum price to be paid for acquisition (Nov 2017 RTP)

Teer Ltd. is considering acquisition of Nishana Ltd. CFO of Teer Ltd. is of opinion that Nishana Ltd. will be able to generate operating cash flows (after deducting necessary capital expenditure) of Rs. 10 crore per annum for 5 years.

The following additional information was not considered in the above estimations.

- (i) Office premises of Nishana Ltd. can be disposed of and its staff can be relocated in Teer Ltd.'s office not impacting the operating cash flows of either businesses. However, this action will generate an immediate capital gain of Rs. 20 crore.
- (ii) Synergy Gain of Rs. 2 crore per annum is expected to be accrued from the proposed acquisition.
- (iii) Nishana Ltd. has outstanding Debentures having a market value of Rs. 15 crore. It has no other debts.
- (iv) It is also estimated that after 5 years if necessary, Nishana Ltd. can also be disposed of for an amount equal to five times its operating annual cash flow.

Calculate the maximum price to be paid for Nishana Ltd. if cost of capital of Teer Ltd. is 20%. Ignore any type of taxation.

Answer:

WN 1: Valuation of business of Nishana Limited:

(in crores)

Year	Cash flow	PVF @ 20%	DCF
0	20	1.000	20.00
1 to 5	12	2.990	35.88
5	50 [10 x 5]	0.402	20.10
Value of business			75.98
Less: Value of debt			(15.00)
Consideration to equity shareholders			60.98

31. Valuation of business (Nov 2019 RTP)

The closing price of LX Limited is Rs.24 per share as on 31st March, 2019 on NSE Limited. The Price earnings ratio was 6. It was found that an amount of Rs.24 lacs as income and an extra ordinary loss of Rs.9 lacs were included in the books of accounts. The existing operations except for the extraordinary items are expected to

continue in future. Further the company has launched a new product during the year with the following expectations:

Particulars	Amount (in lacs)
Sales	150
Material cost	40
Labour cost	34
Fixed cost	24

The company has 5,00,000 equity shares of Rs.10 each and 1,00,000 9% preference shares of Rs.100 each. The price earnings ratio is 6 times. Post tax cost of capital is 10 percent per annum. Tax rate is 34 percent. You are required to determine:

- Existing profit from old operations
- The value of business

Answer:

WN 1: Computation of existing profit from old operations:

Particulars	Calculation	Amount
Market price per share		24
Price earning multiple		6
Earnings per share	24/6	4
No of shares		5,00,000
Earnings available to equity shareholders		20,00,000
Preference Dividend	1,00,000 x 100 x 9%	9,00,000
Profit after tax		29,00,000
Profit before tax	$\frac{29,00,000}{1 - 0.34}$	43,93,939
Less: Extraordinary Income		(24,00,000)
Add: Extraordinary losses		9,00,000
Existing profit from old operations		28,93,939
Profit from new product	150-40-34-24	52,00,000
Future Maintainable Profit before tax		80,93,939
Less: Tax @ 34%		(27,51,939)
Future Maintainable Profit		53,42,000
Capitalization rate		10%
Value of business	53,42,000/0.10	5,34,20,000

32. Valuation of business (Nov 2016):

XN Limited reported a profit of Rs.100.32 lacs after 34% tax for the financial year 2015-16. An analysis of the accounts reveals that the income included extra-ordinary items of Rs.14 lacs and an extra-ordinary loss of Rs.5 lacs. The existing operations, except for the extra-ordinary items, are expected to continue in future. Further a new product is launched and the expectations are as under:

Particulars	Amount in lacs
Sales	70
Material costs	20
Labour costs	16
Fixed costs	10

The company has 50,00,000 equity shares of Rs.10 each and 80,000 9% preference shares of Rs.100 each with P/E ratio being 6 times.

You are required to:

- Compute the value of business assuming cost of capital of 12% after tax and
- Determine the market price per equity share

Answer:

WN 1: Valuation of business:

Particulars	Calculation	Amount (in lacs)
Profit after tax		100.32
Profit before tax	$\frac{100.32}{1 - 0.34}$	152
Less: Extraordinary Income		-14

Add: Extraordinary losses		5
Existing profit from old operations		143
Profit from new product	70-20-16-10	24
Future Maintainable Profit before tax		167
Less: Tax @ 34%		-56.78
Future Maintainable Profit		110.22
Capitalization rate		12%
Value of business	110.22/12%	918.50

WN 2: Computation of market price:

Particulars	Calculation	Amount (in lacs)
Future maintainable profit		110.22
Less: Preference dividend @ 9%		-7.20
EAES		103.02
No of shares		50
EPS	$\frac{103.02}{50}$	2.06
PE Multiple		6
Market price per share	2.06×6	12.36

33. Valuation based on proxy company (Nov 2019 exam):

XY Ltd., a Cement manufacturing Company has hired you as a financial consultant of the company. The Cement Industry has been very stable for some time and the cement companies SK Ltd. & AS Ltd. are similar in size and have similar product market mix characteristic. Use comparable method to value the equity of XY Ltd. In performing analysis, use the following ratios:

- (i) Market to book value
- (ii) Market to replacement cost
- (iii) Market to sales
- (iv) Market to Net Income

The following data are available for your analysis:

Particulars	SK Limited	AS Limited	XY Limited
Market Value	450	400	
Book value	400	300	250
Replacement cost	600	550	500
Sales	550	450	500
Net Income	18	16	14

Answer:**WN 1: Valuation based on Market to Book value approach:**

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	307.25 (250 x 1.2290)
Book value (B)	400	300	250
Market value to book value multiple (A/B)	1.125	1.333	1.2290 $\frac{1.125 + 1.333}{2}$

WN 2: Valuation based on Market to Replacement Cost:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	369.25 (500 x 0.7385)
Replacement Cost (B)	600	550	500
Market value to replacement cost multiple (A/B)	0.750	0.727	0.7385 $\frac{0.750 + 0.727}{2}$

WN 3: Valuation based on Market to Sales:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	426.75 (500 × 0.8535)
Sales (B)	550	450	500
Market value to sales (A/B)	0.818	0.889	0.8535 <u>0.818 + 0.889</u> 2

WN 4: Valuation based on Net Income:

Particulars	SK Limited	AS Limited	XY Limited
Market Value (A)	450	400	350 (25 × 14)
Net Income (B)	18	16	14
Market value to Net Income (A/B)	25	25	25 <u>25 + 25</u> 2

WN 5: Final valuation based on average of four approaches:

$$\text{Final Value of XY Limited} = \frac{307.25 + 369.25 + 426.75 + 350}{4} = \text{Rs. 363.31}$$

34. Valuation of firm (Nov 2019 Exam):

Mr. X, a financial analyst, intends to value the business of PQR Ltd. in terms of the future cash generating capacity. He has projected the following after tax cash flows:

Year	1	2	3	4	5
Cash flows (in lacs)	1,760	480	640	860	1,170

It is further estimated that beyond 5th year, cash flows will perpetuate at a constant growth rate of 8% per annum, mainly on account of inflation. The perpetual cash flow is estimated to be Rs. 10,260 lakh at the end of the 5th year.

Required:

- What is the value of the firm in terms of expected future cash flows, if the cost of capital of the firm is 20%.
- The firm has outstanding debts of Rs. 3,620 lakh and cash/bank balance of Rs. 2,710 lakh. Calculate the shareholder value per share if the number of outstanding shares is 151.50 lakh.
- The firm has received a takeover bid from XYZ Ltd. of Rs. 225 per share. Is it a good offer?

Answer:**WN 1: Valuation of firm based on future cash flows:****(In lacs)**

Year	Cash flow	PVF @ 20%	DCF
1	1,760	0.833	1,466.08
2	480	0.694	333.12
3	640	0.579	370.56
4	860	0.482	414.52
5	1,170	0.402	470.34
5	92,340	0.402	37,120.68
Value of Firm			40,175.30

Note:

$$\text{Perpetual Inflow (Y5)} = \frac{10,260 \times 1.08}{20\% - 8\%} = 92,340 \text{ lacs}$$

WN 2: Valuation of share:

Particulars	Amount In lacs
Value of Firm	40,175.30
Less: Value of debt	(3,620.00)
Value of equity	36,555.30
No of shares	151.50

Value per share	241.29

Takeover bid of Rs. 225 per share seems to be not a good offer as it is lesser than the intrinsic value i.e. value per share of Rs. 241.29.

Part III – Market Value Added and Shareholder Value Added

BHARADWAJ INSTITUTE (DINESH JAIN)

Chapter 13 – Mergers, Acquisitions & Corporate Restructuring**Theory to Solve Problems****Why Merge?**

- ❖ **Create operating synergies** – Operating synergies can affect margins and growth [Positive impact]
 - Economies of scale
 - Greater pricing power from less competition
 - Combination of different functional strengths
 - Higher growth in markets
- ❖ **Create financial synergies** – With financial synergies the payoff can be either higher cash flow or lower cost of capital
 - Merger of a company with slack cash with a company with high-return projects
 - Increase in debt capacity
 - Tax benefits
- ❖ **Acquire under-valued firms:** Firms whose actual value is less than fair value
- ❖ **Diversification:** Leads to reduction in total risk. However an already diversified investor may not be excited
- ❖ Managerial self interest
 - Empire Building
 - Managerial ego
 - Board composition and side effects

Synergy gain:

- ❖ Synergy gain is possible when the combined value of two firms is greater than the sum of the value of two firms
- ❖ Synergy gain means the sum of the parts is less than the whole

Methods for distributing gain:

- ❖ The target company's share of synergy gain will normally be made over to them by the acquiring company at the onset of the merger itself. Should the planned synergy gain not come through, the acquirer loses
- ❖ The target's share of synergy gain is paid out
 - Either in the form of cash
 - Or in the form of shares in the merged entity

Steps in case of Cash deal:

Step	Description
Step 1	Compute synergy gain
Step 2	Compute value of consideration
Step 3	Target company's share of gain = Consideration less market value of target company
Step 4	Net gain to acquiring company = Step 1 – Step 3

Steps in case of stock deal:

Step	Description
Step 1	Compute synergy gain
Step 2	Compute theoretical post-merger price = [MV of acquiring company + MV of target company + synergy gain] / [Existing shares + shares to be issued]
Step 3	Consideration to target company = Shares issues * Step 2 price
Step 4	Target company's share of gain = Consideration less market value of target company
Step 5	Net gain to acquiring company = Step 1 – Step 4

How to compute swap ratio?

- ❖ Write the base values (based on which exchange ratio is computed)
- ❖ Switch it around. Example: EPS of A and T are 10 & 5. The exchange ratio is 5:10

Extent of gain:

- ❖ When stock deal takes place the percentage gain to the acquiring company is the change in market price (pre-merger & post-merger)
- ❖ To compute the percentage gain of the target company we must compare the pre-merger price of the target company with the adjusted MP of the merged company
- ❖ $\text{Adjusted MP} = \text{New MP} \times \text{Exchange ratio}$

Synergy gain and no increase in earnings:

- ❖ If there is no increase in earnings it can be assumed that there is no synergy gain. Even when there is no increase in earnings synergy gain can be computed if we assume a certain P/E ratio of the merged entity
- ❖ In this case the MP of the merged entity can be obtained by multiplying the EPS with PE ratio of the merged entity

Exchange ratio and EPS:

- ❖ If there is no increase in earnings and if the EPS of the acquiring company is to be maintained then the ratio should be in the EPS

Weighted average swap ratio:

- ❖ The swap ratio is normally based on any of the following variables:
 - Book value per share
 - Fair value per share
 - Market value per share
 - EPS
- ❖ It is also possible to base the swap on more than one parameter by assigning to them appropriate weights and thus arrive at a weighted average swap ratio

Steps in computation:

- ❖ **Step 1:** Based on each agreed parameter compute no. of shares to be issued
- ❖ **Step 2:** Use the given weight and arrive at the weighted average no of shares to be issued
- ❖ **Step 3:** With the weighted average number of shares the exchange ratio can be calculated

How is the final exchange ratio determined?

- ❖ The exchange ratio is likely to be favorable to the company
 - Which is financially stronger and
 - Which is less desperate to merge
- ❖ It would also depend on the negotiating skills of two companies

Practical Problems

1. Swap Ratio

ABC Limited is determined to report EPS of Rs.2.67. It is therefore acquires DEF Limited. You are given the following information:

Particulars	ABC Limited	DEF Limited	Merged Entity
EPS	2	2.50	2.67
Price per share	40	25	?
PE Multiple	20	10	?
Number of shares	1,00,000	2,00,000	?
Total earnings	2,00,000	5,00,000	?
Total market value	40,00,000	50,00,000	?

There are no gains from merger. In exchange for DEF Limited shares, ABC Limited issues just enough of its own shares to ensure its Rs.2.67 earnings per share objective.

- ❖ Complete the above table for the merged firm
- ❖ How many shares of ABC Limited are exchanged for each share of DEF Limited
- ❖ What is the cost of merger to ABC Limited?

Answer:

WN 1: Completion of merger table:

Particulars	ABC Limited	DEF Limited	Merged company

PAT/EAES	2,00,000	5,00,000	7,00,000
No of equity shares	1,00,000	2,00,000	2,62,172
EPS	2	2.50	2.67
PE Multiple	20	10	20
MPS	40	25	53.40
No of equity shares	1,00,000	2,00,000	2,62,172
Market value of firm	40,00,000	50,00,000	1,40,00,000

Note:

- Problem on swap ratio and synergy gain can be solved using the above format wherein various inter-linkages can be established and missing information can be calculated

WN 2: Solution table

No of shares of merged company	$\frac{\text{Total earnings}}{\text{EPS}} = \frac{7,00,000}{2.67}$	2,62,172
MPS of merged company	$\text{EPS} \times \text{PE Multiple} = 2.67 \times 20$	Rs.53.40
MV of merged company	$\text{MPS} \times \text{No of shares} = 53.40 \times 2,62,172$	Rs.1,39,99,985 ~ Rs.1,40,00,000
Shares issued to DEF Limited	$2,62,172 - 1,00,000$	1,62,172
Share exchange ratio	$1,61,172 \text{ shares for } 2,00,000 \text{ shares}$	0.81086:1
Gross Cost of merger	$\text{Shares issued} \times \text{Issue price}$ $1,62,172 \times 53.40$	Rs.86,59,985~ Rs.86,60,000
Net cost of merger	$\text{Consideration paid} - \text{Pre merger value}$ $86,60,000 - 50,00,000$	Rs.36,60,000

Note:

- Pre-merger PE Multiple and post-merger PE Multiple of acquiring company (ABC Limited) would remain same in the absence of information

2. Swap Ratio

A Limited wants to acquire T Limited and has offered a swap ratio of 1:2 (0.5 shares for every one share of T Limited). Following information is provided:

Particulars	A Limited	T Limited
Profit after tax	18,00,000	3,60,000
Equity shares outstanding (Nos.)	6,00,000	1,80,000
EPS	3	2
PE ratio	10 Times	7 Times
Market price per share	Rs.30	Rs.14

Required:

- ❖ The number of equity shares to be issued by A Limited for acquisition of T Limited
- ❖ What is the EPS of A limited after the acquisition
- ❖ Determine the equivalent earnings per share of T Limited
- ❖ What is the expected market price per share of A Limited after the acquisition, assuming its PE multiple remains unchanged?
- ❖ Determine the market value of the merged firm
- ❖ What should be the exchange ratio to achieve EPS of Rs.3.5 in case post synergy benefits are expected to be 10% during post acquisition period

Answer:**WN 1: Completion of merger table:**

Particulars	A Limited	T Limited	Merged company
PAT/EAES	18,00,000	3,60,000	21,60,000
No of equity shares	6,00,000	1,80,000	6,90,000
EPS	3	2	3.1304
PE Multiple	10	7	10
MPS	30	14	31.304
No of equity shares	6,00,000	1,80,000	6,90,000
Market value of firm	1,80,00,000	25,20,000	2,16,00,000

WN 2: Solution:

Shares issued	$1,80,000 \times 0.50$	90,000

Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{21,60,000}{6,90,000}$	3.1304
Equivalent EPS of T Limited	3.1304×0.5	1.5652
MPS of merged company	$\text{EPS} \times \text{PE Multiple} = 3.1304 \times 10$	31.304
MV of merged company	$\text{MPS} \times \text{No of shares} = 31.304 \times 6,90,000$	Rs.2,15,99,760 ~ Rs.2,16,00,000
Exchange ratio to achieve EPS of Rs.3.5:		
Total earnings of merged company		21,60,000
Earnings with synergy gain	$21,60,000 + 10\%$	23,76,000
Target EPS		3.50
Target shares post-merger	$\frac{23,76,000}{3.50}$	6,78,857 Shares
Shares to be issued to T Limited	$6,78,857 - 6,00,000$	78,857 Shares
Share exchange ratio	78,857 shares for 1,80,000 shares	0.4381:1

3. Swap ratio

XYZ Ltd., is considering merger with ABC Ltd. XYZ Ltd.'s shares are currently traded at Rs. 20. It has 2,50,000 shares outstanding and its earnings after taxes (EAT) amount to Rs. 5,00,000. ABC Ltd., has 1,25,000 shares outstanding; its current market price is Rs. 10 and its EAT are Rs. 1,25,000. The merger will be effected by means of a stock swap (exchange). ABC Ltd., has agreed to a plan under which XYZ Ltd., will offer the current market value of ABC Ltd.'s shares:

- What is the pre-merger earnings per share (EPS) and P/E ratios of both the companies?
- If ABC Ltd.'s P/E ratio is 6.4, what is its current market price? What is the exchange ratio? What will XYZ Ltd.'s post-merger EPS be?
- What should be the exchange ratio; if XYZ Ltd.'s pre-merger and post-merger EPS are to be the same?

Answer:

WN 1: Computation of pre-merger EPS and PE Multiple of both companies:

Particulars	XYZ Limited	ABC Limited
PAT/EAES	5,00,000	1,25,000
No of equity shares	2,50,000	1,25,000
EPS	2	1
PE Multiple	10	10
MPS	20	10
No of equity shares	2,50,000	1,25,000
Market value of firm	50,00,000	12,50,000

WN 2: Computation of CMP, share exchange ratio and post-merger EPS:

MPS of ABC Limited	$\text{EPS} \times \text{PE Multiple} = 1 \times 6.4$	Rs.6.50
Exchange ratio		
Basis of exchange ratio		Market price
Base values	XYZ:ABC	20:6.40
Exchange ratio		6.40:20 (or) 0.32:1
Post-merger EPS:		
No of shares issued	$1,25,000 \times 0.32$	40,000 shares
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{5,00,000 + 1,25,000}{2,50,000 + 40,000}$	2.1552

WN 3: Exchange ratio to maintain the same EPS:

- If the company wants to maintain the same EPS, then the exchange ratio should be on the basis of EPS
- Base values = XYZ:ABC = 2:1
- Exchange ratio = 1:2 (or) 0.5:1

4. Swap ratio (May 2018 RTP, May 2018)

The following information is provided relating to the acquiring firm Mark Limited and the target firm Mask Limited:

	Mark Limited	Mask Limited
Earnings after tax	2000 lakhs	400 lakhs
Number of shares outstanding	200 lakhs	100 lakhs
PE ratio	10	5

Required:

- What is the swap ratio based on current market prices?
- What is the EPS of mark limited after acquisition?
- What is the expected market price per share of Mark Limited after acquisition, assuming PE ratio of Mark Limited remains unchanged?
- Determine the market value of the merged firm
- Calculate gain/loss for shareholders of the two independent companies after acquisition

Answer:

WN 1: Completion of merger table:

(in lacs)

Particulars	Mark Limited	Mask Limited	Merged
PAT/EAES	2,000	400	2,400
No of equity shares	200	100	220
EPS	10	4	10.9091
PE Multiple	10	5	10
MPS	100	20	109.09
No of equity shares	200	100	220
Market value of firm	20,000	2,000	24,000

WN 2: Solution (Part a to d)

Exchange ratio		
Basis of exchange ratio		Market price
Base values	Mark: Mask	100:20
Exchange ratio		20:100 (or) 1:5
Post-merger EPS:		
No of shares issued	100 lacs x (1/5)	20 lacs
Post-merger EPS	$\frac{\text{Total earnings}}{\text{No of shares}} = \frac{2,000 + 400}{200 + 20}$	10.9091
Expected market price	EPS x PE Multiple 10.9091×10	109.09
MV of merged firm	MPS x No of shares 109.09×220	23,999.80 lacs ~ 24,000 lacs

WN 3: Computation of gain/loss for shareholders:

(in lacs)

Particulars	Mark Limited	Mask Limited
Pre-merger value	20,000	2,000
Post-merger value	21,818 (109.09 x 200)	2,182 (109.09 x 20)
Overall gain/loss (A)	1,818	182
Pre-merger no of shares (B)	200	100
Gain per share (A/B)	9.09	1.82

5. Calculation of true cost of merger (Nov 2014)

Elrond Limited plans to acquire Doom Limited. The relevant financial details of the two firms prior to the merger announcement are:

Particulars	Elrond Limited	Doom Limited
Market price per share	Rs.50	Rs.25
Number of shares	20 lacs	10 lacs

The merger is expected to generate gains, which have a present value of Rs. 200 Lakhs. The exchange ratio agreed to is 0.5. What is the true cost of the merger from the point of view of Elrond Limited?

Answer:

Particulars	Calculation	Amount
Value of Elrond Limited	20 lacs x 50	1,000 lacs
Value of Doom Limited	10 lacs x 25	250 lacs
Synergy gain		200 lacs
Value of merged entity	1,000 lacs + 250 lacs + 200 lacs	1,450 lacs
No of shares issued to Doom Limited	10 lacs x 0.5	5 lacs
Post-merger share price	$\frac{1,450 \text{ lacs}}{20 \text{ lacs} + 5 \text{ lacs}}$	58
Consideration paid	5 lacs x 58	290 lacs
Gross cost of merger		290 lacs
True cost of merger	290 lacs - 250 lacs	40 lacs

6. Calculation of exchange ratio

If the cost of merger is Rs.277.5 lacs after acquiring DEF Limited, what is the exchange ratio worked out by the acquiring company ABC Limited from the following information

MPS of ABC Limited (Before acquisition)	Rs.192.50
MPS of DEF Limited (Before acquisition)	Rs.88
No of shares of ABC Limited (Before acquisition)	20 lacs
No of shares of DEF Limited (Before acquisition)	15 lacs

It is also estimated that the synergy value is measured at present value of Rs.687.5 lacs.

Answer:

Computation of exchange ratio:

Let us assume shares allotted to DEF Limited to be Y

(in lacs)

Particulars	Calculation	Amount
Value of ABC Limited	20 lacs x 192.50	3,850
Value of DEF Limited	15 lacs x 88	1,320
Synergy gain		687.50
Value of merged entity	3,850 + 1,320 + 687.50	5,857.50
No of shares issued to DEF Limited		Y
Post-merger share price	$\frac{5,857.50}{20 + Y}$	
Cost of merger		277.50
Value of DEF Limited before merger		1,320
Consideration paid	1,320 + 277.50	1,597.50

Consideration paid = MPS post merger x No of shares issued

$$1,597.50 = \frac{5,857.50}{20 + Y} \times Y; 1,597.50(20 + Y) = 5,857.50Y; 31,950 + 1,597.50Y = 5,857.50Y$$

$$31,950 = 5,857.50Y - 1,597.50Y; 31,950 = 4,260Y; Y = \frac{31,950}{4,260} = 7.5$$

- No of shares issued to DEF Limited = 7.5 lacs
- Share exchange ratio = (7.5 lacs/15 lacs) = 0.5:1

7. Valuation of debt & equity (May 2013 RTP)

Centurion bank and Bank of Punjab are planning to merge. The total value of the companies is dependent on the fluctuating business conditions. The following information is given for the total value (debt + equity) structure of each of the two companies.

Business Condition	Probability	Centurion (in lacs)	Bank of Punjab (in lacs)
High growth	0.20	820	1050
Medium Growth	0.60	550	825
Slow growth	0.20	410	590

The current debt of Bank of Punjab is Rs.65 lacs and of Centurion bank is Rs.460 lacs. Calculate the expected value of debt and equity separately for the merged entity.

Answer:**WN 1: Computation of expected value of debt and equity of Centurion:**

(in lacs)

Business Condition	Probability	Total Value	Debt	Product	Equity	Product
High growth	0.20	820	460	92	360	72
Medium Growth	0.60	550	460	276	90	54
Slow growth	0.20	410	410	82	0	0
Total				450		126

Note:

- Total value will be first used for debt commitments and balance value will be for equity. Hence in case of slow growth scenario, total value of Rs.410 lacs is fully for debt as equity cannot be negative

WN 2: Computation of expected value of debt and equity of Bank of Punjab:

(in lacs)

Business Condition	Probability	Total Value	Debt	Product	Equity	Product
High growth	0.20	1,050	65	13	985	197
Medium Growth	0.60	825	65	39	760	456
Slow growth	0.20	590	65	13	525	105
Total				65		758

WN 3: Expected value of debt and equity of merged entity:

(in lacs)

Particulars	Debt	Equity	Total
Centurion	450	126	576
Bank of Punjab	65	758	823
Total	515	884	1,399

8. Swap Ratio:

P Limited is considering take-over of R Limited by the exchange of four new shares in P Limited, for every five shares in R Limited. The relevant financial details of the two companies prior to merger announcement are as follows:

	P Limited	R Limited
Profit before tax (Rs. Crores)	15	13.50
No of shares (Crores)	25	15
PE ratio	12	9
Corporate tax rate = 30%		

You are required to determine:

- Market value of both the company
- Value of original shareholders
- Price per share after merger
- Effect on share price of both the company if the Directors of P Limited expect their own pre-merger PE ratio to be applied to the combined earnings

Answer:**WN 1: Completion of merger table:**

(in lacs)

Particulars	P Limited	R Limited	Merged Scenario 1	Merged Same PE
PBT	1,500	1,350	2,850	2,850
Less: Tax	-450	-405	-855	-855
PAT	1,050	945	1,995	1,995
No of equity shares	2,500	1,500	3,700	3,700
EPS	0.42	0.63	0.5392	0.5392
PE Multiple	12	9	10.58	12
MPS	5.04	5.67	5.70	6.47
No of equity shares	2,500	1,500	3,700	3,700
Market value of firm	12,600	8,505	21,105	23,939

WN 2: Solution (part a to c)

(in lacs)

Market value of P Limited		12,600
Market value of R Limited		8,505
Value of original shareholders:		
Original shareholders of P Ltd	$21,105 \times \left(\frac{2,500}{3,700}\right)$	14,260
Original shareholders of R Ltd	$21,105 \times \left(\frac{1,200}{3,700}\right)$	6,845
Price per share after merger	$\frac{21,105}{3,700}$	5.70

Note:

- Question specifically tells situation d where directors expect PE Multiple to be maintained. Hence for earlier parts we have assumed value of merged company as sum of value of P Limited and value of R Limited

WN 3: Effect on share price:

Particulars	P Limited	R Limited
Pre-merger price	5.04	5.67
Post-merger adjusted price	6.47	5.18 (6.47 × (4/5))
Gain/loss per share	1.43	-0.49

9. Minimum and maximum exchange ratio

A Limited plan to acquire B Limited. The following information is provided:

Particulars	A Limited	B Limited
MPS	Rs.300	Rs.200
EPS	Rs.25	Rs.20
No of equity shares	20 lacs	10 lacs
PE Multiple	12	10

- ❖ What is the maximum exchange ratio acceptable to the shareholders of A Limited if the PE ratio after on acquisition is 11 with no synergy gain?
- ❖ What is the minimum exchange ratio acceptable if PE multiple is 11.50 and synergy is 5%?

Answer:**WN 1: Computation of maximum exchange ratio:****Completion of Merger table:**

(in lacs)

Particulars	A Limited	B Limited	Merged
PAT/EAES	500	200	700
No of equity shares	20	10	25.66923
EPS	25	20	27.2727
PE Multiple	12	10	11
MPS	300	200	300
No of equity shares	12	10	25.66923
Market value of firm	3,600	2,000	7,700

- Maximum exchange ratio is computed from acquiring company point of view (A Limited)
- A Limited will accept an exchange ratio which leads to price being at minimum of Rs.300
- Merged table is filled in the following manner
 - PAT = 500 + 200 = 700 lacs
 - PE Multiple = 11 Times
 - MPS = 300
 - EPS = 300/11 = 27.2727 Times
 - No of equity shares = 700/27.2727 = 25.66923 lacs
- No of shares to be issued in merger = 25.66923 lacs - 20 lacs = 5.66923 lacs
- Exchange ratio = 5.66923:10 (or) 0.566923:1

WN 2: Computation of minimum exchange ratio:

- Minimum exchange ratio is computed from target company point of view (B Limited).
- B Limited will accept an exchange ratio which leads to purchase consideration of Rs.2,000 lacs
- **Post-merger value of Firm = PAT of merged entity x PE Multiple = (700 lacs + 5%) x 11.50 = Rs.8,452.50 lacs**
- No of shares to be issued is computed in the below table:

Particulars	Value in lacs	No of Shares
Existing shareholders of A Limited	6,452.50	20,00,000
Existing shareholders of B Limited	2,000.00	6,19,915
Merged Entity	8,452.50	26,19,915

- Merged entity has value of Rs.8,452.50 lacs. Of this Rs.2,000 lacs are to be given to shareholders of B Limited and balance 6,452.50 lacs will belong to shareholders of A Limited

• 20,00,000 shares = 6,452.50 lacs • ? Shares = 2,000 lacs
No of shares to be issued = $\frac{2,000}{6,452.50} \times 20,00,000 = 6,19,915$ shares

- **Minimum Exchange ratio = 6,19,915:10,00,000 (or) 0.619915:1**

10. Weighted swap ratio (May 2020 RTP)

The following information relating to the acquiring Company Abhiman Ltd. and the target Company Abhishek Ltd. are available. Both the Companies are promoted by Multinational Company, Trident Ltd. The promoter's holding is 50% and 60% respectively in Abhiman Ltd. and Abhishek Ltd. :

Particulars	Abhiman Limited	Abhishek Limited
Share capital	200 lakh	100 lakh
Free reserves and surplus	800 lakh	500 lakh
Paid up value per share	100	10
Free float market capitalization	400 lakh	128 lakh
PE ratio (times)	10	4

Trident Ltd. is interested to do justice to the shareholders of both the Companies. For the swap ratio weights are assigned to different parameters by the Board of Directors as follows:

- ❖ Book Value 25%
- ❖ EPS (Earning per share) 50%
- ❖ Market Price 25%

Required:

- What is the swap ratio based on above weights?
- What is the Book Value, EPS and expected Market price of Abhiman Ltd. After acquisition of Abhishek Ltd. (assuming P.E. ratio of Abhiman Ltd. remains unchanged and all assets and liabilities of Abhishek Ltd. are taken over at book value).
- Calculate:**
 - Promoter's revised holding in the Abhiman Ltd.
 - Free float market capitalization.
 - Also calculate No. of Shares, Earning per Share (EPS) and Book Value (B.V.), if after acquisition of Abhishek Ltd., Abhiman Ltd. decided to :
 - Issue Bonus shares in the ratio of 1 : 2; and
 - Split the stock (share) as Rs. 5 each fully paid.

Answer:

WN 1: Basic information:

(in lacs)

Particulars	Abhiman	Abhishek
PAT/EAES	80	80
No of equity shares	2	10
EPS	40	8
PE Multiple	10	4
MPS	400	32
No of equity shares	2	10
Market value of firm	800	320

Note:

- Free-float market capitalization refers to value of shareholding of non-promoters

- Total market value of firm for both companies is calculated as under:

Particulars	Abhiman	Abhishek
Free Float Market capitalization (A)	400	128
Non-promoter shareholding (B)	50%	40%
Total Value of firm (A/B)	800	320

- Based on total value of firm and no of equity shares we reverse work and get MPS. Based on MPS and PE Multiple, we get EPS. Based on EPS and no of shares we get PAT
- Book value per share for both companies is computed as under:

Particulars	Abhiman	Abhishek
Share capital	200	100
Reserves and surplus	800	500
Total Networth (A)	1,000	600
No of shares (B)	2	10
Book value per share (A/B)	500	60

WN 2: Computation of no of shares to be issued and exchange ratio:

Particulars	Base values	Swap Ratio	Shares to be allotted	Weight	Product
Book value	500:60	60:500	1,20,000 (10,00,000 × 60/500)	0.25	30,000
EPS	40:8	8:40	2,00,000 (10,00,000 × 8/40)	0.50	1,00,000
MPS	400:32	32:400	80,000 (10,00,000 × 32/400)	0.25	20,000
No of shares to be issued					1,50,000

- Exchange ratio = 1,50,000:10,00,000 (or) 0.15:1

WN 2: Computation of Book value, EPS and Market price post Acquisition:

Particulars	Amount (in lacs)
PAT/EAES (80 + 80)	160
No of equity shares (2 + 1.5)	3.5
EPS (160/3.50)	45.7143
PE Multiple	10
MPS (45.7143 × 10)	457.14
No of equity shares	3.5
Market value of firm (457.15 × 3.5)	1,600
Networth of merged entity (1,000 + 600)	1,600
No of shares of merged entity	3.5
Book value per share of merged entity	457.14

WN 3: Computation of revised holding of promoters and free-float market capitalization:

Revised holding of promoters:

Particulars	Abhiman	Abhishek	Total
Shares held by original shareholders in merged entity	2,00,000	1,50,000	3,50,000
Promoter holding	50%	60%	54.29%
Shares held by promoters	1,00,000	90,000	1,90,000

- Promoter shareholding in merged entity = $(1,90,000/3,50,000) \times 100 = 54.29\%$

Free-float market capitalization:

- Free-float market capitalization = $1,600 \text{ lacs} \times (100\% - 54.29\%) = \text{Rs.}731.36 \text{ lacs}$

WN 4: Computation of revised No of shares, EPS and Book value per share post bonus and split:

- The merged entity currently has 3,50,000 shares. The company plans to make bonus issue in the ratio of 1:2. This will increase the no of shares to 5,25,000 (3,50,000 + 1,75,000 bonus shares)
- The company plans to split Rs.100 share into Rs.5 share. This will lead to one share becoming 20 shares. Hence 5,25,000 shares will become 105 lacs shares
- No of shares post bonus and split = 105 lacs

- $\text{EPS} = (160 \text{ lacs}/105 \text{ lacs}) = \text{Rs.}1.52381 \text{ per share}$
- $\text{Book value per share} = (1,600 \text{ lacs}/105 \text{ lacs}) = \text{Rs.}15.2381$

11. Fixing swap ratio (May 2015)

R Limited and S Limited are companies that operate in the same industry. The financial statements of both the companies for the current financial year are as follows:

Particulars	R Limited	S Limited
Equity & Liabilities		
Shareholders Fund		
Equity capital (Rs.10 each)	20,00,000	16,00,000
Retained Earnings	4,00,000	-
Non-current liabilities		
16% Long term debt	10,00,000	6,00,000
Current liabilities	14,00,000	8,00,000
Total	48,00,000	30,00,000
Assets		
Non-current Assets	20,00,000	10,00,000
Current Assets	28,00,000	20,00,000
Total	48,00,000	30,00,000
Income statement		
Particulars	R Limited	S Limited
Net sales	69,00,000	34,00,000
Cost of goods sold	55,20,000	27,20,000
Gross Profit	13,80,000	6,80,000
Operating expenses	4,00,000	2,00,000
Interest	1,60,000	96,000
Earnings before tax	8,20,000	3,84,000
Taxes @ 35%	2,87,000	1,34,400
Earnings after tax	5,33,000	2,49,600
No. of equity shares	2,00,000	1,60,000
Dividend payout ratio	20%	30%
Market price per share	Rs.50	Rs.20

You are required to:

- Decompose the share price of both the companies into EPS & PE component. Also segregate their EPS figures into Return on Equity (ROE) and Book value/Intrinsic value per share components
- Estimate future EPS growth rates for both the companies
- Based on expected operating synergies, R Limited estimated that the intrinsic value of S Limited equity share would be Rs.25 per share on its acquisition. You are required to develop a range of justifiable equity share exchange ratios that can be offered by R Limited to the shareholders of S Limited. Based on your analysis on parts (a) and (b), would you expect the negotiated terms to be closer to the upper or the lower exchange ratio limits and why?

Answer:

WN 1: Computation of EPS/PE/ROE/Book value and future growth rates:

Particulars	R Ltd	S Ltd
EAT	5,33,000	2,49,600
No of shares	2,00,000	1,60,000
EPS	2.665	1.560
PE	18.76	12.82
MPS	50	20
BV per share	12	10
ROE	22.21%	15.60 %
Retention ratio	80%	70%
Growth	17.77%	10.92%

Note:

- $\text{PE Multiple} = \text{MPS}/\text{EPS}$
- $\text{Book value per share of R Limited} = (20,00,000 + 4,00,000)/2,00,000 = \text{Rs.}12 \text{ per share}$

- Book value per share of S Limited = $16,00,000/1,60,000 = \text{Rs.}10$ per share
- $\text{ROE} = (\text{EPS}/\text{Book value per share}) \times 100$
- $\text{Retention ratio} = 100\% - \text{Payout ratio}$
- $\text{Growth rate} = \text{ROE} \times \text{Retention Ratio}$

WN 2: Computation of lower and upper limit of exchange ratio:**Option 1: Based on Market Value:**

- Base values = 50:20
- Exchange ratio = 20:50 (or) 0.4:1

Option 2: Based on Intrinsic value:

- The intrinsic value of S Limited is Rs.25 per share.
- The intrinsic value of R Limited would continue to be its market price of Rs.50
- Base values = 50:25
- Exchange ratio = 25:50 (or) 0.5:1

Conclusion:

- Upper limit = 0.5:1
- Lower limit = 0.4:1
- R Limited is a stronger company as compared to S Limited due to the following parameters:
 - Higher PE Multiple (indicative of lower cost of equity)
 - Higher ROE
 - Better growth rate
- Due to the above parameters, the final exchange ratio would be closer to the lower limit of 0.4:1. This is because of R Limited is stronger company and they would push for a lower limit

12. Fixing swap ratio (May 2015, May 2018)

Bank 'R' was established in 2005 and doing banking in India. The bank is facing DO OR DIE Situation There are problems of gross NPA(Non-performing Assets) at 40 % & CAR/CRAR (Capital Adequacy ratio/Capital risk weight asset ratio) at 4%.The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @Rs.8 per share RBI Audit suggested that bank has either to liquidate or to merge with other bank. Bank 'P' is professionally managed bank with low gross NPA of 5%.It has Net NPA as 0% and CAR at 16%.Its Share is quoted in the market @Rs.128 per share. The Board of directors of bank 'P' has submitted a proposal to RBI for takeover of bank 'R' on the basis of share exchange ratio.

The balance sheet details of both the banks are as follows:

Particulars	Bank R Amount in lacs	Bank P Amount in lacs
Paid up share capital	140	500
Reserves & surplus	70	5,500
Deposits	4,000	40,000
Other liabilities	890	2,500
Total liabilities	5,100	48,500
Cash in hand & with RBI	400	2,500
Balance with other banks	-	2,000
Investments	1,100	15,000
Advances	3,500	27,000
Other assets	100	2,000
Total assets	5,100	48,500

It was decided to issue shares at Book value of bank 'P' to the shareholders of Bank 'R'. All assets and liabilities are to be taken over at book value. For the swap ratio, weights assigned to different parameters are as follows:

- ❖ Gross NPA - 30 %
- ❖ CAR - 20%
- ❖ Market Price - 40 %
- ❖ Book Value - 10 %

Required:

- a) What is the swap ratio based on above weights?

- b) How many shares are to be issued?
 c) Prepare Balance sheet after merger.
 d) Calculate CAR & Gross NPA% of Bank 'P' after merger.

Answer:

WN 1: Computation of shares to be issued and swap ratio:

Parameter	Base value	Swap Ratio	Shares to be issued (in lacs)	Weight	Product
Gross NPA	5:40	5:40	1.75	0.3	0.525
CAR	16:4	4:16	3.50	0.2	0.700
Market Price	128:8	8:128	0.875	0.4	0.350
Book value	120:15	15:120	1.75	0.1	0.175
Shares to be issued					1.75

Note:

- ❖ Swap Ratio is the swap of base values for all positive parameters like CAR, Market Price and Book value. However, for negative parameters like Gross NPA the base value and swap ratio would remain same
- ❖ Book value of Bank R = $(140+70)/14 = \text{Rs.15 per share}$
- ❖ Book value of Bank P = $(500 + 5,500)/50 = \text{Rs.120 per share}$
- ❖ **Final swap ratio = 1.75 lac shares for 14 lacs shares. Hence it will be 1 share for every 8 shares**
- ❖ **Swap ratio = 1:8 (or) 0.125:1**

Note: It is assumed that face value of share is Rs.10 for computing the no of shares.

WN 2: Computation of Goodwill/Capital Reserve on Acquisition:

Particulars	Amount (in lacs)
Shares issued	1.75
Issue price (book value)	120
Consideration paid	210
Assets taken over	210
Goodwill/Capita reserve	0

WN 3: Balance Sheet post-merger:

Particulars	Bank R (in lacs)
Liabilities	
Paid up capital $(500 + 1.75 \times 10)$	517.50
Securities Premium (1.75×110)	192.50
Other Reserves and surplus	5,500
Deposits $(4,000 + 40,000)$	44,000
Other liabilities $(890 + 2,500)$	3,390
Total Liabilities	53,600
Cash in hand and with RBI $(400 + 2,500)$	2,900
Balance with other banks	2,000
Investments $(1,100 + 15,000)$	16,100
Advances $(3,500 + 27,000)$	30,500
Other Assets $(100 + 2,000)$	2,100
Total Assets	53,600

WN 4: Computation of Gross NPA % of merged Bank:

(in lacs)

Particulars	Bank R	Bank P	Merged
Total Advances	3,500	27,000	30,500
GNPA %	40	5	9.02
GNPA (in Rs.)	1,400	1,350	2,750
Advances x GNPA %			

$$\text{GNPA \% of merged bank} = \frac{2,750}{30,500} \times 100 = 9.02\%$$

WN 5: Computation of Capital Adequacy Ratio of Merged Bank:

(in lacs)

Particulars	Bank R	Bank P	Merged
Capital	210	6,000	6,210
Capital Adequacy Ratio (5)	4	16	14.53
Risk weighted assets	5,250	37,500	42,750

$$\text{CAR} = \frac{\text{Capital}}{\text{Risk Weighted Assets}}; \text{Risk weighted assets} = \frac{\text{Capital}}{\text{CAR}}$$

- Risk weighted assets of Bank R = $(210/4\%) = \text{Rs.} 5,250$
- Risk weighted assets of Bank P = $(6,000/16\%) = \text{Rs.} 37,500$
- CAR of merged bank = $(6,210/42,750) \times 100 = 14.53\%$

13. Shares to be issued to comply with SEBI guidelines (Nov 2013, May 2018)

Trupti Co. Ltd. promoted by a Multinational group "INTERNATIONAL INC" is listed on stock exchange holding 84% i.e. 63 lakhs shares.

- ❖ Profit after Tax is Rs. 4.80 crores.
- ❖ Free Float Market Capitalisation is Rs. 19.20 crores

As per the SEBI guidelines promoters have to restrict their holding to 75% to avoid delisting from the stock exchange. Board of Directors has decided not to delist the share but to comply with the SEBI guidelines by issuing Bonus shares to minority shareholders while maintaining the same P/E ratio. **Calculate**

- P/E Ratio
- Bonus Ratio
- Market price of share before and after the issue of bonus shares
- Free Float Market capitalization of the company after the bonus shares.

Answer:

WN 1: Computation of PE Multiple:

Particulars	Amount (in lacs)
Profit after Tax	480
P/E Multiple [Total Market Cap/Profit after Tax] [Bal figure]	25 times [12,000/480]
Total Market Capitalization [Free Float Market Cap/Public holding%]	12,000 [1920/16%]

WN 2: Computation of Bonus Ratio:

Particulars	Amount
Existing shares by promoters	63 lacs
Existing shareholding of promoters	84%
Total Shares [63 lacs/84%]	75 lacs
Target shareholding of promoters	75%
Target total shares for 75% promoter holding [63 lacs/75%]	84 lacs
Bonus shares to be issued [84 lacs - 75 lacs]	9 lacs
Existing shares by public [75 lacs - 63 lacs]	12 lacs
Bonus Ratio	9:12 or 3:4

WN 3: Computation of Market Price before and after issue:

Particulars	Before issue	After Issue
Market capitalization	12,000	12,000
Number of shares	75 lacs	84 lacs
Market Price (Market cap/No of shares)	160	142.86

WN 4: Free Float Market Capitalization post bonus issue:

- ❖ Free Float market capitalization = Total market capitalization x % holding by public
- ❖ Free Float Market Capitalization = 12,000 lacs x 25% = Rs.3,000 lacs

14. Consideration to maintain EPS (May 2016, Nov 2018 RTP)

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 Rs. 80.00 lakhs and P/E multiple is 10.5. He wants to buy another firm which has current income of Rs. 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 Rs. 42 and Rs. 105 respectively?

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

Answer:

WN 1: Computation of Exchange Ratio:

(in lacs)

Particulars	Acquirer Company	Target Company
PAT	80	15.75
No of shares	20	1.50
EPS [MPS/PE Multiple]	4	10.50
P/E Multiple	10.5	10
MPS	42	105

- ❖ The company wants to maintain same EPS and hence exchange ratio should be on the basis of EPS
- ❖ Base values for EPS = 4:10.50; Exchange ratio based on EPS = 10.50:4 (or) 2.625:1

WN 2: Computation of cash consideration:

Particulars	Amount (in lacs)
Profit after Tax	15.75
Cost of debt (after tax)	10.50%
Maximum consideration [15.75 lacs/10.50%]	150

15. Bank merger:

XML bank was established in 2001 and doing banking business in India. The bank is facing very critical situation. There are problems of Gross NPA (Non-Performing Assets) at 40% & CAR/CRAR (Capital Adequacy Ratio/Capital. Risk Weight Asset Ratio) at 2%. The net worth of the bank is not good. Shares are not traded regularly. Last week, it was traded @ Rs. 4 per share. RBI Audit suggested that bank has either to liquidate or to merge with other bank. ZML Bank is professionally managed bank with low gross NPA of 5%. It has net NPA as 0% and CAR at 16%. Its share is quoted in the market @ Rs. 64 per share. The Board of Directors of ZML Bank has submitted a proposal to RBI for takeover of bank XML on the basis of share exchange ratio.

The Balance Sheet details of both the banks are as follows:

Particulars	XML Bank (Rs. Crores)	ZML Bank (Rs. Crores)
Liabilities		
Paid up capital (Rs.10)	70	250
Reserves and surplus	35	2,750
Deposits	2,000	20,000
Other liabilities	445	1,250
Total Liabilities	2,550	24,250
Cash in hand and with RBI	200	1,250
Balance with other banks	0	1,000
Investments	550	7,500
Advances	1,750	13,500
Other Assets	50	1,000
Total Assets	2,550	24,250

It was decided to issue shares at Book Value of ZML Bank to the shareholders of XML Bank. All Assets & Liabilities are to be taken over at Book Value. For the Swap Ratio, weights assigned to different parameters are as follows:

Gross NPA	40%
CAR	10%
Market Price	40%
Book value	10%

You are required to:

- (i) Calculate swap ratio based on above rates.
- (ii) Calculate number of shares are to be issued.
- (iii) Prepare Balance Sheet after Merger.

Answer:**WN 1: Computation of shares to be issued and swap ratio:**

Parameter	Base value	Swap Ratio	Shares to be issued (in lacs)	Weight	Product
Gross NPA	5:40	5:40	87.5	0.4	35
CAR	16:2	2:16	87.5	0.1	8.75
Market Price	64:4	4:64	43.75	0.4	17.5
Book value	120:15	15:120	87.5	0.1	8.75
Shares to be issued					70

Note:

- ❖ Swap Ratio is the swap of base values for all positive parameters like CAR, Market Price and Book value. However, for negative parameters like Gross NPA the base value and swap ratio would remain same
- ❖ Book value of XML Bank = $(70+35)/7 = \text{Rs.15 per share}$
- ❖ Book value of ZML Bank = $(250 + 2,750)/25 = \text{Rs.120 per share}$
- ❖ **Final swap ratio = 70 lac shares for 7 crores shares. Hence it will be 1 share for every 10 shares.**
- ❖ **Swap ratio = 1:10 (or) 0.1:1**

WN 2: Computation of Goodwill/Capital Reserve on Acquisition:

Particulars	Amount (in crores)
Shares issued	0.70
Issue price (book value)	120
Consideration paid	84
Assets taken over	105
Capital Reserve	21

WN 3: Balance Sheet post-merger:

Particulars	ZML Bank (Rs. Crores)
Liabilities	
Paid up capital (Rs.10)	257
Securities Premium	77
Capital Reserve	21
Other reserves and surplus	2,750
Deposits	22,000
Other liabilities	1,695
Total Liabilities	26,800
Cash in hand and with RBI	1,450
Balance with other banks	1,000
Investments	8,050
Advances	15,250
Other Assets	1,050
Total Assets	26,800

16. Computation of available liquidity (May 2015 RTP)

A Ltd.'s (Acquirer company) equity capital is Rs. 2,00,00,000. Both A Ltd. and T Ltd. (Target Company) have arrived at an understanding to maintain debt equity ratio at 0.30 : 1 of the merged company. Pre-merger debt outstanding of A Ltd. stood at Rs. 20,00,000 and T Ltd at Rs. 10,00,000 and marketable securities of both companies stood at Rs. 40,00,000. You are required to calculate total fund requirements of A Ltd. to acquire T Ltd. against cash payment at mutually agreed price of Rs. 65,00,000.

Answer:

Particulars	Amount
Debt capacity of merged company $(2,00,00,000 \times 0.30)$	60,00,000
Less: Debt of A Limited and T Limited	30,00,000
Balance debt can be raised	30,00,000
Add: Marketable securities	40,00,000
Total fund available	70,00,000

Since the combined liquidity of merged company shall remain comfortable, it shall be feasible to pay cash for acquiring T Limited against cash consideration of Rs.65,00,000.

17. Return on shares pre and post-merger (Nov 2015 RTP)

Two companies Bull Ltd. and Bear Ltd. recently have been merged. The merger initiative has been taken by Bull Ltd. to achieve a lower risk profile for the combined firm in spite of fact that both companies belong to different industries and disclose a little co-movement in their profit earning streams. Though there is likely to synergy benefits to the tune of Rs. 7 crore from proposed merger. Further both companies are equity financed and other details are as follows:

Company	Market Capitalization	Beta
Bull Limited	1,000 Crores	1.50
Bear Limited	500 Crores	0.60

Expected Market Return and Risk Free Rate of Return are 13% and 8% respectively. Shares of merged entity have been distributed in the ratio of 2:1 i.e. market capitalization just before merger. You are required to:

- Calculate return on shares of both companies before merger and after merger.
- Calculate the impact of merger on Mr. X, a shareholder holding 4% shares in Bull Ltd. and 2% share of Bear Ltd.

Answer:

WN 1: Computation of return on shares before merger and after merger:

Particulars	Beta	Calculation	Return on shares
Bull Limited (pre-merger)	1.50	$8\% + 1.50 \times (13\% - 8\%)$	15.50%
Bear Limited (pre-merger)	0.60	$8\% + 0.60 \times (13\% - 8\%)$	11.00%
Merged entity (post-merger)	1.20 (Note 1)	$8\% + 1.20 \times (13\% - 8\%)$	14.00%

Note 1: Computation of Beta of Merged Firm:

Security	Beta	Weight	Product
Bull Limited	1.50	1,000	1,500
Bear Limited	0.60	500	300
Merged Firm	1.20	1,500	1,800

WN 2: Impact of merger on Mr.X:

Note 1: Value of Mr.X holding pre-merger:

Particulars	Calculation	Amount
Bull Limited	$4\% \times 1,000 \text{ Crores}$	40 Crores
Bear Limited	$2\% \times 500 \text{ Crores}$	10 Crores
Value of holding		50 Crores

Note 2: Value of merged entity:

Particulars	Calculation	Amount in crores
Earnings of Bull Limited	$15.50\% \times 1,000 \text{ crores}$	155
Earnings of Bear Limited	$11\% \times 500 \text{ Crores}$	55
Synergy gain		7
Earnings of merged entity		217
Cost/return on equity		14%
Value of merged firm	$217/14\%$	1,550

Note 3: Value of Mr.X post-merger:

Particulars	Calculation	Amount
Shareholding in Bull Limited		4%
Shareholding in Bear Limited		2%
Shareholding in merged entity	$\left(4\% \times \left(\frac{2}{3}\right) + 2\% \times \left(\frac{1}{3}\right)\right)$	3.333333%
Value of holding	$3.333333\% \times 1,550$	51.67 Crores

Impact: Value of Mr.X holding increases by 1.67 Crores post-merger.

18. Computation of shares to be issued (Nov 2017 RTP)

AB Ltd., is planning to acquire and absorb the running business of XY Ltd. The valuation is to be based on the recommendation of merchant bankers and the consideration is to be discharged in the form of equity shares to be issued by AB Ltd. As on 31.3.2006, the paid up capital of AB Ltd. consists of 80 lakhs shares of

Rs.10 each. The highest and the lowest market quotation during the last 6 months were Rs.570 and Rs.430. For the purpose of the exchange, the price per share is to be reckoned as the average of the highest and lowest market price during the last 6 months ended on 31.3.06.

XY Limited's Balance Sheet as at 31.03.2006 is summarized below:

Particulars	Amount in lacs
Sources	
Share capital	
20 lacs equity shares of Rs.10 each fully paid	200
10 lacs equity shares of Rs.10 each, Rs.5 paid	50
Loans	100
Total	350
Uses	
Fixed assets (net)	150
Net current assets	200
Total	350

An independent firm of merchant bankers engaged for the negotiation, have produced the following estimates of cash flows from the business of XY Ltd.:

Year ended	Amount in lacs
31.03.07	105
31.03.08	120
31.3.09	125
31.3.10	120
31.3.11	100
Terminal value estimate	200

It is the recommendation of the merchant banker that the business of XY Ltd. may be valued on the basis of the average of (i) Aggregate of discounted cash flows at 8% and (ii) Net assets value.

You are required to:

- Calculate the total value of the business of XY Ltd.
- The number of shares to be issued by AB Ltd.; and
- The basis of allocation of the shares among the shareholders of XY Ltd.

Answer:

WN 1: Valuation of company on the basis of discounted cash flows:

Year	Cash flow	PVF @ 8%	DCF (in lacs)
1	105	0.93	97.65
2	120	0.86	103.20
3	125	0.79	98.75
4	120	0.74	88.80
5	300	0.68	204.00
Value of business			592.40

WN 2: Valuation of company on the basis of Net assets value:

Particulars	Amount (in lacs)
Fixed Assets	150
Current Assets	200
Less: Loans	(100)
Net Assets	250

WN 3: Computation of shares to be issued:

Particulars	Amount (in lacs)
Valuation on discounted cash flows	592.40
Valuation on net assets	250
Average value	421.20
Issue price (average of opening and closing)	500
No of shares to be issued (421.20/500)	84,240
Fully paid equivalent shares (20 lacs + 10 lacs x 50%)	25,00,000
Distribution of fully paid shareholders (84,240 x (20/25))	67,392

Distribution of partly paid shareholders (84,240 x (5/25))	16,848

19. Determination of exchange ratio (Nov 2019 RTP):

XYZ Ltd. wants to purchase ABC Ltd. by exchanging 0.7 of its share for each share of ABC Ltd. Relevant financial data are as follows:

Particulars	XYZ Limited	ABC Limited
Equity shares outstanding	10,00,000	4,00,000
EPS	40	28
Market price per share	250	160

- Illustrate the impact of merger on EPS of both the companies.
- The management of ABC Ltd. has quoted a share exchange ratio of 1:1 for the merger. Assuming that P/E ratio of XYZ Ltd. will remain unchanged after the merger, what will be the gain from merger for ABC Ltd.?
- What will be the gain/loss to shareholders of XYZ Ltd.?
- Determine the maximum exchange ratio acceptable to shareholders of XYZ Ltd.

Answer:**WN 1: Valuation of XYZ, ABC and merged firm:**

Particulars	XYZ	ABC	Merged (i)	Merged (ii)
PAT/EAES	4,00,00,000	1,12,00,000	5,12,00,000	5,12,00,000
No of equity shares	10,00,000	4,00,000	12,80,000	14,00,000
EPS	40	28	40	36.57
PE Multiple	6.25	5.71	6.25	6.25
MPS	250	160	250	228.56

Part (i):**Impact of merger on EPS:**

Particulars	XYZ	ABC
Pre-merger EPS	40	28
Post-merger EPS	40	28 (40 x 0.7)
Gain/loss	-	-

Part (ii) & (iii)**Gain/loss from merger if ratio is 1:1**

Particulars	XYZ	ABC
Pre-merger MPS	250	160
Post-merger MPS	228.56	228.56
Gain/loss per share	(21.44)	68.56

Part (iv):

- Maximum exchange ratio should ensure that MPS remains Rs.250. MPS would remain at Rs.250 if EPS continues to be Rs.40
- EPS can be maintained if the exchange ratio is on the basis of EPS
- Base values = 40: 28
- Exchange ratio = 28:40 (or) 0.70:1**

20. Determination of exchange ratio:

A Limited is studying the possible acquisition of B Limited by way of merger. The following data are available:

Firm	After-tax earnings	No of equity shares	Market Price per share
A Limited	10,00,000	2,00,000	75
B Limited	3,00,000	50,000	60

- If the merger goes through by exchange of equity shares and the exchange ratio is set according to the current market prices, what is the new earnings per share for A Limited
- B Limited wants to be sure that its earning per share is not diminished by the merger. What exchange ratio is relevant to achieve the objective?

Answer:

WN 1: Valuation of A Limited, B Limited and Merged company:

Particulars	A Limited	B Limited	Merged Company
PAT	10,00,000	3,00,000	13,00,000
No of shares	2,00,000	50,000	2,40,000
EPS	5	6	5.42

Note:

- ❖ Shares to be issued are on market price basis. Base values are 75:60 and hence the swap ratio will be 60:75
- ❖ Shares to be issued = $50,000 \times (60/75) = 40,000$ shares

WN 2: Shares to be issued so that EPS is not diminished due to merger:

- ❖ The company should allot the shares in the ratio of EPS if it does not want EPS to be impacted by merger.
- ❖ The base values are 5:6 and hence the swap ratio will be 6:5

21. Determination of exchange ratio (Nov 2012 RTP)

Reliable Industries Limited (RIL) is considering a takeover of Sunflower Industries Limited (SIL). The particulars of 2 companies are given below:

Particulars	Reliable Industries Limited	Sunflower Industries Limited
Earnings after Tax	20,00,000	10,00,000
Equity shares outstanding	10,00,000	10,00,000
EPS	2	1
PE Ratio	10	5

Required:

- What is the market value of each company before merger?
- Assume that the management of RIL estimates that the shareholders of SIL will accept an offer of one share of RIL for four shares of SIL. If there are no synergic effects, what is the market value of the post-merger RIL? What is the new price per share? Are the shareholders of RIL better or worse off than they were before the merger?
- Due to synergic effects, the management of RIL estimates that the earnings will increase by 20%. What are the new post-merger EPS and price per share? Will the shareholders be better off or worse off than before the merger?

Answer:**WN 1: Valuation of RIL, SIL and merged entity:**

Particulars	RIL	SIL	Merged (part ii)	Merged (Part iii)
PAT	20,00,000	10,00,000	30,00,000	36,00,000
No of shares	10,00,000	10,00,000	12,50,000	12,50,000
EPS	2	1	2.4	2.88
PE Multiple	10	5	10	10
MPS	20	5	24	28.80
No of shares	10,00,000	10,00,000	12,50,000	12,50,000
Value of firm	2,00,00,000	50,00,000	3,00,00,000	3,60,00,000

WN 2: Computation of gains/loss to shareholders for Part (ii):

Particulars	RIL	SIL
Pre-merger value	2,00,00,000	50,00,000
Post-merger value	2,40,00,000 [10,00,000 × 24]	60,00,000 [2,50,000 × 24]
Gain to shareholders	40,00,000	10,00,000

Thus, the shareholders of RIL and SIL are better-off than before.

WN 3: Computation of gains/loss to shareholders for Part (iii):

Particulars	RIL	SIL
Pre-merger value	2,00,00,000	50,00,000
Post-merger value	2,88,00,000 [10,00,000 × 28.80]	72,00,000 [2,50,000 × 28.80]
Gain to shareholders	88,00,000	22,00,000

Thus, the shareholders of RIL and SIL are better-off than before.

22. EPS/PE/ROE/Book value per share analysis:

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

Particulars	BA Limited	DA Limited
Current Assets	14,00,000	10,00,000
Fixed Assets (net)	10,00,000	5,00,000
Total Assets	24,00,000	15,00,000
Equity capital (Rs.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 Liabilities	24,00,000	15,00,000

Income statement:

Particulars	BA Limited	DA Limited
Net sales	34,50,000	17,00,000
Cost of goods sold	27,60,000	13,60,000
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 @ 50%	2,10,000	99,000
Earnings after taxes	2,10,000	99,000
No of equity shares	1,00,000	80,000
Dividend Payout Ratio	40%	60%
Market price per share	40	15

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:

- 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.
- Estimate future EPS growth rates for each company.
- Based on expected operating synergies BA Ltd. estimates that the intrinsic value of DA's equity share would be Rs.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?
- Calculate the post-merger EPS based on an exchange ratio of 0.4: 1 being offered by BA Ltd. and indicate the immediate EPS accretion or dilution, if any, that will occur for each group of shareholders.
- 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.

Answer:

WN 1: Computation of EPS, PE, ROE and Book value per share:

Particulars	BA Limited	DA Limited	Merged Entity
EAT	2,10,000	99,000	3,09,000
No of shares	1,00,000	80,000	1,32,000
EPS	2.10	1.2375	2.3409
PE Multiple (MPS/EPS)	19.05	12.12	19.05
MPS	40	15	44.59
Book value per share (Equity/No of shares)	12	10	Not needed
ROE (EPS/BVPS) x 100	17.50%	12.37%	Not needed

WN 2: Computation of growth rates:

Particulars	BA Limited	DA Limited
Dividend payout ratio	40%	60%
Retention ratio	60%	40%

ROE	17.50%	12.37%
Growth rate (ROE x Retention ratio)	10.50%	4.95%

WN 3: Identification of justifiable exchange ratio:

Basis	Base value	Swap Ratio	Limit
Intrinsic value	40:20	20:40 (or) 0.5:1	Upper Limit
Market value	40:15	15:40 (or) 0.375:1	Lower Limit

Since, BA Limited has a higher EPS, ROE, PE Multiple and higher EPS growth expectations, the negotiable terms would be expected to be closer to the lower limit, based on the existing share prices.

WN 4: Computation of EPS/MPS accretion or dilution due to merger:

Particulars	BA Limited	DA Limited
Existing EPS	2.1000	1.2375
New EPS	2.3409	0.9364 [2.3409 x 40%]
Impact on EPS	0.2409	(0.3011)
Existing MPS	40	15
New Price	44.59	17.84 [44.59 x 40%]
Impact on MPS	4.59	2.84

23. Synergy gain and swap ratio (May 2019 RTP)

MK Limited is considering acquiring NN Limited. The following information is available:

Company	Earnings after Tax	No of equity shares	Market value per share
MK Limited	60,00,000	12,00,000	200.00
NN Limited	18,00,000	3,00,000	160.00

Exchange of equity shares for acquisition is based on current market value as above. There is no synergy advantage available.

- Find the earning per share for company MK Limited after merger and
- Find the exchange ratio so that shareholders of NN Limited would not be at a loss

Answer:**WN 1: Computation of EPS after merger:**

Particulars	MK Limited	NN Limited	Merged
Earnings after tax	60,00,000	18,00,000	78,00,000
No of shares	12,00,000	3,00,000	14,40,000
Earnings per share	5	6	5.42

- ❖ Shares issued to NN Limited = $3,00,000 \times (160/200) = 2,40,000$
- ❖ Shares post-merger = $12,00,000 + 2,40,000 = 14,40,000$

WN 2: Computation of exchange ratio so that shareholders of NN Limited would not be at a loss:

- ❖ EPS of Company MK Limited = Rs.5; EPS of NN Limited = Rs.6
- ❖ Exchange ratio should be on the basis of EPS so that shareholders are not a loss
- ❖ **Base values are 5:6 and hence the exchange ratio should be 6:5**

24. Synergy gain and swap ratio (May 2013)

Longitude Limited is in the process of acquiring Latitude Limited on a share exchange basis. Following relevant data are available:

Particulars	Longitude Limited	Latitude Limited
PAT	140 lacs	60 lacs
Number of shares	15 lacs	16 lacs
Earnings per share	8	5
PE Multiple (ignore synergy)	15	10

You are required to determine:

- i. Pre-merger Market value per share, and
- ii. The maximum exchange ratio Longitude Limited can offer without the dilution of
 - a. EPS and
 - b. Market Value per share

Calculate Ratio/s up to four decimal points and amounts and number of shares up to two decimal points

Answer:

WN 1: Computation of pre-merger market value per share:

Particulars	Longitude Limited	Latitude Limited
Earnings per share	8	5
PE Multiple	15	10
MPS	120	50

Note: PAT given in the question does not match with EPS figure given in the question and the same looks to be a mistake

WN 2: Computation of exchange ratio:

Target	Swap ratio Basis	Base Value	Exchange Ratio
No dilution in EPS	Exchange ratio should be on the basis of EPS to have no impact on EPS	8:5	5:8 (or) 0.625:1
No dilution in MPS	Exchange ratio should be on the basis of MPS to have no impact on MPS	120:50	50:120 (or) 0.4167:1

25. Post-merger MP for different PE Multiple:

Company Alpha is considering to acquire Company Beta. The financial data of the two companies are given in the following table:

Particulars	Company Alpha	Company Beta
PAT	40,000	8,000
Number of shares	10,000	4,000
EPS	4	2
Market value per share	60	15
PE Multiple	15	7.50
Total Market Capitalization	6,00,000	60,000

Company Alpha is considering to acquire Company Beta through exchange of shares in proportion to the market value per share.

If the price-earnings ratio is expected to be:

- (a) Pre-merger P/E ratio of Beta (7.50)
- (b) Pre-merger P/E ratio of Alpha (15)
- (c) Weighted average of Pre-merger P/E ratio of Alpha and Beta

What would be the impact on wealth of shareholders post-merger?

Answer:

WN 1: Computation of MPS post-merger for different scenarios:

Particulars	Alpha	Beta	Merged (PE of 7.50)	Merged (PE of 15)	Merged (Weighted average PE)
PAT	40,000	8,000	48,000	48,000	48,000
Number of shares	10,000	4,000	11,000	11,000	11,000
EPS	4	2	4.36	4.36	4.36
PE Multiple	15	7.50	7.50	15	13.75
Market value per share	60	15	32.70	65.40	60
Total Market Capitalization	6,00,000	60,000	3,59,700	7,19,400	6,60,000

$$\text{Weighted average PE Multiple} = \frac{(40,000 \times 15) + (8,000 \times 7.50)}{48,000} = 13.75$$

$$\text{Shares to be issued to Beta} = (4,000 \times 15/60) = 1,000 \text{ shares}$$

WN 2: Computation of impact on shareholder's wealth for Part (a):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	32.70	8.175 [32.70 x 0.25]
Impact on MPS	(27.30)	(6.825)

WN 3: Computation of impact on shareholder's wealth for Part (b):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	65.40	16.35 [65.40 x 0.25]
Impact on MPS	5.40	1.35

WN 4: Computation of impact on shareholder's wealth for Part (c):

Particulars	Alpha	Beta
Pre-merger MPS	60	15
Post-merger MPS	60	15 [60 x 0.25]
Impact on MPS	0	0

26. Exchange ratio and EPS:

Company A and Company B have the following financial data under consideration

Particulars	Company A	Company B
Present earnings (in lacs)	300	40
No of shares (thousands)	1,000	100
Price-earnings ratio	20	12

- In case, the company A and company B were to merge and exchange ratio were one share of company A for one share of company B, what would be the initial impact on earnings per share of the two companies. What is the market value exchange ratio? Shareholders of which company stand to gain?
- In case the exchange ratio was two shares of Company A for one share of Company B which company would find merger to be attractive
- Similarly, if the exchange ratio was 1.5 shares of Company A for one share of Company B what would happen?

Answer:**WN 1: Computation of EPS and MPS for different scenarios:**

Particulars	A	B	Merged (1:1)	Merged (2:1)	Merged (1.5:1)
PAT (lacs)	300	40	340	340	340
Number of shares (lacs)	10	1	11	12	11.5
EPS	30	40	30.91	28.33	29.57
PE Multiple	20	12	Not needed	Not needed	Not needed
Market value per share	600	480	Not needed	Not needed	Not needed

WN 2: Analysis of scenario 1(one share for every one share):

Particulars	A	B
Pre-merger EPS	30	40
Post-merger EPS	30.91	30.91 [30.91 x 1]
Impact of merger on EPS	0.91	(9.09)

- ❖ Merger is favourable to company A as EPS increases from Rs.30 to Rs.30.91. However, the same will not be acceptable to company B as their EPS reduced from 40 to 30.91
- ❖ Market value-based exchange ratio: The base values are 600:480 and hence swap ratio will be 480:600 (or) 0.8:1. This will make merger more attractive to Company A and shareholders of company B would not be interested in merger

WN 3: Analysis of scenario 2(two share for every one share):

Particulars	A	B
Pre-merger EPS	30	40
Post-merger EPS	28.33	56.66 [28.33 x 2]
Impact of merger on EPS	(1.67)	16.66

- ❖ Swap ratio is favourable to company B but not acceptable to company A

WN 3: Analysis of scenario 3(1.5 shares for every one share):

Particulars	A	B
Pre-merger EPS	30	40
Post-merger EPS	29.57	44.35 [29.57 x 1.5]
Impact of merger on EPS	(0.43)	4.35

- ❖ Swap ratio is favourable to company B but not acceptable to company A

27. Exchange ratio based on different basis:

A Limited want to take over B Limited and the financial details of both are as follows:

Particulars	A Limited	B Limited
Preference share capital	20,000	
Equity share capital of Rs.10 each	1,00,000	50,000
Share premium	-	2,000
Profit and Loss Account	38,000	4,000
10% Debentures	15,000	5,000
Total	1,73,000	61,000
Fixed assets	1,22,000	35,000
Current assets	51,000	26,000
Total	1,73,000	61,000
Profit after tax after preference dividend	24,000	15,000
Market Price	24	27

What should be share exchange ratio to be offered to the shareholders of B Limited based on

- net assets value
- EPS
- Market price

Which should be preferred from the point of view of A Limited.

Answer:

WN 1: Computation of exchange ratio based on net assets method:

Particulars	A Limited	B Limited
Total assets	1,73,000	61,000
Less: 10% Debentures	(15,000)	(5,000)
Less: Preference share capital	(20,000)	-
Net Assets	1,38,000	56,000
No of shares	10,000	5,000
Value per share	13.80	11.20

- ❖ Base values = 13.80:11.20
❖ Exchange ratio = 11.20:13.80 (or) 0.812:1

WN 2: Computation of exchange ratio based on EPS:

Particulars	A Limited	B Limited
EAES	24,000	15,000
No of shares	10,000	5,000
EPS	2.40	3.00

- ❖ Base values = 2.40: 3.00
❖ Exchange ratio = 3:00:2.40 (or) 1.25:1

WN 3: Computation of exchange ratio based on MPS:

- ❖ Base values = 24:27
❖ Exchange ratio = 27:24 (or) 1.125:1

Preferred ratio:

- ❖ Company A would prefer exchange ratio on the basis of net assets method as the same will lead to allotment of lower number of shares.

28. Computation of minimum and maximum exchange ratio (Nov 2018)

C Limited and D Limited are contemplating a merger deal in which C Limited will acquire D Limited. The relevant information about the firms are given as follows:

Particulars	C Limited	D Limited
Total earnings (in millions)	Rs.96	Rs.30
No of shares	20	14
EPS	4.80	2.143
Price Earnings Ratio	8	7
Market price per share	38.40	15

- What is the maximum exchange ratio acceptable to the shareholders of C Limited, if the PE ratio of the combined firm is 7?
- What is the minimum exchange ratio acceptable to the shareholders of D Limited, if the PE ratio of the combined firm is 9?

Answer:**WN 1: Computation of market value of merged entity:**

Particulars	C LTD	D Ltd	Merged firm (Part 1)	Merged Firm (Part 2)
PAT	96	30	126	126
PE Multiple	8	7	7	9
Value of firm (PAT x PE Multiple)	768	210	882	1134

WN 2: Computation of maximum exchange ratio acceptable to shareholders of C Limited:

Particulars	Calculation	Amount (in million)
Pre-merger value of C Limited		768
Post-merger value of C Limited		882
Maximum consideration to D Ltd shareholders	882 - 768	114
Shares to be issued: 768 million of C Limited = 20 million shares 114 million of D Limited = ? Shares	$\frac{114 \times 20}{768}$	2.96875 million
Existing shares of C Limited shareholders		14 million
Exchange ratio		2.96875:14 (or) 0.212:1

WN 3: Computation of minimum exchange ratio acceptable to shareholders of D Limited:

Particulars	Calculation	Amount (in million)
Post-merger value of C Limited		1134
Minimum consideration to D Ltd shareholders (pre-merger value)		210
Value of C Limited shareholders	1134-210	924
Shares to be issued: 924 million of C Limited = 20 million shares 210 million of D Limited = ? Shares	$\frac{210 \times 20}{924}$	4.54545 million
Existing shares of C Limited shareholders		14 million
Exchange ratio		4.5454:14 (or) 0.325:1

29. Cash consideration and stock consideration (May 2019)

Given is the following information:

Particulars	Day Limited	Night Limited
Net earnings	Rs.5 Crores	Rs.3.5 Crores
No of equity shares	10,00,000	7,00,000

The shares of Day Limited and Night Limited trade at 20 and 15 times their respective P/E Ratios. Day Limited considers taking over Night Limited by paying Rs.55 Crores considering that the market price of Night Limited 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 Limited on the best alternative.

Answer:

WN 1: Computation of value of Day Limited and Night Limited:

Particulars	Day Limited	Night Limited
PAT	Rs.5 Crores	Rs.3.5 Crores
No of equity shares	10,00,000	7,00,000
Earnings per share	50	50
PE Multiple	20	15
MPS	1,000	750
No of shares	10,00,000	7,00,000
Market value	Rs.100 Crores	Rs.52.50 Crores

WN 2: Computation of true cost of merger:

Situation 1: Takeover funded with cash:

- ❖ True cost of merger = Consideration paid - Value of Night Limited
- ❖ True cost of merger = Rs.55 Crores - Rs.52.50 Crores = Rs.2.50 Crores

Situation 2: Takeover funded with stock:

No of shares to be issued = 55 crores/1,000 = 5,50,000 shares
Post – merger MP = $\frac{\text{Value of company A} + \text{Value of company B}}{\text{No of shares}}$
Post – merger MP = $\frac{100 \text{ Crores} + 52.50 \text{ Crores}}{10,00,000 + 5,50,000} = \text{Rs. } 983.87$
Consideration for merger = Rs.983.07 x 5,50,000 shares = Rs.54.11 Crores
True cost of merger = Consideration paid -Value of Night Limited
True cost of merger = Rs.54.11 Crores - Rs.52.50 Crores = Rs.1.61 Crores

Conclusion: True cost of merger is lower in case of consideration in the form of stock and hence the takeover should be funded with stock.

30. Share exchange ratio (Nov 2019 Exam):

ABC Ltd. is a company operating in the software industry. It is considering the acquisition of XYZ Ltd. which is also into software industry. The following information are available for the companies:

Particulars	ABC Limited	XYZ Limited
Earnings after tax	9,00,000	2,40,000
Number of equity shares	1,50,000	60,000
PE Ratio	14	10

ABC Ltd. is planning to offer a premium of 25% over the market price of XYZ Ltd.

Required:

- (i) What is the swap ratio based on current market price?
- (ii) Find the number of shares to be issued by ABC Ltd. to the shareholders of XYZ Ltd.
- (iii) Compute the new EPS of ABC Ltd. after merger and comment on the impact of merger.
- (iv) Determine the market price of the share when P/E ratio remains unchanged.
- (v) Compute the market price when P/E declines to 12 and comment on the results.

Figures are to be rounded off to 2 decimals.

Answer:

WN 1: Basic table:

Particulars	ABC Limited	XYZ Limited	Merged
Earnings after tax	9,00,000	2,40,000	11,40,000
Number of equity shares	1,50,000	60,000	1,85,714
EPS	6	4	6.14
PE Ratio	14	10	14
MPS	84	40	85.96

WN 2: Solution:

Swap ratio:

- Base values on the basis of MPS is ABC Limited (84) & XYZ Limited (40)
- Premium of 25 percent is to be paid and hence revised price of XYZ Limited is 50
- Revised base values = 84 & 50
- Exchange ratio = 50:84

Number of shares to be issued:

Number of shares to be issued = $60,000 \times \left(\frac{50}{84}\right) = 35,714$ shares

Impact of merger on new EPS:

Particulars	ABC Limited	XYZ Limited
Old EPS	6	4
New EPS	6.14	3.65 $6.14 \times \left(\frac{50}{84}\right)$
Increase/decrease in EPS	0.14	(0.35)

New MPS if PE Multiple remains same:

New MPS = $6.14 \times 14 = \text{Rs.}85.96$

New MPS if PE Multiple falls to 12:

New MPS = $6.14 \times 12 = \text{Rs.}73.68$

Comments on MPS:

Particulars	ABC Limited	XYZ Limited
Old MPS	84	40
New MPS	73.68	43.86 $73.68 \times \left(\frac{50}{84}\right)$
Increase/decrease in MPS	(10.32)	3.86

Comments: With the merger there is a decrease in the market price of shares for the shareholders of ABC Ltd and a gain for shareholders of XYZ Ltd.

31. Swap ratio and merger gain (May 2020 MTP):

X Ltd. is studying the possible acquisition of Y Ltd. by way of merger. The following data are available in respect of both the companies.

Particulars	X Limited	Y Limited
Market capitalization (Rs.)	75,00,000	90,00,000
Gross Profit Ratio	20%	20%
Inventory Turnover Ratio	5 Times	4 Times
Debtors Turnover Ratio	3 Times	5 Times
12% Debentures	10,00,000	-
10% Debentures	-	14,40,000
No of equity shares	1,00,000	60,000
Operating expenses	86%	78%
Corporate Tax rate	30%	30%
Closing stock	15,00,000	5,00,000
Debtors	10,00,000	8,00,000

You are required to calculate:

- Swap ratio based on EPS & MPS respectively as weightage of 40% and 60%.
- Post Merger EPS
- Post Merger market price assuming same PE Ratio of X Ltd.
- Post Merger gain or loss in EPS.

Answer:**WN 1: Computation of sales of X Limited and Y Limited:****Note 1: Computation of COGS:**

Particulars	X Limited	Y Limited
Closing stock	15,00,000	5,00,000

Inventory Turnover Ratio	5	4
COGS (Stock x Inventory Turnover Ratio)	75,00,000	20,00,000

Note 2: Computation of Sales:

Particulars	X Limited	Y Limited
COGS	75,00,000	20,00,000
GP Ratio	20%	20%
COGS Ratio	80%	80%
Sales (COGS/80%)	93,75,000	25,00,000

Note: Sales could have been calculated using Debtors Turnover Ratio and the same would lead to different answer. ICAI has used above approach and accordingly the data on sales and debtors is of no relevance to the question.

WN 2: Income statement:

Particulars	X Limited	Y Limited
Sales	93,75,000	25,00,000
Less: Operating expenses (sales x Operating expenses ratio)	80,62,500	19,50,000
EBIT	13,12,500	5,50,000
Less: Interest	1,20,000	1,44,000
EBT	11,92,500	4,06,000
Less: Tax @ 30%	3,57,750	1,21,800
EAT	8,34,750	2,84,200

WN 3: Basic data:

Particulars	X Limited	Y Limited	Merged
EAT	8,34,750	2,84,200	11,18,950
No of shares	1,00,000	60,000	1,85,624
EPS	8.35	4.74	6.03
PE Multiple	8.98	31.65	8.98
MPS	75	150	54.15
No of shares	1,00,000	60,000	Not reqd
Market capitalization	75,00,000	90,00,000	Not reqd

Note 1: Computation of shares to be issued:

Parameter	Base values	Exchange ratio	Shares to be issued	Weight	Product
EPS	8.35:4.74	4.74:8.35	34,060 (60,000 x (4.74/8.35))	0.40	13,624
MPS	75:150	150:75	1,20,000 (60,000 x (150/75))	0.60	72,000
Shares to be issued					85,624

Solution:

- Swap ratio = 85,624 shares for 60,000 shares = 1.427:1
- Post-merger EPS = 6.03
- Post-merger MPS = 54.15

Post-merger gain or loss in EPS:

Particulars	ABC Limited	XYZ Limited
Old EPS	8.35	4.74
New EPS	6.03	8.60 $6.03 \times \left(\frac{1.427}{1}\right)$
Gain/loss in EPS	(2.32)	3.86

32. Exchange ratio (May 2015 RTP)

Hanky Limited and Shanky Limited operate in the same field, manufacturing newly born babies clothes. Although Shanky Limited also has interests in communication equipments, Hanky Limited is planning to take over Shanky Limited and the shareholders of Shanky Limited do not regard it as a hostile bid.

The following information is available about the two companies:

Particulars	Hanky Limited	Shanky Limited
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 Limited plans to adopt a policy of retaining 35% of earnings after the takeover and expects to achieve a 17% return on investment. Savings due to economies of scale are expected to be Rs.85,00,000 per annum. Required return to equity shareholders will fall to 20% due to portfolio effects.

Required:

- Calculate the existing share prices of Hanky Limited and Shanky Limited
- Find the value of Hanky Limited after the takeover
- Advise Hanky Limited on the maximum amount it should pay for Shanky Limited

Answer:

WN 1: Computation of existing share prices:

Particulars	Hanky Limited	Shanky Limited
PAT	6,50,00,000	2,40,00,000
Number of shares	50,00,000	15,00,000
EPS	13.00	16.00
Growth rate:		
Retention ratio	20%	80%
Return on new investment	15%	15%
Growth rate	3%	12%
DPS of next year:		
DPS (EPS x payout ratio)	10.40	3.20
DPS of next year (DPS + Growth)	10.712	3.584
Cost of equity	21%	24%
Existing price	59.51	29.87
	10.712	3.584
	21% - 3%	24% - 12%

WN 2: Value of Hanky Limited after takeover:

Note 1: Next year earnings of merged entity:

Particulars	Amount
PAT of Hanky Limited	6,50,00,000
PAT of next year (6,50,00,000 x 1.03)	6,69,50,000
PAT of Shanky Limited	2,40,00,000
PAT of next year (2,40,00,000 x 1.12)	2,68,80,000
Cost savings	85,00,000
Next year earnings of merged entity [6,69,50,000 + 2,68,80,000 + 85,00,000]	10,23,30,000

- The company has already made invested in new projects and hence the next year PAT of individual entity has been computed based on individual growth rate and cost savings

Note 2: Valuation post-merger:

Particulars	Amount
PAT	10,23,30,000
Payout ratio	65%
Total Dividend	6,65,14,500
Growth rate:	

Retention ratio	35%
Return on new investment	17%
Growth rate	5.95%
Post-merger value 6,65,14,500 20% – 5.95%	Rs.47,34,12,811

WN 3: Computation of maximum consideration:

Particulars	Amount
Post-merger value	47,34,12,811
Pre-merger value (59.51 x 50,00,000)	29,75,50,000
Maximum consideration	17,58,62,811