(VII) BETA MANAGEMENT

Question – 27

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Value
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 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio.

You can make use of the following information:

(1) The current NIFTY value is 8500.

(2) NIFTY futures can be traded in units of 25 only.

(3) Futures for May are currently quoted at 8700 and Futures for June are being quoted at 8850.

You are required to calculate:

(i) The beta of his portfolio.

(ii) The theoretical value of the futures contract for contracts expiring in May and June. Given ($e^{0.03}$ =1.03045, $e^{0.04}$ = 1.04081, $e^{0.05}$ =1.05127)

(iii) The number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:

(A) His total portfolio

(B) 50% of his portfolio

(C) 120% of his portfolio

(SM TYK – 13)

Solution:

(i) Calculation of Beta of Portfolio

Stocks	Market Price	No. of Shares	Value	Weight	Beta	W × B
A	29.40	400	11,760	0.01182	0.59	0.0070
B	318.70	800	2,54,960	0.2564	1.32	0.3384
C	660.20	150	99,030	0.0996	0.87	0.0866
D	5.20	300	1,560	0.00157	0.35	0.0005
E	281.90	400	1,12,760	0.1134	1.16	0.1315
F	275.40	750	2,06,550	0.2077	1.24	0.2575
G	514.60	300	1,54,380	0.15524	1.05	0.1630
H	170.50	900	1,53,450	0.1543	0.76	0.1173
			9,94,450		B.P = 1.102	

(ii) Calculation of theoretical future price

May future (2 months)

$F = Se^{rt}$

$= 8,500 \times e^{0.20 \times 2/12}$

$= 8,500 \times e^{0.0333}$

$= 8,500 \times 1.03387$

$= 8,787.89$

Interpolation

$e^{0.03}$ ---------- 1.03045

$e^{0.0333}$

$e^{0.04}$ ---------- 1.04081

$e^{0.01}$	0.01036

$$1.03045 + \frac{0.01036}{0.01} \times 0.0033$$

$= 1.03387$

June Future

$F = 8,500 \times e^{(0.20 \times 3/12)}$

$= 8,500 \times 1.05127$

$= ₹ 8,935.79$

(iii) Calculation of no. of contacts

$$\text{No. of Contract} = \frac{V_P \times (B_T - B_P)}{F \times M}$$

(A) Total portfolio

$$\text{No of contracts} = \frac{9,94,450 \times (0 - 1.102)}{8,850 \times 25}$$

$= 4.95$ Contracts

5 contracts sold

(B) 50% of Portfolio

$$\text{No of contracts} = \frac{9,94,450 \times 50\% \times (0 - 1.102)}{8850 \times 25}$$

$= 2.48$ Contracts

2 contracts sold

(C) 120% of Portfolio

$$\text{No of contracts} = \frac{(9,94,450 \times 120\%) \times (0 - 1.102)}{8850 \times 25}$$

$= 5.94$ Contracts

6 contracts sold.

Question – 28

Details about portfolio of shares of an investor is as below:

Shares	No. of shares (Iakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	₹ 750	1.20

C Ltd.	2.00	₹ 250	1.60

The 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:

(i) Dispose off a part of his existing portfolio to acquire risk free securities, or

(ii) Take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹ 200.

You are required to determine:

(1) Portfolio beta,

(2) The value of risk free securities to be acquired,

(3) The number of shares of each company to be disposed off,

(4) The number of Nifty contracts to be bought/sold; and

(5) The value of portfolio beta for 2% rise in Nifty.

(SM TYK – 12)

Solution:

1. Beta of Portfolio

Shares	MPS	No.	Amount	Weights	Beta	β × W
A	3.00	500	1,500	0.3	1.40	0.42
B	4.00	750	3,000	0.6	1.20	0.72
C	2.00	250	500	0.1	1.60	0.16
		Vp =	5,000		Bp =	1.30

2. Value of Risk Free Securities

$$0.91 = \frac{(5{,}000 \times 1.30) - (x \times 1.30) + (x \times 0)}{5{,}000}$$

$$x = 1{,}500$$

ICAI

$$Wp = \frac{B_T}{B_P} = \frac{0.91}{1.30} = 0.70$$

Rf = 5,000 × 0.3 = 1,500

Investment in Rf = ₹ 1,500

3. No. of Shares

Shares	Weights	Amount (Lakh)	MPS	No. of Shares in (Lakh)
A	0.3	450	500	0.9
B	0.6	900	750	1.20
C	0.1	150	250	0.6
		1,500		

4. No. of Nifty Contracts

$$No. = \frac{V_P \times (B_T - B_P)}{F \times M}$$

$$= \frac{5{,}000 \times (0.91 - 1.30)}{8{,}125 \times 200}$$

= 120 Contracts Short

5. Value of Portfolio Beta

Portfolio (Bp = 1.30)
₹ 5,000 Lakhs

↓

Portfolio will rise by (2 × 1.30)
= 2.6%

↓

Gain on Long Position
(5,000 × 2.6%) = +130

Nifty 5,000(0.91 – 1.30)
1,950 Lakhs Short Position

↓

Nifty rise by 2%

↓

Loss on Short Position of Nifty
1,950 × 2% = -39

Overall Gain OR Loss = +91 Lakhs

% of Gain/Loss $= \frac{91}{5{,}000} \times 100 = 1.82\%$

Beta $= \frac{\Delta \text{ In Portfolio Return}}{\Delta \text{ In Market Rate}} = \frac{1.82}{2} = 0.91$

Question – 29

On January 1, 2013 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	Beta
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:

(i) The beta of his portfolio.

(ii) The theoretical value of the NIFTY futures for February 2013.

(iii) The number of contracts of NIFTY the investor needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures have a minimum trade lot requirement of 200 units. Assume that the futures are trading at their fair value.

(iv) The number of future contracts the investor should trade if he desires to reduce the beta of his portfolios to 0.6.

No. of days in a year be treated as 365.

Given: In (1.105) = 0.0998 and $e^{(0.015858)} = 1.01598$

(SM TYK – 11)

Solution:

1. Beta of Portfolio

Shares	MPS	No.	Amount	Weights	Beta	β × W
A	349.30	5,000	17,46,500	0.093	1.15	0.107
B	480.50	7,000	33,63,500	0.178	0.40	0.071
C	593.52	8,000	47,48,160	0.252	0.90	0.227
D	734.70	10,000	73,47,000	0.380	0.95	0.370
E	824.85	2,000	16,49,700	0.087	0.85	0.074
		Vp =	1,88,54,860		Bp =	0.849

2. Theoretical Future

$F = S \times e^{rt}$

$= 5,900 \times e^{0.105 \times 58/365}$

$= 5,900 \times e^{0.01668}$

$= 5,900 \times 1.01682$

$= 5,999.24$

3. No. of Contracts ($B_T = 0$)

$$No. = \frac{V_P \times (B_T - B_P)}{F \times M}$$

$$= \frac{1,88,54,860 \times (0 - 0.849)}{5,999.24 \times 200}$$

= 13.35 OR 13 Contracts Short

4. $B_T = 0.6$

$$No. = \frac{1,88,54,860 \times (0.6 - 0.849)}{5,999.24 \times 200}$$

= 3.91 OR 4 Contracts Short

Question – 30

Following information is available for consideration:

BSE Index 25,000

Value of portfolio	₹ 50,50,000
Risk free interest rate	9% p.a.
Dividend yield on Index	6% p.a.
Beta of portfolio	1.5

We assume that a future contract on the BSE index with 4 months maturity is used to hedge the value of portfolio over next 3 months. One future contract is for delivery of 50 times the index.

Based on the above information calculate:

(i) Price of future contract.

(ii) Gain on short futures position if index turns out to be 22,500 in 3 months.

Note: Daily compounding (exponential) formula is not required to be used.

(RTP May – 2022, Exam July – 2021)

Solution:

(i) Price of Future Contracts

$F = S[1 + (r - d)t]$

$= 25,000[1 + (0.09 - 0.06)4/12]$

$= ₹ 25,250$

Price of 1 Future Contract $= ₹ 25,250 \times 50$

$= ₹ 12,62,500$

No. of Contracts $= \frac{V_p(B_T - B_p)}{F \times M}$

$= \frac{50,50,000 \times (0 - 1.5)}{25,250 \times 50}$

= 6 Contracts Short

(ii) Gain or Loss on Short Position

3 months spot = 22,500

[हमने Contract 4 month future पर किया है तो, 3 month के End पर काटना है Spot पर नहीं कटेगा, ये Contract 1 month future पर सौदा कटेगा]

$$F = 22,500\left[1 + (0.09 - 0.06)\frac{1}{12}\right]$$

$$= 22,556.25$$

Gain on Short Position = (25,250 – 22,556.25) × 50 × 6

= ₹ 8,08,125

Question – 31

A Future contract on BSE Index with 4 months maturity is used to hedge the value of the portfolio over the next 3 months. One future contract for delivery is 50 times of the index.

The following information is available :

Value of the portfolio	₹ 1,16,00,000
BSE Sensex on 1st January 2022	58,580
(Anticipated on 1st September 2021)	
BSE Sensex on 1st January 2022	56641.25
(Anticipated on 1st December 2021)	
Dividend Yield of Index	6% p.a
181 day's treasury bills offers a rate of interest	9% p.a.
Beta of the portfolio	1.5

You are required to calculate

(i) The present value of the Sensex as on 1st September 2021

(ii) Turned out value of the Sensex on 1st December 2021

(iii) The number of contracts to hedge the portfolio.

(Exam December – 2021)

Solution:

(I) Spot (01/09/2021)

$F = S[1 + (r - d)t]$

₹ 58,580 $= S[1 + (0.09 - 0.06)4/12]$

$S = ₹ 58,000$

(II) Spot Rate (01/12/2021)

$56641.25 = S[1 + (0.09 - 0.06) \times 1/12]$

$S = ₹ 56,500$

(III) No. of Contracts

$$\text{No. of Contracts} = \frac{V_P(B_T - B_P)}{F \times M}$$

$$= \frac{1,16,00,000\ (0 - 1.50)}{58,580 \times 50}$$

= 6 Contracts Short

Question – 32

Mr. X is having a portfolio of shares worth ₹ 170 lakhs at current price and cash ₹ 30 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

(i) Current portfolio beta.

(ii) Portfolio beta after 3 months if Mr. X on current date goes for long position on ₹ 200 lakhs Nifty futures.

(Exam July – 2021)

Solution:

(I) Beta of Portfolio