6 PORTFOLIO MANAGEMENT

Question 1

CMT Pension Fund has a portfolio of shares of diversified companies valued at ₹ 800 crore enters into a swap arrangement with Boom Bank on the terms that it will get 1.15% quarterly on notional principal of ₹ 800 crore in exchange of return on portfolio which is exactly tracking the Sensex which is presently 43,200. You are required to determine the net payment to be received/paid if Sensex turns out to be 43,720, 43,560, 44,160 and 43,920 at the end of each quarter.

(MTP 6 Marks Oct 21)

Note: Make calculations in Crore and round off calculations upto 4 decimal points.

Answer:

Qtrs. (1)	Sensex (2)	Sensex Return (%) (3)	Amount Payable (₹ Crore) (4)	Fixed Return (Receivable) (₹ Crore) (5)	Net (₹ Crore) (5) – (4)
0	43,200	-	-	-	-
1	43,720	1.2037	9.6296	9.2000	−0.4296
2	43,560	−0.3660	−2.9280	9.2000	12.1280
3	44,160	1.3774	11.0192	9.2000	−1.8192
4	43,920	−0.5435	−4.3480	9.2000	13.5480

Question 2

Suppose one of your HNI clients is holding the following portfolio as per his risk appetite:

Particulars	Securities
Equity Shares:	
G Ltd.	1000
S Ltd.	1000
B Ltd.	500
PSU Bonds	20,000

The other data related to each of these securities is as follows:

Cost ₹	Dividends / Interest ₹	Market price ₹	Beta
10,000	1,725	9,800	0.6
15,000	1,000	16,200	0.8
28,000	1400	28,300	0.6
1,800	180	1,725	0.10

Your client is interested in investing some more funds in Bonds issued by GOI.

(1) Estimate the minimum rate of return that your client would expect from these Bonds keeping in view his risk appetite and assuming Market Return as 15.70%.

(2) Analyze whether this portfolio has out-performed the market or not assuming Risk Free Rate of Return as 7%.

(MTP 8 Marks Nov 21)

Answer:

(1) Working Notes:

Calculation of Return on each single security

	Cost ₹ (1)	No. of Securities (2)	Total Cost (3) = (1) × (2)	Dividend / Interest	Capital Gain	Total (4)	Total Income (5) = (2) × (4)	Beta (6)	(6) × (3)
G. Ltd.	10,000	1000	1,00,00,000	1,725	200	1,525	15,25,000	0.6	60,00,000
S. Ltd.	15,000	1000	1,50,00,000	1,000	1,200	2,200	22,00,000	0.8	1,20,00,000
B. Ltd.	28,000	500	1,40,00,000	1,400	300	1,700	8,50,000	0.6	84,00,000
PSU Bonds	1,800	20,000	3,60,00,000	180	75	105	21,00,000	0.10	36,00,000
Total			7,50,00,000				66,75,000		3,00,00,000

Rate of return on earned on the portfolio

$$= \frac{\text{Dividend Earned + Capital Appriaciation}}{\text{Initial Investment}} \times 100$$

$$= \frac{₹\ 66,75,000}{₹\ 7,50,00,000} \times 100 = 8.90\%$$

Weighted Average Beta of the Portfolio

$$= \frac{3,00,00,000}{7,50,00,000} = 0.40$$

Expected Risk Free Rate of Return using CAPM 8.90% = Rf + 0.40 [12.7% - Rf]

8.90% = Rf + 5.08 - 0.40 Rf

3.82% = 0.60 Rf

Rf = 6.37%

Thus keeping in view the present risk appetite, the client would expect at least a return of 6.37% on Bonds.

(2) The expected return on the Portfolio using CAPM:

= 7% + 0.40 [12.7 - 7%]

= 9.28%

Since the actual return is 8.90% which is quite lower than expected return considering the systematic risk borne by the investor and hence portfolio has not outperformed the market rather has underperformed.

Question 3

Shiva has a fund of ₹ 5 lacs which he wants to invest in share market with rebalancing target after every 15 days to start with for a period of one month from now. The present NIFTY is 17025. The minimum NIFTY within a month can at most be 15322.50. He wants to know as to how he should rebalance his portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

(1) Immediately to start with.

(2) 15 days later-being the 1st day of rebalancing if NIFTY falls to 16321.89.

(3) 15 days further from the above date if the NIFTY touches 17512.14.

Note: Assume that the value of his equity component will change in tandem with that of the NIFTY.

(MTP 8 Marks April'23, RTP Nov'23)

Answer:

Maximum decline in one month = $\frac{17025 - 15322.50}{17025} \times 100 = 10\%$

(1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value - Floor value)

= 2 (5,00,000 - 4,50,000) = ₹ 1,00,000

Shiva may invest ₹ 1,00,000 in equity and balance in risk free securities.

(2) After 15 days

Value of equity = 1,00,000 x 16321.89 / 17025	=	₹ 95,870
Value of risk free investment	=	₹ 4,00,000
Total value of portfolio	=	₹ 4,95,870

Investment in equity = Multiplier x (Portfolio value - Floor value)

= 2 (4,95,870 - 4,50,000) = ₹ 91,740

Revised Portfolio:

Equity = ₹ 91,740

Risk free Securities = ₹ 4,95,870 - ₹ 91,740 = ₹ 4,04,130

(3) After another 15 days

Value of equity = 91,740 x 17512.14 / 16321.89 = ₹ 98,430

Value of risk free investment = ₹ 4,04,130

Total value of portfolio = ₹ 5,02,560

Investment in equity = Multiplier x (Portfolio value - Floor value)

= 2 (5,02,560 - 4,50,000) = ₹ 1,05,120

Revised Portfolio:

Equity = ₹ 1,05,120

Risk Free Securities = ₹ 5,02,560 - ₹ 1,05,120 = ₹ 3,97,440

The investor should off-load ₹ 6,690 of risk free securities and divert to Equity.

Question 4

On the basis of given information, Mr. XLY want to create a portfolio equally as risky as the market and is having ₹ 20,00,000 to invest.

Assets	Investment	Beta
Stock A	₹ 4,00,000	0.70
Stock B	₹ 5,00,000	1.10
Stock C	?	1.60
Debenture (D)	?	0

How do you recommend and interpret the risk scenario and investment in all the securities?

(MTP 6 Marks April' 23)

Answer:

Let W_A, W_B, W_C and W_D be the weights of Stock A, B, C and Debenture respectively.

W_A = 4,00,000 ÷ 20,00,000 = 0.20

W_B = 5,00,000 ÷ 20,00,000 = 0.25 Now = $W_C + W_D = 1 - W_A - W_B$ = 0.55

It is given in the question that Portfolio should be as risky as that of the market. It means Beta of the portfolio should be 1.

Hence,

W_A (0.7) + W_B (1.1) + W_C (1.6) + W_D (0) = 1

$0.2 \times 0.7 + 0.25 \times 1.1 + 1.6W_C + W_D \times 0 = 1$

$0.14 + 0.275 + 1.6WC + 0 = 1$

$1.6\ W_C = 1 - 0.415$

$1.6\ W_C = 0.585$

$W_C = \frac{0.585}{1.6} = 0.3656$

Weight of Debenture (W_D) = 1 − 0.2 − 0.25 − 0.3656

= 0.1844

Hence, Amount invested in Stock C

= 0.3656 × 20,00,000

= ₹ 7,31,200

Amount invested in Debenture (D)

= 0.1844 × 20,00,000

= ₹ 3,68,800

Thus, amount to be invested in stock (C) is ₹ 7,31,200 and in Debenture is ₹ 3,68,800.

Question 5

Indira has a fund of ₹ 3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. She has 3 close friends who have advised following different strategies:

(i) Buy and Hold strategy

(ii) Constant Ratio

(iii) CPPI

Suppose she immediately starts with investment in Bonds (non-fluctuating) and Equity and decides to rebalance her portfolio after each 10 days and to invest in Nifty as equity component changes in tandem with that of Nifty. Further, Bond has no Beta.

As on date (i.e. beginning of month) Nifty is 5326 and minimum Nifty within a month can be most be 4793.40. If she chooses CPPI she will use "2" as the multiplier. If she chooses Constant Ratio plan she will maintain the ratio of 60:40 in Equity and Bonds respectively. Further, portfolio will be rebalanced each time Nifty is changed by 5% as compared to the previous Nifty.

You are required to evaluate Portfolio Position of Indira under each of the Strategies suggested by her friends and highlight the course of action to be taken if in the coming month after a gap of 10 days Nifty happened:

(1) 10 days later-being the 1st day of rebalancing if NIFTY fails to 5122.96.

(2) 10 days further from the above date if the NIFTY touches 5539.04.

(MTP 10 Marks Oct'23)

Answer:

(i) Under Buy and Hold Strategy

(1) Maximum decline in one month = $\frac{5326 - 4793.40}{5326} \times 100 = 10\%$

Floor Value = 3,00,000 × (1 − 0.10) = ₹ 2,70.000

Under this strategy investor invests an amount equal to floor value in non-fluctuating assets (Bonds). Thus, Indira will invest ₹ 2,70,000 in Bonds and the remaining ₹ 30,000 in equity.

(2) After 10 days

Value of equity = 30,000 × 5122.96/5326	=	₹ 28,856
Value of Bonds	=	₹ 2,70,000
Total value of portfolio	=	₹ 2.98.856

(3) After another 10 days

Value of equity = 28,856 × 5539.04/5122.96	=	₹ 31.200
Value of Bonds	=	₹ 2,70,000
Total value of portfolio	=	₹ 3,01,200

(ii) Under CPPI

(1) Immediately to start with

Investment in equity = Multiplier x (Portfolio value - Floor value)

= 2 (3,00,000 - 2,70,000) = ₹ 60,000

Indira may invest ₹ 60,000 in equity and balance in bonds

(2) After 10 days

Value of equity = 60,000 x 5122.96 / 5326	=	₹ 57,713
Value of bonds	=	₹ 2,40,000
Total value of portfolio	=	₹ 2,97,713
Change in Investment (%) = $\frac{(60,000-57,713)}{60,000}$	=	3.81%

As the change in investment is less than 5%, Indira will not rebalance the portfolio.

(3) After another 10 days

Value of equity = 57,713 x 5539.04/5122.96 = ₹ 62,400

Value of bonds = ₹ 2,40,000

Total value of portfolio = ₹ 3,02,000

Change in Investment (%) = $\frac{(62,400-57,713)}{57,713}$ = 8.12%

As the change in investment is more than 5%, Indira will rebalance the portfolio.

Investment in equity = Multiplier x (Portfolio value – Floor value)

= 2 (3,02,400 – 2,70,000) = ₹ 64,800

Revised Portfolio:

Equity = ₹ 64,800

Bonds = ₹ 3,02,400 – ₹ 64,800 = ₹ 2,37,600

The investor should off-load ₹ 2,400 of bonds and divert to Equity.

(iii) Under Constant Ratio Strategy

(1) The ratio to be maintained is given as 60:40. Thus, Indira will invest ₹ 1,80,000 in equity and ₹ 1,20,000 in bonds.

(2) After 10 days

Value of equity = 1,80,000 x 5122.96/5326 = ₹ 1,73,138

Value of Bonds = ₹ 1,20,000

Total value of portfolio = ₹ 2,93,138

Change in Investment (%) = $\frac{(1,80,000-1,73,138)}{1,80,000}$ = 3.81%

As the change in investment is less than 5%, Indira will not rebalance the portfolio.

(3) After another 10 days

Value of equity = 1,73,138 × 5539.04/5122.96 = ₹ 1,87,200

Value of Bonds = ₹ 1,20,000

Total value of portfolio = ₹ 3,07,200

Change in Investment (%) = $\frac{(1,87,200-1,73,138)}{1,73,138}$ = 8.12%

As the change in investment is more than 5%, Indira will rebalance the portfolio.

Revised Portfolio:

Equity = $\frac{60}{60+40}$ x 3,07,200 = ₹ 1,84,320

Bonds = ₹ 3,07,200 - ₹ 1,84,320 = ₹ 1,22,880

The investor should off-load ₹ 2,880 of Equity and divert to Bonds.

Question 6

Mr. A is having 1 lakh shares of K Ltd. The beta of the company is 1.40. Mr. B a financial advisor has suggested having the following portfolio:

Security	Beta	% holding
L	1.20	10
M	0.75	10
N	0.40	30
O	1.40	50
		100

Market Return is 12% Risk free rate is 8% You. Are required to calculate the following for the present investment and suggested portfolio:

(i) What is the expected return based on CAPM and also

(1) If the market goes up by 2.5%.

(2) If the market goes down by 2.5%.

(3) If the market is giving a negative return of 2.5%

(ii) if the probability of market giving negative return is more, please advise Mr. A whether to continue the holdings of M/s. K Ltd. or to buy the portfolio as per the suggestion of Mr. B. If so, why?

(RTP May 22, MTP 8 Marks Oct'22)

Answer:

Working Notes-

Calculation of Portfolio Beta suggested by Mr. B

Security	Beta	Wt. of Holding	Beta x Wt. of Holding
L	1.20	0.1	0.120
M	0.75	0.1	0.075
N	0.40	0.3	0.120
O	1.40	0.5	0.700
Total		1.0	1.015

Portfolio Beta is 1.015.

Calculation of Expected Return based on CAPM at present situation-

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = Rm–Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d – b	f = c × e	g = b + f
K Ltd.	8	1.400	12	4	5.600	13.60
Portfolio	8	1.015	12	4	4.060	12.06

(i) (1) Calculation of Expected Return based on CAPM if market goes up by 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = Rm – Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d – b	f = c × e	g = b + f
K Ltd.	8	1.400	14.5	6.5	9.100	17.10
Portfolio	8	1.015	14.5	6.5	6.598	14.60

(2) Calculation of Expected Return based on CAPM if market goes down by 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = Rm–Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d – b	f = c × e	g = b + f
K Ltd.	8	1.400	9.5	1.5	2.100	10.10
Portfolio	8	1.015	9.5	1.5	1.523	9.52

(3) Calculation of Expected Return based on CAPM if market gives negative returns of 2.5%:

Particulars	Risk Free Rate (Rf)	Beta	Market Return	Risk Premium = Rm– Rf	Beta X Risk Premium	Expected Return
a	b	c	d	e = d – b	f = c × e	g = b + f
K Ltd.	8	1.400	–2.5	–10.5	–14,700	– 6.70
Portfolio	8	1.015	–2.5	–10.5	-10.658	–2.66

(ii) if the probability of market giving negative return is more, it is advisable to Mr. A to buy the portfolio suggested by Mr. B because Beta of the portfolio is less than of K Ltd.

Question 7

Mayuri is interested to construct a Portfolio of Securities X and Y. She has collected the following information:

	X	Y
Expected Return (ER)	19%	23%
Risk (σ)	14%	18%

Mayuri has 5 Portfolio options of X and Y as follows:

(i) 50% of funds in each X and Y

(ii) 75% of funds in X and 25% in Y

(iii) 25% of funds in X and 75% in Y

(iv) 60% of funds in X and 40% in Y

(v) 35% of funds in X and 65% in Y

Suppose if Co-efficient of correlation (r) between X and Y is 0.16, you are required to calculate:

(i) Expected Return under different Portfolio Options.

(ii) Risk Factor associated with these Portfolio Options.

(iii) Which Portfolio is best from the point of view of Risk?

(iv) Which Portfolio is best from the point of view of Return?

(RTP May'22, MTP 10 Marks Oct'21)

Answer:

We have $E_p = W_1E_1 + W_3E_3 + \ldots\ldots\ldots\ldots W_nE_n$

And for standard deviation $\sigma^2_p = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij}$

$\sigma^2_p = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j$

Two asset portfolio

$\sigma^2_p = w^2_1 \sigma^2_1 + w^2_2 \sigma^2_2 + 2 w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$

Or

$\sigma_p = \sqrt{W_1 \sigma_1 + W_2 \sigma_2 + 2 w_1 w_2 \sigma_1 \sigma_2 \rho_{12}}$

Substituting the respective values we get,

(1) 50% of funds in each of X and Y

$E_p = 0.50 \times 19\% + 0.50 \times 23\% = 21\%$

$\sigma^2_p = (0.50)^2 (14\%)^2 + (0.50)2(18\%)^2 + 2(0.50)(0.50)(0.16)(14\%)(18\%)$

$\sigma^2_p = 49 + 81 + 20.16 = 150.16$

$\sigma_p = 12.25\%$

75% in X and 25% in Y

Ep = 0.75 X 19% + 0.25 X 23% = 20%

$\sigma^2_p = (0.75)^2 (14\%)^2 + (0.25)^2 (18\%)^2 + 2(0.75)(0.25)(0.16)(14\%)(18\%)$

$\sigma^2_p = 110.25 + 20.25 + 15.12 = 145.62$

$\sigma_p = 12.07\%$

25% in X and 75% in Y

Ep = 0.25 X 19% + 0.75 X 23% = 22%

$\sigma^2_p = (0.25)^2 (14\%)^2 + (0.75)^2 (18\%)^2 + 2(0.25)(0.75)(0.16)(14\%)(18\%)$

$\sigma^2_p = 12.25 + 182.25 + 15.12 = 209.62$

$\sigma_p = 14.48\%$

60% in X and 40% in Y

Ep = 0.60 X 19% + 0.40 X 23% = 20.60%

$\sigma^2_p = (0.60)^2 (14\%)^2 + (0.40)^2 (18\%)^2 + 2(0.60)(0.40)(0.16)(14\%)(18\%)$

$\sigma^2_p = 70.56 + 51.84 + 19.35 = 141.75$

$\sigma_p = 11.91\%$

35% in X and 65% in Y

Ep = 0.35 X 19% + 0.65 X 23% = 21.60%

$\sigma^2_p = (0.35)^2(14\%)^2 + (0.65)2(18\%)^2 + 2(0.35)(0.65)(0.16)(14\%)(18\%)$

$\sigma^2_p = 24.01 + 136.89 + 18.35$

$= 179.25$

$\sigma_p = 13.39\%$

Portfolio	(i)	(ii)	(iii)	(iv)	(v)
Return	21.00	20.00	22.00	20.60	21.60
σ	12.25	12.07	14.48	11.91	13.39

In the terms of return, we see that portfolio (iii) is the best portfolio. In terms of risk we see that portfolio (iv) is the best portfolio.

Question 8

Ramesh has identified stocks of two companies A and B having good investment potential:

Following data is available for these stocks:

Year	A (Market Price per Share in ₹	B (Market Price per Share in ₹
2013	19.60	8.70
2014	18.75	12.80
2015	33.42	16.20
2016	42.64	18.25
2017	43.25	15.60
2018	44.60	13.25
2019	34.75	18.60

You are required to calculate:

(i) The Risk and Return by investing in Stock A and B

(ii) The Risk and Return by investing in a portfolio of these Stocks if he invests in Stock A and B in proportion of 6:4.

(iii) The better opportunity for investment

(RTP May 23, PYP 10 Marks Jan'21)

Answer:

	A				B				
Year	Market price per shre in ₹	Return (%)	Return – A	Squared	Market price per shre in ₹	Return (%)	Return – B	Squared	(Return – A) (Return – B)
2013	19.60				8.70				
2014	18.75	-4.34	-18.33	335.9889	12.80	47.13	30.94	957.2836	-567.1302
2015	33.42	78.24	64.25	4128.0625	16.20	26.56	10.37	107.5369	666.2725
2016	42.64	27.59	13.60	184.9600	18.25	12.65	-3.54	12.5316	-48.1440
2017	43.25	1.43	-12.56	157.7536	15.60	-14.52	-30.71	943.1041	385.7176
2018	44.60	3.12	-10.87	118.1569	13.25	-15.06	-31.25	976.5625	339.6875
2019	34.75	-22.09	-36.08	1301.7664	18.60	40.38	24.19	585.1561	-872.7752
		83.95		6226.6883	Mean (B)	97.14		3582.1748 8	
Mean (A)		13.99	Varience 1037.7814			16.19	Varience	597.0291	Cov. = - 16.0620

(i) Return A = 13.99% and Risk (SD) = $\sqrt{1037.7814}$ = 32.2146 and Return B = 16.19% and Risk (SD) = $\sqrt{597.0291}$ = 24.4342

(ii) Return of Portfolio = 0.60 x 13.99% +0.40 x 16.19% = 14.87%

Risk (Standard Deviation) of Portfolio = [0.602 × 1037.7814 + 0.402 x 597.0291 + 2 x 0.60 x 0.40 x (-16.0620)]½

= [373.6013 + 95.5247 - 7.7098)½ = 21.4806

(iii) On the basis of Return 'B' is preferable and on the basis of Risk Portfolio Investment' is preferable over the individual stocks.

Question 9

Following are the details of a portfolio consisting of 3 shares:

Shares	Portfolio Weight	Beta	Expected Return (%)	Total Variance
X Ltd.	0.3	0.50	15	0.020
Y Ltd.	0.5	0.60	16	0.010
Z Ltd.	0.2	1.20	20	0.120

Standard Deviation of Market Portfolio Return = 12%

You are required to calculate the following:

(i) The Portfolio Beta.

(ii) Residual Variance of each of the three shares.

(iii) Portfolio Variance using Sharpe Index Model.

(PYP 8 Marks May'19)

Answer:

(i) **Portfolio Beta**

0.30 x 0.50 + 0.50 x 0.60 + 0.20 x 1.20

= 0.15 + 0.3 + 0.24 = 0.69

(ii) **Residual Variance**

To determine Residual Variance first of all we shall compute the Systematic Risk as follows:

$\beta_X^2 \times \sigma_M^2$ = $(0.5)^2(0.12)^2$ = 0.0036

$\beta_Y^2 \times \sigma_M^2$ = $(0.6)^2(0.12)^2$ = 0.0052

$\beta_Z^2 \times \sigma_M^2$ = $(1.20)^2(0.12)^2$ = 0.0207

Residual Variance = Total Variance - Systematic Risk

X	0.020 - 0.0036	= 0.0164
Y	0.010 - 0.0052	= 0.0048
Z	0.120 - 0.0207	= 0.0993

(iii) **Portfolio Variance** = Systematic Risk of the Portfolio + Unsystematic Risk of the Portfolio Systematic Variance of Portfolio

= $(0.12)^2 \times (0.69)^2 = 0.006856$

Unsystematic Variance of Portfolio a $0.0164 \times (0.30)^2 + 0.0048 \times (0.50)^2 + 0.0993 \times (0.20)^2 = 0.006648$

Total Variance = 0.006856 + 0.006648 = 0.013504

EXAMINERS' COMMENTS ON THE PERFORMANCE OF EXAMINEES;

Overall performance of the examinees was good. Although Portfolio Beta and Residual Variance was calculated correctly by most of the examinees, Portfolio Variance using Sharpe Index Model was calculated correctly only by a few examinees.

Question 10

Mr. X holds the following portfolio:

Securities	Cost (₹)	Dividends (₹)	Market Price (₹)	Beta
Equity shares:				
A Ltd.	16,000	1,600	16,400	0.9
B Ltd.	20,000	1,600	21,000	0.8
C Ltd.	32,000	1,600	44,000	0.6
PSU Bonds	68,000	6,800	64,600	0.4

The risk-free rate of return is 12%. Calculate the following:

1. The expected rate of return on his portfolio using Capital Asset Pricing Model (CAPM).
2. The average return on his portfolio. (Calculate up to two decimal points)

(PYP 8 Marks Nov'19) (Same concept different figures Old & New SM)

Answer:

Calculation of expected return on market portfolio (R_m)

Securities	Cost (₹)	Dividends (₹)	Capital Gains (₹)
Shares A	16,000	1600	400
Shares B	20,000	1600	1000
Shares C	32,000	1600	12,000
PSU Bonds	68,000	6800	-3,400
	1,36,000	11,600	10,000

$$R_m = \frac{11,600 + 10,000}{1,36,000} \times 100 = 15.88\%$$

Calculation of expected rate of return on individual security: Security

Shares A	12 + 0.9(15.88 – 12.0) = 15.49%
Shares B	12 + 0.8(15.88 – 12.0) = 15.10%
Shares C	12 + 0.6(15.88 – 12.0) = 14.33%
PSU Bonds	12 + 0.4(15.88 – 12.0) = 13.55%

Calculation of the Average Return of the Portfolio:

$$= \frac{15.49 + 15.10 + 14.33 + 13.55}{4} = 14.62\%$$

EXAMINER'S COMMENTS ON THE PERFORMANCE OF EXAMINEES:

Overall above average performance was observed in this question as some examinees were not able to calculate expected rate of return on individual security though they calculated correctly average rate of return of the portfolio.

Question 11

Following are risk and return estimates for two stocks

Stock	Expected returns (%)	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:

(i) The standard deviation of expected returns on A and B.

(ii) 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? **(PYP 8 Marks Nov'19)**

Answer:

(i) Total Risk = Systematic Risk + Unsystematic Risk

Stock A

Systematic Risk $= \beta^2\sigma_m^2 = (0.8)^2 \times (25)^2 = 400$

Unsystematic Risk $= 35^2$

Total Risk = $\sigma = \sqrt{400 + (35)^2} = \sqrt{1625} = 40.31\%$

Stock B

Systematic Risk $= \beta^2\sigma_m^2 = (1.2)^2 \times (25)^2 = 900$

Unsystematic Risk $= 45^2$

Total Risk = $\sigma = \sqrt{900 + (45)^2} = \sqrt{2925} = 54.08\%$

(ii) **Expected return of the porfolio**

$(0.25 \times 14) + (0.40 \times 18) + (0.35 \times 6) = 12.8\%$

Total Risk = Systematic Risk + Unsystematic Risk

Systematic Risk $\beta P^2\sigma_m^2$

$\beta p = 0.25(0.8) + 0.4(1.2) + 0.35(0)$

$= 0.2 + 0.48 + 0 = 0.68$

Systematic Risk of Portfolio $= \sqrt{(0.68)^2 \times (25)^2} = \sqrt{289}$

Non-Systematic Risk of Portfolio $= (0.25)^2(35)^2 + (0.40)^2(45)^2 + 0$

$= 76.56 + 324 = \sqrt{400.56}$

Total Risk $= \sqrt{289 + 400.56} = 26.26$

EXAMINER'S COMMENTS ON THE PERFORMANCE OF EXAMINEES:

The overall performance of the examinees in this question was not satisfactory. Only few examinees could correctly attempt. Total Risk (Standard Deviation) based on Systematic Risk and Unsystematic Risk.

Question 12

Following is the information related to three mutual funds:

Year	MF-A	MF-B	MF-C
2020	10%	5%	14%
2021	8%	10%	10%
2022	12%	8%	18%

Correlation between market and Mutual fund:

	MF-A	MF-B	MF-C
Correlation with market	0.45	0.25	0.65

Variance of the market is 9% and rate of government bond is 7%. You are required to Rank the Mutual fund using Sharp's ratio and Treynor's ratio.

(PYP 8 Marks Nor 22)

Answer:

(i) Calculation of Standard Deviation of Funds:

Year	MF-A (%)	Dev.	Dev.2	MF-B (%)	Dev.	Dev.2	MF-C (%)	Dev.	Dev.2
2020	10	-	-	5	-2.67	7.13	14	-	1
2021	8	-2	4	10	2.33	5.43	10	-4	16
2022	12	2	4	8	0.33	0.11	18	4	16
	30		8	23		12.67	42		32
	Avg.		Var.	Avg		Var.	Avg.		Var.
	$= \frac{30}{3}$		$= \frac{8}{3}$	$= \frac{23}{3}$		$= \frac{12.67}{3}$	$= \frac{42}{3}$		$= \frac{32}{3}$
	= 10		= 2.67	= 7.67		= 4.22	= 14		= 10.67
			σA =1.63			σB = 2.05			σC = 3.27

(ii) Calculation of Beta of MFs:

	r	σM	σi	Var. of Market	βi
MF-A	0.45	3	1.63	9	0.244
MF-B	0.25	3	2.05	9	0.171
MF-C	0.65	3	3.27	9	0.709

Reward to Variability (Shape Ratio)

Mutual Fund	Rp	Rf	Rp - Rf	σp	Reward to Variability	Ranking
MF-A	10.00	7.00	3.00	1.63	1.84	2
MF-B	7.67	7.00	0.67	2.05	0.33	3
MF-C	14.00	7.00	7.00	3.27	2.14	1

Reward to Variability (Treynor Ratio)

Mutual Fund	Rp	Rf	Rp - Rf	βp	Reward to Volatility	Ranking
MF-A	10.00	7.00	3.00	0.244	12.30	1
MF-B	7.67	7.00	0.67	0.171	3.92	3
MF-C	14.00	7.00	7.00	0.709	9.87	2

Question 13

M/s. Siri Ltd. Has a surplus amount of ₹ 3 crores to invest and has shortlisted the following equity shares:

Company	Beta
S Ltd.	1.6
K Ltd.	1
P Ltd.	-0.3
D Ltd.	2
C Ltd.	0.6

Required:

(i) If M/s. Siri Ltd. invests an equal amount in all securities, what is the beta of the portfolio?

(ii) If M/s. Siri Ltd. invests 15% of its investment in S Ltd., 15% in P Ltd., 10% in C Ltd. and the balance in equal amount in the other two securities, what is the beta of the portfolio?

(iii) If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the portfolios expected return in both the situations given above?

(iv) If the Company changes its policy to invest in any 3 securities with a minimum of 20% in each of these 3 securities to diversify risk, you are requested to advise the company to have a right mix of securities to maximize the return in the following two scenarios and also calculate the expected return:

(1) Bull Phase: Expected Market returns 10%

(2) Bear Phase: Expected Market returns-5%

(PYP 8 Marks Nov 22)

Answer:

(a) **Beta of the Portfolio**

Investment	Beta(β)	Investment (₹ Lakhs)	Weighted Investment
S Ltd.	1.6	60	96
K Ltd.	1.0	60	60
P Ltd.	-0.3	60	-18
D Ltd.	2.0	60	120
C Ltd.	0.6	60	36
		300	**294**

$$\beta_P = \frac{294 \text{ lakh}}{300 \text{ lakh}} = 0.98$$

Alternatively, it can also be computed as follows:

$$1.6 \times \frac{1}{5} + 1.0 \times \frac{1}{5} + (-0.30) \times \frac{1}{5} + 2 \times \frac{1}{5} + 0.6 \times \frac{1}{5} = 0.98$$

With varied percentages of investments portfolio beta is calculated as follows:

Investment	Beta(β)	Investment (₹ Lakhs)	Weighted Investment
S Ltd.	1.6	45	72
K Ltd.	1.0	90	90
P Ltd.	-0.3	45	-13.50
D Ltd.	2.0	90	180
C Ltd.	0.6	30	18
		300	**346.50**

$$\text{Beta} = \frac{346.50}{300} = 1.155$$

(ii) Expected return of the portfolio with pattern of investment as in case (i) = 12% x 0.98 i.e. 11.76%

Expected Return with pattern of investment as in case (ii) = 12% x 1.155 i.e., 13.86%

(iii) (1) Securities to be selected during Bull Phase Expected Market returns 10% As it is bull Market Higher Beta stocks should be selected.

Shares	% to be invested	Beta(β)	Investment	Weighted Investment
S Ltd.	20	1.6	60,00,000	96,00,000
K Ltd.	20	1	60,00,000	60,00,000
P Ltd.	0	-0.3	-	-
D Ltd.	60	2	1,80,00,000	3,60,00,000
C Ltd.	0	0.6	-	-
	100		**3,00,00,000**	**5,16,00,000**

Portfolio or Weighted Beta (β) $\left(\frac{5,16,00,000}{3,00,00,000}\right)$ 1.72

Portfolio Beta (β) 1.72
Market Return 10%
Expected Return 17.20%

(2) Securities to be selected During Bear Phase Expected Market returns -5% As it is bear market Lower Beta stocks should be selected.

Shares	% to be invested	Beta(β)	Investment	Weighted Investment
S Ltd.	0	1.6	-	-
K Ltd.	20	1	60,00,000	60,00,000
P Ltd.	60	-0.3	1,80,00,000	-54,00,000
D Ltd.	0	2	-	-
C Ltd.	20	0.6	60,00,000	36,00,000
	100		**3,00,00,000**	**42,00,000**

Portfolio or Weighted Beta (β) $\left(\frac{42,00,000}{3,00,00,000}\right)$ 0.14
Portfolio Beta (β) 0.14
Market Return -5%
Expected Return -0.70%

Question 14

Following is the information related to return on shares of three different companies:

Years	A Ltd.	B Ltd.	C Ltd.
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	7%	9%	11%

Required:

(i) Construct maximum number of portfolio and its return, if each portfolio consists of any two Company's shares in proportion of 65% and 35% and suggest which portfolio provides highest return.

(ii) Calculate portfolio return and beta (β), if Mr. X invests ₹ 65,000 in A Ltd. having beta (β) of 0.45; ₹ 20,000 in B Ltd. having beta (β) of 1.15 and ₹ 15,000 in C Ltd. having beta (β) of 1.8

(PYP 8 Marks Nov 22)

Answer:

(a) Calculation of Average Return

Years	A Ltd.	B Ltd.	C Ltd.
2018	2%	3%	5%
2019	6%	8%	7%
2020	13%	14%	15%
2021	7%	9%	11%
Sum	28%	34%	38%
Average	7%	8.50%	9.50%

(i) (1) Combination 1 = 65% in A Ltd. & 35% B Ltd.

Return = 7% x 0.65 + 8.50% x 0.35 = 4.55% + 2.975% = 7.525% or 7.53%

(2) Combination 2 = 65% in B Ltd. & 35% in C Ltd.

Return = 8.50% x 0.65 + 9.50% x 0.35 = 5.525% + 3.325% = 8.85%

(3) Combination 3 = 65% in C Ltd. & 35% in A Ltd.

Return = 0.65% x 9.50% + 0.35% x 7.00% = 6.175% + 2.45%

= 8.625% or 8.63%

(4) Combination 4 = 65% in A Ltd. & 35% in C Ltd.

Return = 6.5% x 7% + 0.35 x 9.50% = 4.55% + 3.325%

= 7.875% or 7.88%

(5) Combination 5 = 35% in A Ltd. & 65% in B Ltd.

Return = 0.35 x 7% + 0.65 x 8.50% = 2.45% + 5.525%

= 7.975% or 7.98%

(6) Combination 6 = 35% in B Ltd. & 65% in C Ltd.

Return = 0.35 x 8.50% + 0.65 x 9.50% = 2.975% + 6.175% = 9.15%

Since maximum return is under Combination - 6 i.e. 65% investment in C Ltd. and 35% in B Ltd. hence it should be opted for.

(ii) Calculation of Return and Beta of Portfolio

$$\text{Return of Portfolio} = 7\% \times \frac{65,000}{1,00,000} + 8.50\% \times \frac{20,000}{1,00,000} + 9.50\% \times \frac{15,000}{1,00,000}$$

= 7.675%

$$\text{Beta of Portfolio} = 0.45 \times \frac{65,000}{1,00,000} + 1.15 \times \frac{20,000}{1,00,000} + 1.80\% \times \frac{15,000}{1,00,000}$$

= 0.7925 or 0.79

Question 15

Mr. Potential has made investment in two mutual in two funds. The following information is available:

Mutual Fund	Smart	Growth
Jensen Alpha	1.10%	1.50%
Treynor's Ratio	0.0714	0.0775
Actual Return	8.50%	9.10%
Risk Premium		4%

You are required to calculate:

(i) Beta (β) for both the funds

(ii) Risk free Rate

(iii) Security Market Line

(PYP 8 Marks May '23)

Answer:

	Smart	Growth
Jensen Alpha	0.011	0.015
Treynor's Ratio	0.0714	0.0775
Actual Return	0.085	0.091
Risk Premium	0.04	0.04

Jensen Alpha = Actual Return – E(r)

$$\text{Treynor's Ratio} = \frac{E(r) - Rf}{\beta}$$

E(r) = Actual Return – Jensen Alpha

For Smart:

$0.04\beta S = 0.074 - Rf$ (1)

$0.0714\beta S = 0.085 - Rf$ (2)

On solving (1) and (2) we get $\beta S = 0.35$ and $Rf = 0.06$

For Growth:

$0.04\beta G = 0.076 - Rf$ (3)

$0.0775\beta G = 0.091 - Rf$ (4)

On solving (3) and (4), we get $\beta G = 0.40$ and $Rf = 0.06$

(i) Beta of Smart Mutual Fund is 0.35 and Growth Mutual Fund is 0.40.

(ii) Risk free Rate = 6%

(iii) Security Market Line for Smart = $0.06 + 0.04\beta$

Security Market Line for Growth = $0.06 + 0.04\beta$

Alternative Solution: In case students have assumed Risk Premium as Equity Risk Premium of respective securities.

Working Notes:

(i) **Smart**

Jensen Alpha = 0.011

Actual Return = 0.085

Thus, expected return(as per CAPM) = 0.074

Accordingly, Risk Free Rate of Return:

$0.074 = Rf + 0.04$

$Rf = 0.034$

Treynor's Ratio = 0.0714

$$0.0714 = \frac{0.085 - 0.034}{\beta s}$$

$$\beta s = 0.714$$

$$\text{Market Risk Premium} = \frac{0.04}{0.714} = 0.056$$

(ii) **Growth**

Jensen Alpha = 0.015

Actual Return = 0.091

Thus, expected return(as per CAPM) = 0.076

Accordingly, Risk Free Rate of Return:

$0.076 = R_f + 0.04$

$R_f = 0.036$

Treynor's Ratio = 0.0775

$$0.0775 = \frac{0.091 - 0.036}{\beta_G}$$

$\beta_G = 0.710$

$$\text{Market Risk Premium} = \frac{0.04}{0.710} = 0.056$$

Security Market Line for Smart $= 0.034 + 0.056\beta s$

Security Market Line for Growth $= 0.036 + 0.056\beta_G$

Question 16

An Investor is proposing to invest ₹ 10,000/- in two Portfolios A and B in the ratio of 3:2.

The Portfolios have three securities each with following weights:

	Wx	Wy	Wz
Portfolio A	0.30	0.25	0.45
Portfolio B	0.20	0.45	0.35

You are required to

(i) Calculate the weight of each stock.

(ii) Calculate the amount allocated to Y and Z if half of the funds are allocated to security X. **(PYP 8 Marks May '23, Old & New SM) (MTP 4 Marks April'24)**

Note: In question paper in sub part (ii) Y and Z mistakenly got typed as B and C.

Answer:

(i) **Investment committed to each security would be:**

	X (₹)	Y (₹)	Z (₹)	Total (₹)
Portfolio A	1,800	1,500	2,700	6,000
Portfolio B	800	1,800	1,400	4,000
Combined Portfolio	2,600	3,300	4,100	10,000
Stock Weights	0.26	0.33	0.41	

Alternatively, it can also be computed as follows:

$$\text{Weight of Security X} = 0.30 \times \frac{3}{5} + 0.20 \times \frac{2}{5} = 0.26$$

$$\text{Weight of Security Y} = 0.25 \times \frac{3}{5} + 0.45 \times \frac{2}{5} = 0.33$$

$$\text{Weight of Security Z} = 0.45 \times \frac{3}{5} + 0.35 \times \frac{2}{5} = 0.41$$

(ii) **The equation of critical line takes the following form:**

$WY = a + bWX$

Substituting the values of WX & WY from portfolio A and B in above equation, we get

$0.25 = a + 0.30b$, and

$0.45 = a + 0.20b$

Solving above equation we obtain the slope and intercept, $a = 0.85$ and $b = -2$ and thus, the critical line is

$WY = 0.85 - 2WX$

If half of the funds is invested in security X then, $WY = 0.85 - 1.00 = -0.15$

Since $WX + WY + WZ = 1$

$WZ = 1 - 0.50 + 0.15 = 0.65$

∴ Allocation of funds to Security Y = − 0.15 × 10,000 = - ₹ 1,500 and

Security Z = 0.65 × 10,000 = ₹ 6,500

Alternative, it can also be solved as follows:

Amount to be allocated ot Y & Z if half of the funds are allocated to X.

The balance fund of ₹ 5,000 shall be allocated in the ratio of 33:41.

$$\text{Allocated of funds to − Security Y} = 5{,}000 \times \frac{33}{74} = ₹\ 2{,}230$$

$$\text{Security Z} = 5{,}000 \times \frac{41}{74} = ₹\ 2{,}770$$

Question 17

Your client is holding the following securities:

Particulars of Securities	Cost	Dividends/ Interest	Market price at the end of holding period	Beta
	₹	₹	₹	
Equity Shares:				
G Ltd.	20,000	1,450	19,600	0.6
S Ltd.	30,000	1,000	30,400	0.8
B Ltd.	28,000	1,400	32,000	0.6
GOI Bonds	72,000	5,060	71,980	0.01

Evaluate:

(i) Risk free rate of return.

(ii) Expected rate of return of each security (except GOI Bond), using the Capital Asset Pricing Model (CAPM).

Note: (1) Use weighted average Beta in calculations.

(2) Round off calculations up-to 3 decimal points.

(MTP 6 Marks April'24)

Answer:

Particulars of Securities	Cost ₹	Market Price	Capital Gain	Dividend / Interest
G Ltd.	20,000	19,600	-400	1,450
S Ltd.	30,000	30,400	400	1,000
B Ltd.	28,000	32,000	4,000	1,400
GOI Bonds	72,000	71,980	-20	5,060
Total	1,50,000	1,53,980	3,980	8,910

(i) Risk free return [Return on Govt. Security (GOI Bond)]

$$\frac{5,060 + (72,000 - 71,980)}{72,000} = 7\%$$

(iii) Weighted Average of Beta

$$= 0.6 \times \frac{19,600}{1,53,980} + 0.8 \times \frac{30,400}{1,53,980} + \frac{32,000}{1,53,980} + 0.01 \times \frac{71,980}{1,53,980}$$

$$= 0.076 + 0.158 + 0.125 + 0.005$$

$$= 0.364$$

Average Return on Portfolio

$$\frac{(8,910 + 3,980)}{1,50,000} \times 100\% = 8.593\%$$

Market Return

$8.593\% = 7\% + (Rm - 7\%) \times 0.364$

$Rm = 11.376\%$

Expected Rate of Return for each security is

Rate of Return = $Rf + \beta(Rm - Rf)$

G Ltd. = $7.000\% + 0.6\ (11.376\% - 7.000\%) = 9.626\%$

S Ltd. = $7.000\% + 0.8\ (11.376\% - 7.000\%) = 10.501\%$

B Ltd. = $7.000\% + 0.6\ (11.376\% - 7.000\%) = 9.626\%$

Question 18

An investor has categorized all the available stock in the market into the following types and the estimated weights of the categories of stocks in the market index are given below. Further, the sensitivity of returns of these categories of stocks to two factors Inflation and Stock market are also given below:

Category	Weight in Market Index	Factor 1 (Inflation)			Factor 2 (Stock Market)		
		Beta 1	Expected Value in %	Actual Value in %	Beta 2	Expected Value in %	Actual Value in %
Small Cap	20%	1.20	6.70	6.70	0.80	10.00	10.50
Medium Cap	30%	1.75	4.50	6.00	0.90	7.00	8.00
Large Cap	15%	1.30	6.75	8.00	1.165	9.00	10.00
Flexi Cap	35%	1.70	7.00	6.50	0.85	8.85	9.75

Risk Free Rate of Interest is 7.50%. Round off to 2 decimals.

You are required to calculate:

(i) Expected return on the market index for both the factors.

(ii) Expected return on the market index under Arbitrage Pricing Theory (Existing Scenario).

(iii) Expected return on the market index under Arbitrage Pricing Theory if the composition of the Portfolio is changed to 25% equally in all four categories.

(iv) Which alternative (Existing or Changed) will be more profitable?

(PYP 8 Marks Nov'23)

Answer:

(i) Expected Return on Market Index for Both factors

Factor 1

= 0.20 × 6.70% + 0.30 × 4.50% + 0.15 × 6.75% + 0.35 × 7.00%

= 1.34% + 1.35% + 1.01% + 2.45% = 6.15%

Factor 2

= 0.20 × 10% + 0.30 × 7% + 0.15 × 9% + 0.35 × 8.85%

= 2% + 2.10% + 1.35% + 3.10%

= 8.55%

(ii) Calculation of expected Return on the Market index under Arbitrage pricing Theory (Existing Scenario):

Factor 1 (Inflation)					
Category	Beta	Actual Value	Expected Value	Difference	Beta × Diff.
	(a)	(b) (%)	(c) (%)	(b) – (c) = (d) (%)	(e)
Small Cap	1.20	6.70	6.70	0.00	0.00
Medium Cap	1.75	6.00	4.50	1.50	2.63
Large Cap	1.30	8.00	6.75	1.25	1.63
Flexi Cap	1.70	6.50	7.00	(0.50)	(0.85)

Factor 2 (Stock Market)						
Category	Beta	Actual Value	Expected Value	Difference	Beta × Diff.	Total
	(f)	(g) (%)	(h) (%)	(g) - (h) = (i) (%)	(j)	(e) + (j) = (k)
Small Cap	0.80	10.50	10.00	0.50	0.40	0.40
Medium Cap	0.90	8.00	7.00	1.00	0.90	3.53
Large Cap	1.165	10.00	9.00	1.00	1.17	2.80
Flexi cap	0.85	9.75	8.85	0.90	0.77	(0.08)

Category	Weight in Market index (1)	Total Beta Diff × (2)	Expected Return (2 × 1 = 3)
Small Cap	20%	0.40	0.08
Medium Cap	30%	3.53	1.06
Large Cap	15%	2.80	0.42
Flexi cap	35%	(0.08)	(0.03)
Total			1.53
Add: Risk Free Rate of Inerest			7.50
Expected Return(%)			9.03

(ii) Expected Return on the Market Index under Arbitrage Pricing Theory under changed scenario:

Category	Weight in Market index (1)	Total Beta Diff × (2)	Expected Return (2 × 1 = 3)
Small Cap	25%	0.40	0.10
Medium Cap	25%	3.53	0.88
Large Cap	25%	2.80	0.70
Flexi cap	25%	(0.08)	(0.02)
Total			1.66
Add: Risk Free Rate of Interest			7.50
Expected Return (%)			9.16

(ii) As per above calculation, the investors by investing 25% equally in all four categories, is profitable compared to the existing compostion. As the proposed composition gives rate of return of 9.16% per annual when compared to the existing return of the present portfolio.

Question 19

Expected returns on two stocks against BSE SENSEX returns are given in the following table under two scenarios-bullish and bearish:

Market return	Scenario -1: Bullish Case	Scenario -2: Bearish Case
BSE Sensex	25%	-5%
Stock R	32%	-4%
Stock Z	18%	-3%

You are required to calculate:

(i) The Betas of two stocks R and Z.

(ii) Expected return on each stock, if the likelihood of market achieving Scenario-1 is thrice the likelihood of the market achieving Scenario-2.

(iii) The Security Market Line (SML), if the risk-free rate is 8% and likelihood of the market return achieving the bullish base returns of 25% is thrice that of achieving -5% returns.

(iv) The Alphas of the two stocks based on Sharpe Index Model.

(PYP 8 Marks Nov'23)

Answer:

(i) The Betas of two stocks:

Stock R - $\frac{(32\% + 4\%)}{(25\% + 5\%)}$ = 1.2

Stock Z - $\frac{(18\% + 3\%)}{(25\% + 5\%)}$ = 0.70

Alternatively, it can also be solved by using the Characteristic Line Relationship as follows:

Rs = α + βRm

Where

α = Alpha β = Beta

Rm = Market Return

For Stock R

32% = α + β (25%)

-4% = α + β (-5%) 36% = β (30%)

β = 12

For Stock Z

18% = α + β (25%)

-3% = α + β (-5%) 21% = β (30%)

β = 0.70

Alternatively, Beta can also be calculated as follows:

Basic Calculaiton for stock R

(RR)	RR	RR - RR	(RR - RR)2	(Rm)	RM	Rm - RM	(Rm - RM)2	(RR - RR) (Rm - RM)
32%	14%	18%	324	25%	10%	15%	225	270
-4%	14%	-18%	324	-5%	10%	-15%	225	270
TOTAL			**648**				**450**	**540**

Basic Calculaiton for stock Z

(RZ)	RZ	RZ - RZ	(RZ - RZ)2	(Rm)	RM	Rm - RM	(Rm - RM)2	(RZ - RZ) (Rm - RM)
18%	7.5%	10.5%	110.25	25%	10%	15%	225	157.50
-3%	7.5%	-10.5%	110.25	-5%	10%	-15%	225	157.50
TOTAL			**220.50**				**450**	**315**

Co - Variance (R, M) = $\frac{540}{2}$ = 270

Co - Variance (Z, M) = $\frac{315}{2}$ = 157.50 (σ M)2 = $\frac{450}{2}$ =225

Beta of stock R & Z

Beta (R) = $\frac{Cov.(R,M)}{\sigma_M^2}$ = $\frac{270}{225}$ = 1.2

Beta (R) = $\frac{Cov.(R,Z)}{\sigma_M^2}$ = $\frac{157.5}{225}$ = 0.7

(ii) Expected returns of the two stocks:

Stock R - 0.75 × 32% - 0.25 × 4% = 23%

Stock Z - 0.75 × 18% - 0.25 × 3% = 12.75%

(iii) Expected return of market portfolio = 0.75 × 25% + 0.25% × (-5%) = 17.50%

∴ Market risk prem = 17.50% - 8.00% = 9.5%

∴ SML is, required return = 8.00% + βi 9.5%

(iv) Alpha for two stocks Required Retun for Stock R

E(R) = αR + βRM

Accordingly

23% = αR + 1.20 × 17.50%

αR = 2%

Required Return for Stock Z

E(Z) = αZ + βRM

Accordingly

12.75% = αZ + 0.70 × 17.50%

αZ = 0.5%

Question 20

The following information are available with respect of Krishna Ltd.

Year	Krishna Ltd. Average share 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 Ltd. at the end of 2015 and state your observation.

Answer:

(i) Computation of Beta Value

Calculation of Returns

$$\text{Returns} = \frac{D_1 + (P_1 - P_0)}{P_0} \times 100$$

Year	Returns
2012 – 13	$\frac{22 + (253 - 245)}{245} \times 100 = 12.24\%$
2013 – 14	$\frac{25 + (310 - 253)}{253} \times 100 = 32.41\%$
2014 – 15	$\frac{30 + (330 - 310)}{310} \times 100 = 16.13\%$

Calculation of Returns from market Index

Year	% of Index Appreciation	Dividend Yield %	Total Return %
2012 – 13	$\frac{(2130 - 2013)}{2013} \times 100 = 5.81\%$	5%	10.81%
2013 – 14	$\frac{(2350 - 2130)}{2130} \times 100 = 10.33\%$	6%	16.33%
2014 – 15	$\frac{(2580 - 2350)}{2350} \times 100 = 9.79\%$	7%	16.79%

Computation of Beta

Year	Krishna Ltd. (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 Return of Krishna Ltd. = $\frac{60.78}{3}$ = 20.26%

Average Market Return = $\frac{43.93}{3}$ = 14.64%

Beta (β) = $\frac{\sum XY - n\bar{X}\bar{Y}}{\sum Y^2 - n(\bar{Y})^2} = \frac{932.38 - 3 \times 20.26 \times 14.64}{665.43 - 3(14.64)^2}$ = 1.897

(ii) Observation

	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

Question 21

Mr. Abhishek is interested in investing ₹ 2,00,000 for which he is considering following three alternatives:

(i) Invest ₹ 2,00,000 in Mutual Fund X (MFX)

(ii) Invest ₹ 2,00,000 in Mutual Fund Y (MFY)

(iii) Invest ₹ 1,20,000 in Mutual Fund X (MFX) and ₹ 80,000 in Mutual Fund Y (MFY)

Average annual return earned by MFX and MFY is 15% and 14% respectively. Risk free rate of return is 10% and market rate of return is 12%.

Covariance of returns of MFX, MFY and market portfolio Mix are as follow:

	MFX	MFY	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:

(i) variance of return from MFX, MFY and market return,

(ii) portfolio return, beta, portfolio variance and portfolio standard deviation,

(iii) expected return, systematic risk and unsystematic risk; and

(iv) Sharpe ratio, Treynor ratio and Alpha of MFX, MFY and Portfolio Mix

Answer:

(i) **Variance of Returns**

By referring diagonally the given Table these values can identified as follows:

$Variance_X$ = 4.800

$Variance_Y$ = 4.250

$Variance_X$ = 3.100

(ii) **Portfolio return, beta, variance and standard deviation**

Weight of MFX in portfolio = $\frac{1,20,000}{2,00,000}$ = 0.60

Weight of MFY in portfolio = $\frac{80,000}{2,00,000}$ = 0.40

Accordingly Portfolio Return

0.60 × 15% + 0.40 × 14% = 14.60%

Beta of each Fund

$\beta_X = \frac{\text{Cov (Fund, Market)}}{\text{Variance of Market}}$

$\beta_X = \frac{3.370}{3.100}$ = 1.087

$\beta_Y = \frac{2.800}{3.100}$ = 0.903

Portfolio Beta

0.60 × 1.087 + 0.40 × 0.903 = 1.013

Portfolio Variance

$\sigma^2_{XY} = W^2_X \sigma^2_X + W^2_Y \sigma^2_Y + 2 W_X W_Y Cov_{X,Y}$

$= (0.60)^2 (4.800) + (0.40)^2 (4.250) + 2(0.60)(0.40)(4.300)$

= 4.472

Or Portfolio Standard Deviation

$\sigma_{XY} = \sqrt{4.472}$ = 2.115

(iii) Expected Return, Systematic and Unsystematic Risk of Portfolio

Portfolio Return = 10% + (12% – 10%) 1.0134 = 12.03%

MF X Return = 10% + (12% – 10%) 1.087 = 12.17%

MF Y Return = 10% + (12% – 10%) 0.903 = 11.81%

Systematic Risk = $\beta^2\sigma m^2$

Accordingly,

Systematic Risk of MFX = $(1.087)^2 \times 3.10 = 3.663$

Systematic Risk of MFY = $(0.903)^2 \times 3.10 = 2.528$

Systematic Risk of Portfolio = $(1.013)^2 \times 3.10 = 3.181$

Unsystematic Risk = Total Risk – Systematic Risk

Accordingly,

Unsystematic Risk of MFX = 4.80 – 3.663 = 1.137

Unsystematic Risk of MFY = 4.250 – 2.528 = 1.722

Unsystematic Risk of Portfolio = 4.472 – 3.181 = 1.291

(iv) Sharpe and Treynor Ratios and Alpha

Sharpe Ratio

$$\text{MFX} = \frac{15\% - 10\%}{\sqrt{4.800}} = 2.282$$

$$\text{MFY} = \frac{14\% - 10\%}{\sqrt{4.250}} = 1.94$$

$$\text{Portfolio} = \frac{14.6\% - 10\%}{2.115} = 2.175$$

Treynor Ratio

$$\text{MFX} = \frac{15\% - 10\%}{1.087} = 4.60$$

$$\text{MFY} = \frac{14\% - 10\%}{0.903} = 4.43$$

$$\text{Portfolio} = \frac{14.6\% - 10\%}{1.0134} = 4.54$$

Alpha

MFX = 15% – 12.17% = 2.83%

MFY = 14% – 11.81% = 2.19%

Portfolio = 14.6% – 12.03% = 2.57%

Question 22

Following are the details of a portfolio consisting of three shares:

Share	Portfolio weight	Beta	Expected return in %	Total Variance
A	0.20	0.40	14	0.015
B	0.50	0.50	15	0.025
C	0.30	1.10	21	0.100

Standard Deviation of Market Portfolio Returns = 10%

You are given the following additional data:

Covariance (A, B) = 0.030

Covariance (A, C) = 0.020

Covariance (B, C) = 0.040

Calculate the following:

(i) The Portfolio Beta

(ii) Residual variance of each of the three shares

(iii) Portfolio variance using Sharpe Index Model

(iv) Portfolio variance (on the basis of modern portfolio theory given by Markowitz)

Answer:

(i) Calculation of βp:

$\beta p = W_A\beta_A = W_B\beta_B + W_c\beta_c$

$= 0.2 \times 0.4 + 0.5 \times 0.5 + 0.3 \times 1.1$

$= 0.66$ times

(ii) Calculation of USR for each stock:

TR – SR = USR

$\sigma x^2 - \beta x^2 \sigma m^2 = \sigma e x^2$

A $0.015 - 0.4^2 \times 0.1^2 = 0.0134$

B $0.025 - 0.5^2 \times 0.1^2 = 0.0225$

C $0.100 - 1.1^2 \times 0.1^2 = 0.0879$

(iii) Calculation of σp^2 using Sharpe Index Model

$\sigma p^2 = \beta p^2 \times \sigma m^2 + W_A^2 \sigma_{eA}^2 + W_B^2 \sigma_{eB}^2$

$= 0.66^2 \times 0.1^2 + 0.2^2 \times 0.0134 + 0.5^2 \times 0.0225 + 0.3^2 \times 0.0879$

$\therefore \quad \sigma p^2 = 0.018428$

(iv) Calculation of σp^2 using Markowitz

$\sigma p^2 = W_A^2 \sigma_A^2 \times W_B^2 \sigma_B^2 + W_C^2 \sigma_C^2$

$+ 2W_AW_B COV_{AB}$

$+ 2W_BW_C COV_{BC}$

$+ 2W_AW_C COV_{AC}$

$\sigma p^2 = 0.2^2 \times 0.015 + 0.5^2 \times 0.025 + 0.3^2 \times 0.100$

$+ 2 \times 0.2 \times 0.5 \times 0.030$

$+ 2 \times 0.5 \times 0.3 \times 0.020$

$+ 2 \times 0.2 \times 0.3 \times 0.040$

$= 0.03265$

Question 23

Mr. Nirmal Kumar has categorized all the available stock in the market into the following types:

(i) Small cap growth stocks

(ii) Small cap value stocks

(iii) Large cap growth stocks

(iv) Large cap value stocks

Mr. Nirmal Kumar also estimated the weights of the above categories of stocks in the market index. Further, 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 (Book Price)	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:

(a) Using Arbitrage Pricing Theory, determine the expected return on the market index.

(b) Using Capital Asset Pricing Model (CAPM), determine the expected return on the market index.

(c) 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:

(i) **Calculation of ke (P) under APT**

$ke = \lambda_0 + \beta_1\lambda_1 + \beta_2\lambda_2 + \beta_3\lambda_3$

SCG

$ke = 4.5 + 0.8 \times 6.85 + 1.39 \times (3.5) + 1.35 \times 0.65$

$= 5.9925\%$

SCV

$ke = 4.5 + 0.9 \times 6.85 + 0.75 \times (3.5) + 1.25 \times 0.65$

$= 8.8525\%$

LCG

$ke = 4.5 + 1.165 \times 6.85 + 2.75 \times (3.5) + 8.65 \times 0.65$

$= 8.47775\% \approx 8.4778\%$

LCV

$ke = 4.5 + 0.85 \times 6.85 + 2.05 \times (3.5) + 6.35 \times 0.65$

$= 7.535\%$

Security	ke	Weights
SCG	5.9925%	0.25
SCV	8.8525%	0.1
LCG	8.4778%	0.5
LCV	7.535%	0.15

$k_e(P) = WAK_eA + WB\ K_eB + WCK_eC + WD\ K_eD$

$\therefore\ k_e(P) = 0.25 \times 5.9925$

$+ 0.1 \times 8.8525$

$+ 0.5 \times 8.4778$

$+ 0.15 \times 7.535$

$= 7.7525\%$

(ii) Calculation of ke(P) → CAPM

$k_e = I_{RF} + (R_m - I_{RF})\ \beta$

$\downarrow \quad \downarrow \quad \downarrow$

$\lambda_0 \quad \lambda_1 \quad \beta$

SCG: ke = 4.5 + 6.85 × 0.8 = 9.98%

SCV: ke = 4.5 + 6.85 × 0.9 = 10.665%

LCG: ke = 4.5 + 6.85 × 1.165 = 12.48%

LCV = ke = 4.5 + 6.85 × 0.85 = 10.32%

ke (P) = 0.25 × 9.98% [CAPM]

+ 0.1 × 10.665%

+ 0.5 × 12.48%

+ 0.15 × 10.32%

= 11.35%

(iii) Desired βP = 1

$\beta P = WA\beta A + WB\beta B$

$1 = WA \times 0.9 + WB \times 1.165$

$1 = WA \times 0.9 + (1 - WA)\ 1.165$

$\therefore\ -0.165 = -0.265WA$

$\therefore\ WA = \frac{0.165}{0.265} = 0.62$

$\therefore\ WB = 1 - 0.62 = 0.38$

$\therefore\ W_{SCV} \rightarrow 0.62$

$\therefore\ W_{LCG} \rightarrow 0.38$

Question 24

Mr. A is interested to invest ₹ 1,00,000 in the securities market. He selected two securities B and D for this purpose. The risk return profile of these securities are as follows :

Security	Risk (σ)	Expected Return (ER)
B	10%	12%
D	18%	20%

Co-efficient of correlation between B and D is 0.15.

You are required to calculate the portfolio return of the following portfolios of B and D to be considered by A for his investment.

(i) 100 percent investment in B only;

(ii) 50 percent of the fund in B and the rest 50 percent in D;

(iii) 75 percent of the fund in B and the rest 25 percent in D; and

(iv) 100 percent investment in D only.

Also indicate that which portfolio is best for him from risk as well as return point of view?

Answer:

$\overline{b}$ = 12% σb = 10% r_{bd} = 0.15

$\overline{d}$ = 20% σd = 18%

$R_p = W_b R_p + W_d R_d$

$\sigma_p = \sqrt{W_b^2 \sigma b^2 + W_d^2 \sigma d^2 + 2 W_b W_d \sigma b \sigma d r_{bd}}$

Portfolio 1: 100% Investment in b

R_p = 12%

σ_p = 10%

Portfolio 2: 50% in b and 50% in d

$R_p = 0.5 \times 12 + 0.5 \times 20$

= 16%

$\sigma_p = \sqrt{0.5^2 \times 10^2 + 0.5^2 \times 18^2 + 2 \times 0.5 \times 0.5 \times 10 \times 18 \times 0.15}$

= 10.93%

Portfolio 3: 75% in b and 25% in d

$R_p = 0.75 \times 12 + 0.25 \times 20$

= 14%

$\sigma_p = \sqrt{0.75^2 \times 10^2 + 0.25^2 \times 18^2 + 2 \times 0.75 \times 0.25 \times 10 \times 18 \times 0.15}$

= 9.31%

Portfolio 4: 100% in d

Rp = 20%

σ_p = 18%

Portfolio	Rp	σp
1	12%	10%
2	16%	10.93%
3	14%	9.31%
4	20%	18%

Best acc. to Rp → Portfolio 4

Best acc. to σ_p → Portfolio 3

Question 25

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:

(i) The expected return on a portfolio containing A and B in the proportion of 40% and 60% respectively.

(ii) The Standard Deviation of return from each of the two stocks.

(iii) The covariance of returns from the two stocks.

(iv) Correlation coefficient between the returns of the two stocks.

(v) The risk of a portfolio containing A and B in the proportion of 40% and 60%.

Answer:

(i) Expected return of the portfolio A and B

$E(A) = \frac{(10 + 16)}{2} = 13\%$

$E(B) = \frac{(12 + 18)}{2} = 15\%$

$R_p = \sum_{i=1}^{N} X_i R_i = 0.4(13) + 0.6(15) = 14.2\%$

(ii) Stock A:

Variance = $0.5 (10 - 13)^2 + 0.5 (16 - 13)^2 = 9$

Standard deviation = $\sqrt{9}$ = 3%

Stock B:

Variance = $0.5 (12 - 15)^2 + 0.5 (18 - 15)^2 = 9$

Standard deviation = 3%

(iii) Covariance of stocks A and B

$Cov_{AB} = 0.5 (10 - 13) (12 - 15) + 0.5 (16 - 13) (18 - 15) = 9$

(iv) Correlation of coefficient

$$r_{AB} = \frac{Cov_{AB}}{\sigma_A \sigma_B} = \frac{9}{3 \times 3} = 1$$

(v) Portfolio Risk

$$\sigma_p = \sqrt{X^2_A \sigma^2_A + X^2_B \sigma^2_B + 2X_A X_B (\sigma_A \sigma_B \sigma_{AB})}$$

$$= \sqrt{(0.4)^2(3)^2 + (0.6)^2(3)^2 + 2(0.4)(0.6)(3)(3)(1)}$$

$$= \sqrt{1.44 + 3.24 + 4.32} = 3\%$$

Question 26

The distribution of return of security 'F' and the market portfolio 'P' is given below:

Probability	Return %	
	F	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 for the security.

Answer:

Let the security F be 'x'

Let the market P be 'm'

$\bar{x} = \Sigma Px = 17\%$

$\bar{m} = \Sigma Pm = 14\%$

Cov xm = $\Sigma P(x - \bar{x})(m - \bar{m})$

= −168%

$$\beta x = \frac{Cov\ xm}{\sigma m^2} = \frac{-168}{264}$$

$$= -0.64 \text{ times}$$

					(1)	(2)	P (1) (2)	P $(2)^2$
P	x	m	Px	Pm	$(x - \bar{x})$	$(m - \bar{m})$		
0.3	30	−10	9	−3	13	−24	−93.6	172.8
0.4	20	20	8	8	3	6	7.2	14.4
0.3	0	30	–	9	−17	16	−81.6	76.8
			$\bar{x}$ = 17%	$\bar{m}$ = 14%			−168	264

Question 27

A company has a choice of investments between several different equity oriented mutual funds. The company has an amount of ₹1 crore to invest. The details of the mutual funds are as follows:

Mutual Fund	Beta
A	1.6
B	1.0
C	0.9
D	2.0
E	0.6

Required:

(i) If the company invests 20% of its investment in each of the first two mutual funds and an equal amount in the mutual funds C, D and E, what is the beta of the portfolio?

(ii) If the company invests 15% of its investment in C, 15% in A, 10% in E and the balance in equal amount in the other two mutual funds, what is the beta of the portfolio?

(iii) If the expected return of market portfolio is 12% at a beta factor of 1.0, what will be the portfolios expected return in both the situations given above?

Answer:

(i) Calculation of βp

→ Calculation of weights

Mutual Fund	Amt.	Weights	β	W × β
A	20,00,000	0.2	1.6	0.32
B	20,00,000	0.2	1.0	0.2
C	20,00,000	0.2	0.9	0.18
D	20,00,000	0.2	2.0	0.40
E	20,00,000	0.2	0.6	0.12
		1		βp = 1.22 times

∴ βp = 1.22 times

(ii) Calculation of βp

→ Calculation of weights

Mutual Fund	Amt.	Weights	β	W × β
A	15,00,000	0.15	1.6	0.24
B	30,00,000	0.3	1	0.3
C	15,00,000	0.15	0.9	0.135
D	30,00,000	0.3	2.0	0.6
E	10,00,000	0.1	0.6	0.06
		1		βp = 1.335 times

→ βp = 1.335 times

(iii) Rm = 12%

Since there no mention of IRF in the question we shall cross-multiply in order to find out the ke.

	I	(For i)	II	(For ii)
	Return	β	Return	β
Market	12%	1	12%	1
Portfolio	?	1.22	?	1.335
	ke = 14.64%		ke = 16.02%	

Question 28

Mr. FedUp wants to invest an amount of ₹ 520 lakhs and had approached his Portfolio Manager.

The Portfolio Manager had advised Mr. FedUp to invest in the following manner:

Security	Moderate	Better	Good	Very Good	Best
Amount (in ₹ Lakhs)	60	80	100	120	160
Beta	0.5	1.00	0.80	1.20	1.50

You are required to advise Mr. FedUp in regard to the following, using Capital Asset Pricing Methodology:

(i) Expected return on the portfolio, if the Government Securities are at 8% and the NIFTY is yielding 10%.

(ii) Advisability of replacing Security 'Better' with NIFTY.

Answer:

(i) Calculation of βp

$\beta p = WA\beta A + WB\beta B + WC\beta C + WD\beta D + WE\beta E$

Security	Amount	Weights	β	W × β
A	60L	0.115	0.5	0.0575
B	80L	0.154	1	0.154
C	100L	0.192	0.8	0.1536
D	120L	0.231	1.2	0.2772
E	160L	0.308	1.5	0.462
	520L	1		$\therefore \beta p$ = 1.104 times

$ke(p) = IRF + (Rm - IRF)\beta p$

$= 8 + (10 - 8)1.104$

$= 10.208\%$

(ii) 'Better' and NIFTY have the same systematic expected risk(β) i.e. 1, and the same return. Therefore there is no point in replacing 'Better' with NIFTY.

[ke of better $= 8 + (10 - 8)1$

$= 10\%$

Question 29

The historical rates of return of two securities over the past ten years are given. Calculate the Covariance and the Correlation coefficient of the two securities:

Years:	1	2	3	4	5	6	7	8	9	10
Security 1: (Return per cent)	12	8	7	14	16	15	18	20	16	22
Security 2: (Return per cent)	20	22	24	18	15	20	24	25	22	20

Answer:

$$r_{xy} = \frac{COV_{xy}}{\sigma x \times \sigma y}$$

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

$$\sigma x = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n}};$$

$$\sigma y = \sqrt{\frac{\Sigma(y - \bar{y})^2}{n}};$$

Year	x	y	$(x - \bar{x})$	$(y - \bar{y})$	(1) (2)	1^2	2^2
1	12	20	– 2.8	– 1	2.8		
2	8	22	– 6.8	1	– 6.8		
3	7	24	– 7.8	3	– 23.4		
4	14	18	– 0.8	– 3	2.4		
5	16	15	1.2	– 6	– 7.2		
6	15	20	0.2	– 7	– 0.2		
7	18	24	3.2	3	9.6		
8	20	25	5.2	4	20.8		
9	16	22	1.2	1	1.2		
10	22	20	7.2	– 1	– 7.2		
					– 8	207.6	84

$$\bar{x} = \frac{\Sigma x}{n} = 14.8\%$$

$$\bar{y} = \frac{\Sigma y}{n} = 21\%$$

$$COVxy \frac{\Sigma(x-\bar{x})(y-\bar{y})}{n} = \frac{-8}{10} = -0.8$$

$$\sigma x = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} ; = \sqrt{\frac{207.6}{10}} = \sqrt{20.76} = 4.56\%$$

$$\sigma y = \sqrt{\frac{\Sigma(y-\bar{y})^2}{n}} ; = \sqrt{\frac{84}{10}} = \sqrt{8.4} = 2.90\%$$

$$r_{xy} = \frac{COV_{xy}}{\sigma x \times \sigma y} = \frac{-0.8}{4.56 \times 2.90} = -0.0605$$

Question 30

A portfolio consists of 3 securities A, B & C with the following relevant information:

	A	B	C
Expected Returns (%)	27	24	22
Standard deviation (%)	33	28	26

Correlation Coefficient between:

A & B	0.20
B & C	0.32
A & C	0.50

If the weights of securities is equal, find out the risk & expected return of the portfolio.

Answer:

$$R_p = W_A R_A + W_B R_B + W_C R_C$$

$$= \frac{1}{3} \times 27 + \frac{1}{3} \times 24 + \frac{1}{3} \times 22$$

$$= 24.33\%$$

$$\sigma_p = \sqrt{\begin{matrix} W_A^2\sigma_A^2 + W_B^2\sigma_B^2 + W_C^2\sigma_C^2 \\ +2W_AW_B\sigma_A\sigma_B r_{AB} \\ +2W_AW_C\sigma_A\sigma_C r_{AC} \\ +2W_BW_C\sigma_B\sigma_C r_{BC} \end{matrix}}$$

$$= \sqrt{\begin{matrix} \frac{1^2}{3} \times 33^2 + \frac{1^2}{3} \times 28^2 + \frac{1^2}{3} \times 26^2 \\ +2 \times \frac{1}{3} \times \frac{1}{3} \times 33 \times 28 \times 0.20 \\ +2 \times \frac{1}{3} \times \frac{1}{3} \times 33 \times 26 \times -0.50 \\ +2 \times \frac{1}{3} \times \frac{1}{3} \times 28 \times 26 \times 0.40 \end{matrix}}$$

$$= 17.14\%$$

Question 31

A Stock costing ₹150 pays no dividends. The possible prices at which the stock may be sold for at the end of the year with the respective probabilities are:

Price (in ₹)	Probability
130	0.2
150	0.1
160	0.1
165	0.3
175	0.1
180	0.2
Total	1.0

Required:

(i) Calculate the Expected Return,

(ii) Calculate the Standard Deviation (σ) of Returns.

Show calculations upto three decimal points

Answer:

Calculation of K:

P_0 = 150

$$K_1 = \frac{P_1 - P_0}{P_0} \times 100$$

(i) If P_1 = 130

$$K_1 = \frac{130 - 150}{150} \times 100 = (13.333\%)$$

(ii) If P_1 = 150

$$K_1 = \frac{150 - 150}{150} \times 100 = 0\%$$

(iii) If P_1 = 160

$$K_1 = \frac{160 - 150}{150} \times 100 = 6.6\%$$

(iv) If P_1 = 165

$$K_1 = \frac{165 - 150}{150} \times 100 = 10\%$$

(v) If P_1 = 175

$$K_1 = \frac{175 - 150}{150} \times 100 = 16.667\%$$

(vi) If P_1 = 180

$$K_1 = \frac{180 - 150}{150} \times 100 = 20\%$$

(i) Calculation of Expected Return of security X:

P	x	Px	$P(x - \bar{x})^2$
0.2	(13.333%)	(2.667)	80
0.1	0	0	4.445
0.1	6.667%	0.667	0
0.3	10%	3	3.333
0.1	16.667%	1.667	10
0.2	20%	4	35.554
1		6.667%	133.33

∴ Expected Return $\bar{x} = \Sigma px = 6.667\%$

(ii) Calculation of risk of Security X:

$\sigma x = \sqrt{\Sigma P(x - x)^2} = \sqrt{133.33} = 11.5469\%$

∴ Risk (σx) = 11.547%

Question 32

XYZ Ltd. paid a dividend of ₹ 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:

D_0 = ₹2

I_{RF} = 11%

R_m = 18% COVxm = 30%

σm^2 = 24% (Variance)

$\beta = \frac{\text{Cov xm}}{\sigma m^2} = \frac{30}{24}$ = 1.25 times

Ke = $I_{RF} + [R_m - I_{RF}]\beta$

= 11 + [18 − 11]1.25 = 19.75%

V(E) = PV of all future cash Inflows (Intrinsic Value)

Year	CI	Df @ 19.75%	P.V.
1	2.8	0.8351	2.34
2	3.92	0.6973	2.73
3	5.49	0.5823	3.19
4	7.69	0.4863	3.74
5	10.77	0.4061	4.37
5	260.75*	0.4061	105.89

*PS = $\frac{D6}{Ke - g} = \frac{10.77 + 15\%}{19.75 - 15\%}$ =260.75

= 122.27 = V(E)