

Question Paper

Portfolio Management and Mutual Funds – I (251) : July-2005

Section A : Basic Concepts (30 Marks)

- This section consists of questions with serial number 1 - 30.
- Answer all questions.
- Each question carries one mark.
- Maximum time for answering Section A is 30 Minutes.

1. Consider the following table:

[< Answer >](#)

Securities	Probability of Investment	Expected Return (Rs.)
Equities	0.4	50,000
	0.2	0
	0.4	-30,000
Treasury bills	1.0	4,000

Assuming that funds available for investment are Rs.1,00,000, what is the expected risk premium (in rupee terms) of investing in Equities versus Treasury bills?

- (a) Rs.1,000 (b) Rs.4,000 (c) Rs.8,000
 (d) Rs.12,000 (e) Rs.20,000.

2. Which of the following will result in a non-linear payoff diagram?

[< Answer >](#)

- I. Buying 100 shares of Tisco at Rs.400 per share.
 II. Short selling 100 shares of Tisco at Rs.400 per share.
 III. Buying 100 shares of Tisco at Rs.400 per share and writing a call on the 100 shares at a strike price of Rs.410 per share.
 (a) Only (II) above (b) Only (III) above
 (c) Both (I) and (II) above (d) Both (I) and (III) above
 (e) Both (II) and (III) above.

3. Which of the following models of portfolio selection believes that decision makers do not use mathematical models such as utility analysis and instead focus on reducing the bad outcome?

[< Answer >](#)

- (a) Stochastic dominance model (b) Safety First model
 (c) Geometric Mean model (d) Sharpe Optimization model
 (e) Markowitz model.

4. Pure cash matching strategy of portfolio dedication can be easily implemented by

[< Answer >](#)

- (a) Using low coupon bonds (b) Using high-rated coupon bonds
 (c) Using high coupon bonds (d) Using government bonds with low coupon rate
 (e) Using zero coupon bonds.

5. Duration of a bond portfolio is 5 years and its average YTM is 13.50%. If average YTM decreases to 13.10%, the percentage change in value of the portfolio is

[< Answer >](#)

- (a) -1.25% (b) +1.76% (c) +1.85% (d) -1.76% (e) +2.05%.

6. Based on the current dividend yields and expected growth rates, the expected rates of return on stocks X and Y are 12% and 14% respectively. The beta of stock X is 0.8 and that of stock Y is 1.5. The T-bill is currently traded in the market at 6% while the expected rate of return on the SENSEX is 12%. If you currently hold a well-diversified portfolio, which of the two stocks will you add to your portfolio?

[< Answer >](#)

- (a) Stock X since it has a lower β of 0.8
 (b) Stock Y since it has higher expected return of 14%
 (c) Stock Y since it has a positive α of 1.6%
 (d) Stock X since it has a positive α of 1.2%
 (e) Stock Y since it is undervalued.

7. An investor expecting interest rate to decline should

[< Answer >](#)

- (a) Swap high rated debt to low rated debt
 (b) Swap variable rate bonds to fixed rate bonds
 (c) Swap short term bonds to long term bonds

- (d) Swap fixed rate bonds to variable rate bonds
(e) Swap corporate bonds to government bonds.

[< Answer >](#)

8. Consider a bullish spread option strategy using a call option with Rs.35 exercise price priced at Rs.4 and a call option with a Rs.50 exercise price priced at Rs.2.50. If the price of the stock increases to Rs.60 at expiration and the option is exercised on the expiration date, the net profit per share at expiration is

- (a) Rs.1.50 (b) Rs.10.50 (c) Rs.13.50 (d) Rs.35.00 (e) Rs.60.00.

[< Answer >](#)

9. In which of the following phases of **life cycle model**, the living expenses are not any more covered by earned salary but rather by accumulated assets?

- (a) Accumulation phase (b) Consolidation phase
(c) Spending phase (d) Gifting phase
(e) Maturity phase.

[< Answer >](#)

10. Correlation coefficients for the stocks A, B, C, D and E are given below.

Stocks	A	B	C	D	E
A	-	0.85	0.60	0.45	0.30
B	0.85	-	-0.25	0.10	-0.16
C	0.60	-0.25	-	0.78	0.37
D	0.45	0.10	0.78	-	0.86
E	0.30	-0.16	0.37	0.86	-

Each stock has an expected return of 10% and a standard deviation of 15%.

If your entire portfolio is composed of only Stock A and you can add one more stock to your portfolio, the stock that you should select is

- (a) B (b) C (c) D
(d) E (e) Insufficient information.

[< Answer >](#)

11. Which of the following statements is/are **true** as per the formula plans for portfolio revision?

- I. For dollar-cost averaging the investor must fix predetermined actions points called revaluation points.
II. Variable -ratio plan implies selling of stocks and buying of bonds as stock prices rise and the buying of stocks and selling of bonds as stock prices fall.
III. Dollar-cost averaging works well over long periods of time.
IV. Variable-ratio plan requires less accurate forecasting than other plans and hence is less complicated.
(a) Only (I) above (b) Only (II) above
(c) Both (I) and (IV) above (d) Both (II) and (III) above
(e) Both (III) and (IV) above.

[< Answer >](#)

12. The index model for two stocks A and B is estimated as follows:

$$R_A = 2\% + 0.65R_M + e_A$$

$$R_B = 4\% + 1.10R_M + e_B$$

$$\sigma_M = 25\%$$

$$\rho^2_A = 0.15 \text{ and } \rho^2_B = 0.30 \text{ (in relation to return on the market index)}$$

(The symbols are in standard notation)

The correlation coefficient between the returns on two stocks is

- (a) 0.12 (b) 0.21 (c) 0.35 (d) 0.79 (e) 0.92.

[< Answer >](#)

13. The following two types of securities are available in the market for investment.

Security	Return (%)	Standard deviation (%)
Gilt-edged security	5	0
Equity	20	26

If you are planning to invest Rs.10,00,000 to construct a portfolio with a standard deviation of 20%, the return on such portfolio is

- (a) Rs.5,000 (b) Rs.89,500
(c) Rs.1,65,500 (d) Rs.2,60,000 (e) Rs.2,65,000.

14. The data requirement under Single Index model is less than Markowitz model only if number of securities in a portfolio is [< Answer >](#)
- (a) Less than 4 (b) Greater than 4
(c) Less than 8 (d) Greater than 10 (e) Greater than 12.

15. If a portfolio manager consistently obtains a high Sharpe's measure, [< Answer >](#)
- I. The portfolio manager has exhibited above average forecasting ability.
II. The portfolio manager has exhibited above average selection ability.
III. The market supports market efficiency in strong form.
IV. Nothing could be concluded as it may be due to chance.
(a) Only (II) above (b) Only (IV) above
(c) Both (I) and (II) above (d) Both (II) and (III) above
(e) (I), (II) and (III) above.

16. Consider the following information pertaining to two stocks P and Q: [< Answer >](#)
- $R_P = 4\% + 0.8 R_M + e_P$
 $R_Q = -1\% + 1.3 R_M + e_Q$
 $\sigma_M = 25\%$; $\rho_P = 0.90$; $\rho_Q = 0.74$
- Total risks of stocks P and Q respectively are
- (a) $400(\%)^2$ and $1056.58(\%)^2$ (b) $493.83(\%)^2$ and $1928.87(\%)^2$
(c) $400(\%)^2$ and $1928.87(\%)^2$ (d) $493.83(\%)^2$ and $1056.58(\%)^2$
(e) $500(\%)^2$ and $1084.68(\%)^2$.

17. Consider the following information of the portfolio of a Fund Manager: [< Answer >](#)

Existing	
Market value (Rs.)	500 lakh
Effective duration	4.75 years
Target	
Effective duration	5.0 years
Futures contracts available on index	
Market value (Rs.)	1780
Multiple	100
Effective duration	3 months

The number of futures contract that the fund manager should buy to achieve the targeted effective duration is

- (a) 171 (b) 229 (c) 253 (d) 281 (e) 290. [< Answer >](#)
18. A zero-investment portfolio with a positive alpha could arise, if
- I. The expected return of the portfolio equals zero.
II. The capital market line is tangent to the opportunity set.
III. The law of one price remains unviolated.
IV. A risk free arbitrage opportunity exists.
(a) Only (II) above (b) Only (IV) above
(c) Both (II) and (III) above (d) (I), (II) and (IV) above
(e) All (I), (II), (III) and (IV) above.

19. You are managing a portfolio of Rs.1 million. Your target duration is 10 years and you can choose from two bonds: a zero-coupon bond with a maturity of 5 years and a perpetual bond, each currently yielding 5%. How much of each bond respectively will you hold in your portfolio? [< Answer >](#)
- (a) 0.5675 and 0.4325 (b) 0.6875 and 0.3125
(c) 0.7255 and 0.2745 (d) 0.8625 and 0.1375
(e) 0.9125 and 0.0875.

20. Assume that all stocks in the economy have a beta of 1 on the market index. Firm specific returns have a standard deviation of 30%. An analyst studies 20 stocks and finds that one-half have an alpha of 2% and the other half an alpha of -2%. He buys Rs.1 million of an equally weighted portfolio of the positive alpha stocks and shorts Rs.1 million of an equally weighted portfolio of the negative alpha stocks. The expected profit and the standard deviation of analysts' profit are respectively [< Answer >](#)
- (a) Rs.40,000 and 6.71% (b) Rs.20,000 and 7.71%

- (c) – Rs.20,000 and 8.71% (d) Rs.50,000 and 9.71%
 (e) Rs.60,000 and 10.71%.

[< Answer >](#)

21. The difference between the payoff diagrams of a straddle and strangle for a buyer is

- (a) The straddle is a more defensive strategy
 (b) The payoff for a straddle has a flat base
 (c) The payoff for a strangle has a flat base
 (d) Strangle is more profitable when prices are volatile on the downside
 (e) A straddle buyer does not assign equal probabilities to rise and fall in the prices of underlying security.

[< Answer >](#)

22. Consider the following information regarding a three-stock financial market that satisfies the single-index model.

Stock	Capitalization (Rs.)	Beta	Mean Excess Return (%)	Standard Deviation (%)
X	1,50,00,000	1.2	10	40
Y	97,00,000	0.2	2	30
Z	68,00,000	1.7	17	50

The single factor in this economy is perfectly correlated with the value-weighted index of the stock market. If the standard deviation of market portfolio is 25%, the mean excess return of the market portfolio and the covariance between stock Y and the market portfolio respectively are

- (a) 8.50% and $625(\%)^2$ (b) 9.50% and $225(\%)^2$
 (c) 9.05% and $125(\%)^2$ (d) 10.50% and $225(\%)^2$
 (e) 10.05% and $125(\%)^2$.

[< Answer >](#)

23. The following information is available for a portfolio:

Return on the portfolio	=	16.52%
S.D of the portfolio returns	=	23.68%
Return on the market index	=	12.62%
S.D of the market index returns	=	17.34%
Risk-free rate of return	=	5%

The return due to net selectivity of the portfolio is

- (a) 1.11% (b) 1.99% (c) 5.94% (d) 6.11% (e) 6.99%.

[< Answer >](#)

24. In equilibrium, the marginal price of risk for a risky security must be

- I. Less than the marginal price of risk for the market portfolio.
 II. Greater than the marginal price of risk for the market portfolio.
 III. Equal to the marginal price of risk for the market portfolio.
 IV. Adjusted by its' degree of nonsystematic risk.
 (a) Only (I) above (b) Only (II) above
 (c) Only (III) above (d) Only (IV) above
 (e) Both (III) and (IV) above.

[< Answer >](#)

25. According to Bielard, Biehl and Kaiser model of investor classification, straight arrows are

- (a) The confident and careful type of investors
 (b) Swayed too much by the trend and do not have any expertise or opinion about investment avenues
 (c) Both anxious and careful type of investors
 (d) Those type of investors who are half way between complete confidence and anxiety and extreme carefulness and impetuosity
 (e) Gamblers and always interested in big bets.

[< Answer >](#)

26. Which of the following statements are **true** in the context of bond laddering strategy?

- I. Bond ladder means buying bonds scheduled to mature at several different dates in the future, rather than all at the same time.
 II. A bond laddering is an effective tool for some one who needs to ride the yield curve.
 III. In bond laddering each group of bonds represents a rung on the investment maturity ladder.
 IV. Bond laddering is an active bond management strategy.
 (a) Both (I) and (IV) above (b) Both (I) and (III) above
 (c) Both (II) and (IV) above (d) Both (III) and (IV) above
 (e) Both (II) and (III) above.

[< Answer >](#)

27. Consider two well diversified portfolios A and B. The expected return on portfolio A, $E(r_A) = 14\%$ and the expected return on portfolio B, $E(r_B) = 14.8\%$. Economy has only one factor represented by Beta(β). If $\beta_A = 1$ and $\beta_B = 1.1$, the risk-free rate of return is expected to be
- (a) 4.0% (b) 5.4% (c) 6.0% (d) 6.4% (e) 7.0%.

[< Answer >](#)

28. The utility function for Mr. Shailendra is given by $u(r) = r - r^{-1/3}$, where 'r' is the expected return. He is considering investment in one of the following portfolios:

Portfolio A		Portfolio B		Portfolio C	
Expected return (%)	Probability	Expected return (%)	Probability	Expected return (%)	Probability
7	0.40	8	0.20	9	0.10
8	0.20	9	0.20	11	0.10
9	0.20	10	0.20	12	0.20
10	0.10	12	0.10	13	0.30
12	0.10	13	0.30	14	0.30

If Mr. Shailendra is a moderately risk averse investor, and the risk tolerance level of a moderate risk averse investor is 50%. Which of the following statements is/are **true**?

- (a) He should invest in portfolio A only
(b) He should invest in portfolio B only
(c) He should invest in portfolio C only
(d) He should invest 25% in portfolio A, 50% in portfolio B and 25% in portfolio C
(e) He should invest in all the three portfolios in equal proportions.

[< Answer >](#)

29. If the correlation coefficient between the returns on two stocks is perfectly positive, then

- I. There is no gain from diversification.
II. The efficient frontier is the curved line between the two stocks.

$$\frac{E(R_A) - E(R_B)}{\sigma_A - \sigma_B}$$

- III. The slope of efficient frontier of the stocks is equal to $\frac{E(R_A) - E(R_B)}{\sigma_A - \sigma_B}$.
IV. The covariance between the returns on two stocks will be negative.
(a) Only (I) above (b) Only (IV) above
(c) Both (I) and (III) above (d) Both (II) and (IV) above
(e) All (I), (II), (III) and (IV) above.

[< Answer >](#)

30. What is the expected return of a zero beta portfolio?

- (a) The risk-free rate (b) Zero rate of return
(c) A negative rate of return (d) The market rate of return
(e) None of the above.

END OF SECTION A

Section B : Problems (50 Marks)

This section consists of questions with serial number 1 – 5.

Answer **all** questions.

Marks are indicated against each question.

Detailed workings should form part of your answer.

Do not spend more than 110 - 120 minutes on Section B.

1. A bond portfolio manager of Sundaram Finance is building a portfolio of bonds from three companies: HLL, Infosys and Ranbaxy. These bonds will be used to fund the out flow of a close-ended scheme scheduled to expire after 5 years. All the bonds have a par value of Rs100. All the bonds pay coupons annually, except Ranbaxy, which pays semi-annually.

Bonds	Coupon (%)	Maturity (in years)	Current market price (Rs.)
HLL	12.50	10	103
Infosys	13.60	7	108
Ranbaxy	11.85	5	101

The bond portfolio manager has been instructed by the company to keep 40% of the portfolio investment in HLL.

You are **required** to

- Calculate the proportions of investment to be made in the bonds of Infosys and Ranbaxy to immunize the portfolio. Ignore the taxes.
- Comment whether the portfolio arrived in (a) is perfectly immunized. Substantiate your answer.

(8 + 2 = 10 marks) [< Answer >](#)

2. Mr. Rishab Singh is trying to construct an optimal portfolio with least risk and a target return of 16% p.a. from the three stocks namely Dr.Reddy's Labs, Gujarat Ambuja and I-Flex. The relevant market data is given as under:

Stock	Expected monthly return	Standard deviation	Variance-covariance matrix (%) ²		
			Dr.Reddy's Labs	Gujarat Ambuja	I-Flex
Dr.Reddy's Labs	18%	17%	289	90	140
Gujarat Ambuja	20%	20%	90	400	195
I-Flex	13%	15%	140	195	225

You are **required** to calculate the proportions of funds to be invested in each of the three securities by Mr. Singh so as to generate a return of 16% with least possible risk.

(12 marks) [< Answer >](#)

3. The market is expecting a return of 15% and the standard deviation of returns of the market is 15%. Treasury Bills are trading at 6% in market.

Assuming that capital asset pricing model holds good, you are **required** to

- Determine the expected return on an individual security with a standard deviation of 50% and beta of 2.
- Determine the expected return and beta of an efficient portfolio with a standard deviation equal to market standard deviation.
- Calculate the expected return and beta of an efficient portfolio with a standard deviation equal to twice the standard deviation of the market.
- Given your answers above, explain what type of risky assets can SML be used for and what type of risky assets can CML be used for.

(2 + 2 + 2 + 2 = 8 marks) [< Answer >](#)

4. Mr. Lunia is expecting a great upward potential in the stock market and is planning to take the advantage of it. However, he is not in a position to afford substantial stock market losses and cannot run the risk of a stock market collapse, which he thinks is a possibility. Mr. Jitendra, Investment Advisor of Mr. Lunia suggests him to adopt a protective put position, which involves buying the market index and buying put option on the market index with three-month maturity and with an exercise price of Rs.780. The index is current selling at an equivalent rupee

value of 900. However, Mr. Prakash, a friend of Mr. Lunia, on the other hand suggests him to buy a three-month call option on the index with an exercise price of Rs.840 and buy three-month T-bills with the face value of Rs.840, which are currently selling at Rs.810. You are **required** to

- Draw the payoffs for each of these strategies as a function of the index value in three months and also determine which portfolio requires a greater initial outlay.
- Prepare the pay-off for each portfolio, if the equivalent rupee values of the index in three months are Rs.700, Rs.840, Rs.900 and Rs.960, based on the information given below and also draw the payoff diagram for each portfolio as a function of current market price of index on a single graph.

	Exercise Price (Rs.)	Market Price (Rs.)
Index	-	900
Call option on index	840	120
Put option on index	780	6

- Based on the pay-off arrived at in part (b) above, determine which strategy is riskier and which should have a higher beta.
- Explain why the data for the securities given in part (b) do not violate the put-call parity relationship.

(5 + 5 + 1+1 = 12 marks) [< Answer >](#)

- A global equity manager is assigned to select stocks from a universe of large stocks throughout the world. The manager will be evaluated by comparing the returns on a portfolio so constructed to the returns on the Morgan Stanley Capital International (MSCI) World Market Portfolio. He is free to hold stocks from various countries in whatever propositions he finds desirable. Results for a given month are given in the following table.

Country	Weight in MSCI Index	Manager's Weight	Manager's Return In a given Country (%)	Return of Stock Index for that Country (%)
U.K.	0.15	0.30	20	12
Japan	0.30	0.10	15	15
U.S.	0.45	0.40	10	14
Germany	0.10	0.20	5	12

You are **required** to

- Calculate the total value added by the decision of the manager during this period.
- Calculate the value added (or subtracted) by his country allocation decisions.
- Calculate the value added from his stock selection ability within countries. Confirm that the sum of the contributions to value added from his country allocation decisions plus security selection decisions equals total over-or underperformance.

(2 + 3 + 3 = 8marks) [< Answer >](#)

END OF SECTION B

Section C : Applied Theory (20 Marks)

This section consists of questions with serial number 6 - 7.
 Answer **all** questions.
 Marks are indicated against each question.
 Do not spend more than 25 -30 minutes on section C.

- Arbitrage pricing theory has wide applications in corporate finance and investment management. How can it be used for active and passive portfolio management? Elucidate.
- The risky assets tend to fluctuate in value, which in turn leads to the changes in values of the portfolio composed of these risky assets. Thus, it becomes important to rebalance the portfolio at regular intervals. The dynamic strategies for asset allocation lay down explicit rules for rebalancing the portfolio. Discuss some of the dynamic

(6 marks) [< Answer >](#)

END OF SECTION C

END OF QUESTION PAPER

Suggested Answers

Portfolio Management and Mutual Funds – I (251) : July-2005

Section A : Basic Concepts

1. Answer : (b) [< TOP >](#)
Reason : Expected return from Equities = $0.4 \times 50,000 + 0.2 \times 0 + 0.4 \times -30,000$
= Rs.8,000
Expected return from Treasury bills = Rs.4,000
Expected return from Equities – Expected return from Treasury bills =
Rs.4,000.
2. Answer : (b) [< TOP >](#)
Reason : Statement (I) & (II) are not correct as these will entail linear payoff.
3. Answer : (b) [< TOP >](#)
Reason : Safety first model advocates that decision makers do not use mathematical model such as utility analysis and instead focus on reducing bad outcome. Hence (b) is the answer.
4. Answer : (e) [< TOP >](#)
Reason : Pure cash matching strategy of portfolio dedication can be implemented very easily by using zero coupon bonds because balancing of coupon with liabilities doesn't arise and only fixed value of zero coupon bond at different points of time with respective liability should be achieved.
5. Answer : (b) [< TOP >](#)
Reason : Change in YTM = $13.10 - 13.50 = -0.40\%$
Change in price of the bond = $\frac{\text{Duration}}{1 + \text{YTM}} \times \text{Change in YTM}$
= $\frac{-5}{1.135} \times -0.40 = 1.76\%$.
6. Answer : (d) [< TOP >](#)
Reason : The α of stock X = $R_x - (R_f + \beta_x (R_m - R_f))$
= $12\% - (6\% + 0.8 (12\% - 6\%))$
= $12\% - 10.8\% = 1.2\%$
The α of stock Y = $R_Y - (R_f + \beta_Y (R_m - R_f))$
= $14\% - (6\% + 1.5 (12\% - 6\%))$
= $14\% - 15\% = -1\%$
Stock X would be a good addition since it has positive α .
7. Answer : (c) [< TOP >](#)

Reason : An investor expecting interest rate to decline should shorten the duration of bond so that interest rate volatility will be minimal and hence he should swap short-term bonds to long bond to reduce the duration.

8. Answer : (c) [< TOP >](#)

Reason : A bullish vertical spread with calls will involve buying an in-the-money call and selling an out-of-the-money call of the same term to expiration.

Buy a call option with exercise price of Rs.35 @ Rs.4.00
 Sell a call option with exercise price of Rs.50 @ Rs.2.50
 Initial outlay Rs.1.50
 If stock price on expiration increases to Rs.60,
 Profit from buying call option = Rs.60 – Rs.35 = Rs.25
 Loss on selling call option = Rs.60 – Rs.50 = Rs.10
 Net payoff after considering initial outlay = 25 – 10 – 1.50 = Rs.13.50.

9. Answer : (c) [< TOP >](#)

Reason : In spending phase of life cycle model, the living expenses are not more covered by an earned salary but rather than accumulated assets.

10. Answer : (d) [< TOP >](#)

Reason : Intuitively, we note that since all stocks have the same expected rate of return and standard deviation, we wish to choose the stock that will result in lowest risk. This will be the one with the lowest correlation with stock A. Among the given stocks, stock E has the lowest correlation with A i.e., 0.30.

11. Answer : (d) [< TOP >](#)

Reason : The dollar-cost averaging plan forces the investors to make decisions that they may otherwise be unwilling to take. The decision is of making investments periodically.

So, statement (I) is not correct.

Dollar cost averaging plan generally gives best results when undertaken over a long period of time. So statement (III) is correct.

In a variable ratio plan, the ratio of the aggressive portfolio to the conservative portfolio changes with change in the value of the aggressive portfolio. This will result in the investment in stocks increasing when stock prices are low and decreasing when stock prices are high. So statement (II) is correct. The success of variable-ratio plan depends on the accuracy of the forecasts. So statement (IV) is incorrect.

Hence, correct answer is (d).

12. Answer : (b) [< TOP >](#)

Reason : Covariance between the returns of A and B is given by

$$\begin{aligned}\text{Cov}_{A,B} &= \beta_A \beta_B \sigma_M^2 \\ &= 0.65 \times 1.1 \times 625 \\ &= 446.875\end{aligned}$$

$$\text{The correlation coefficient } \rho_{A,B} = \frac{\text{Cov}_{A,B}}{\sigma_A \sigma_B}$$

$$\sigma_A^2 = \beta_A^2 \sigma_M^2 / \rho_A^2 = \frac{0.65^2 \times 25^2}{0.15} = 1760.42$$

$$\sigma_A = 41.96\%$$

Similarly

$$\sigma_B^2 = \beta_B^2 \sigma_M^2 / \rho_B^2 = \frac{1.1^2 \times 25^2}{0.30} = 2520.83$$

$$\sigma_B = 50.21\%$$

$$\therefore \rho_{A,B} = \frac{446.875}{41.96 \times 50.21} = 0.212$$

So, the correct answer is (b)

13. Answer : (c)

[< TOP >](#)

Reason : $\sigma_p^2 = W_f^2 \sigma^2 + W_r^2 \sigma^2 + 2 W_f W_r \sigma_f \sigma_r \rho_{rf}$

Since, standard deviation of Gilt-edged securities is 0 and its' correlation with the equity is also 0, the above formula will be reduced to

$$\sigma_p^2 = W_r^2 \sigma^2$$

$$\sigma_p = W_r \sigma$$

$$20\% = 26\% W_r$$

$$W_r = 20\%/26\% = 0.77$$

$$R_p = W_f R_f + W_r R_r = 0.23 \times 5\% + 0.77 \times 20\% = 16.55\%$$

$$\text{Return (in rupees)} = 16.55\% \times 10,00,000 = \text{Rs.} 1,65,500.$$

14. Answer : (b)

[< TOP >](#)

Reason : Data requirement under single index model = $3n + 2$

$$\text{Data requirement under Markowitz model} = \frac{n(n+3)}{2}$$

$$3n + 2 < \frac{n(n+3)}{2}$$

$$6n + 4 < n^2 + 3n$$

$$0 < n^2 - 3n - 4$$

$$n^2 - 3n - 4 > 0$$

$$n(n-4) + 1(n-4) > 0$$

$$(n-4)(n+1) > 0$$

$$n > 4, -1$$

n should be always greater than 4.

15. Answer : (c)

[< TOP >](#)

Reason : Sharpe's Ratio = $\frac{R_i - R_f}{\sigma_i}$ i.e., excess return over total risk. Consistent outperformance based on this ratio indicates proper stock/asset selection, which reduces the proportion of unsystematic risk in portfolio. It further indicates better forecasting ability to outperform the market for the level of risk taken.

16. Answer : (b)

[< TOP >](#)

Reason : Total risk of stock P:

$$\text{Coefficient of determination of stock P with the market} = 0.90 \times 0.90 =$$

$$0.81$$

$$\text{Systematic risk of stock P} = \beta^2 \times \sigma_M^2 = 0.8^2 \times 25^2 = 400(\%)^2$$

$$\text{Total risk of stock P} = (400/0.81) = 493.83 (\%)^2$$

Total risk of stock Q:

$$\text{Coefficient of determination of stock Q with the market} = 0.74 \times 0.74 =$$

$$0.5476$$

$$\text{Systematic risk of stock Q} = \beta^2 \times \sigma_M^2 = 1.3^2 \times 25^2 = 1056.25(\%)^2$$

$$\text{Total risk of stock Q} = (1056.25/0.5476) = 1928.87(\%)^2$$

17. Answer : (d)

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Reason : The approximate number of contracts (X) necessary to achieve the targeted duration for the portfolio is given by;

$$X = \frac{(D_T - D_I) P_I}{D_F P_F}$$

Where X = Approximate number of futures contracts
 D_T = Target effective duration for the portfolio
 D_I = Initial effective duration of the portfolio
 P_I = Initial market value of the portfolio
 D_F = Effective duration of the futures contract
 P_F = Market value of the futures contract

$$X = \frac{(5 - 4.75) 500}{0.25 \times \frac{1780 \times 100}{1,00,000}} = 280.898$$

i.e, 281 contracts.

18. Answer : (b) [< TOP >](#)

Reason : A zero-investment portfolio with a positive alpha could arise, if a risk free arbitrage opportunity exists.

19. Answer : (b) [< TOP >](#)

Reason : The duration of the perpetuity is $= (1 + YTM/YTM) = 1.05/0.05 = 21$ years.

Let w be the weight of the zero-coupon bond. Then we can find w by solving the following equation

$$W \times 5 + (1-w) \times 21 = 10$$

$$21 - 16w = 10$$

$$w = 11/16 = 0.6875$$

Therefore, your portfolio would be 0.6875 or 68.75% invested in the zero coupon bond and 0.3125 or 31.25% in the perpetuity.

20. Answer : (a) [< TOP >](#)

Reason : Shorting equally the 10 negative-alpha stocks and investing the proceeds equally in the 10 positive-alpha stocks eliminates the market exposure and creates a zero-investment portfolio. The expected excess rupee return is $10,00,000 \times 0.02 + (-10,00,000) \times (-0.02) = \text{Rs.} 40,000$

The beta of this portfolio is zero, because, it is equally weighted, with half of the weights negative and all betas equal to one. Thus, the systematic component of the total risk is also zero. The variance of the analyst's profit is not zero, however, since this portfolio is not well diversified. Total variance amounts to the non-systematic risk.

$$\sigma^2 = \sigma^2_{(ep)} = \sigma^2_{(ei)}/n = 30^2/20 = 45$$

$$\sigma = 6.71\%.$$

21. Answer : (c) [< TOP >](#)

Reason : Among the given alternatives, the only correct statement is that the payoff diagram for strange has a flat base and hence (c) is answer.

22. Answer : (c) [< TOP >](#)

Reason : Total market capitalization = Rs.1,50,00,000 + Rs.97,00,000 + Rs.68,00,000

$$= \text{Rs.} 3,15,00,000$$

$$\begin{aligned} \text{Mean excess return} &= (1,50,00,000/3,15,00,000) 10\% + \\ & (97,00,000/3,15,00,000) 2\% + (68,00,000/3,15,00,000) \\ & 17\% = 9.0457\% = 9.05\% \text{ (appro)} \end{aligned}$$

The covariance between stock Y and the index portfolio equals

$$\text{Cov}(R_Y, R_M) = \beta_Y \sigma_M^2 = 0.2 \times 25^2 = 125(\%)$$

23. Answer : (a) [< TOP >](#)

Reason : Return due to Net selectivity

$$= R_i - \left[R_f + (R_M - R_f) \frac{\sigma_P}{\sigma_M} \right]$$

Substituting the given values, we get

Return due to net-selectivity

$$= 16.52 - \left[5 + (12.62 - 5) \times \frac{23.68}{17.34} \right]$$

$$= 1.1139\%$$

Hence, the correct answer is (a).

24. Answer : (c)

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Reason : In equilibrium, the marginal price of risk for a risky security must be equal to the marginal price of risk for the market portfolio. Hence, alternative (c) is answer.

25. Answer : (d)

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Reason : (a) Individualists are careful and confident type of investors.

(b) Celebrities are very strongly influenced by the trends and generally do not have any expertise or opinion about the various possible investment avenues.

(c) Guardians are very risk averse and therefore always very anxious and careful.

(d) Straight arrows are halfway between complete confidence and anxiety and extreme carefulness.

(e) Adventurers are risk lovers and generally go for big bets.

26. Answer : (b)

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Reason : Bond laddering is a passive bond management strategy where the purpose is to match the assets with liability in the terms of maturity. Here the effort is not made to take advantage of change in yield curve.

27. Answer : (c)

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$$\text{Reason : } \Sigma (r_A) = r_f + \beta_A (r_m - r_f)$$

$$14 = r_f + 1 (r_m - r_f) \dots\dots\dots 1$$

$$\Sigma (r_B) = r_f + \beta_B (r_m - r_f)$$

$$14.8 = r_f + 1.1 (r_m - r_f) \dots\dots\dots 2$$

$$\text{From equation 1 } r_m - r_f = 14 - r_f$$

Substituting this value of $(r_m - r_f)$ in equation 2 we get

$$14.8 = r_f + 1.1 (14 - r_f)$$

$$14.8 = r_f + 15.4 - 1.1 r_f$$

$$0.1 r_f = 0.6 \Rightarrow r_f = 6\%$$

28. Answer : (c)

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Reason : We have to calculate the expected utility of these investments for investor.

$$\text{Expected utility} = \text{Return} - \frac{(\text{S.D.})^2}{\text{Risk tolerance}}$$

Investment A

$$\text{Expected return} = 7 \times 0.40 + 8 \times 0.20 + 9 \times 0.20 + 10 \times 0.10 + 12 \times 0.10 = 8.4\%$$

$$\text{S.D. of return} = [(7 - 8.4)^2 \times 0.40 + (8 - 8.4)^2 \times 0.20 + (9 - 8.4)^2 \times 0.20 + (10 - 8.4)^2 \times 0.10 + (12 - 8.4)^2 \times 0.10]^{1/2} = \sqrt{2.44} = 1.56$$

$$\text{Expected utility} = 8.4 - \frac{(1.56)^2}{50} = 8.35\%$$

Investment B

$$\text{Expected return} = 8 \times 0.20 + 9 \times 0.20 + 10 \times 0.20 + 12 \times 0.10 + 13 \times 0.30 = 10.5\%$$

$$\begin{aligned} \text{S.D. of return} &= [(8 - 10.5)^2 \times 0.20 + (9 - 10.5)^2 \times 0.20 + (10 - 10.5)^2 \\ &\times 0.20 + (12 - 10.5)^2 \times 0.10 + (13 - 10.5)^2 \times 0.30]^{1/2} \\ &= \sqrt{3.85} = 1.962\% \end{aligned}$$

$$\text{Expected utility} = 10.5 - \frac{(1.962)^2}{50} = 10.423\%$$

Investment C

$$\text{Expected return} = 9 \times 0.10 + 11 \times 0.10 + 12 \times 0.20 + 13 \times 0.30 + 14 \times 0.30 = 12.5\%$$

$$\begin{aligned} \text{S.D. of return} &= [(9 - 12.5)^2 \times 0.10 + (11 - 12.5)^2 \times 0.10 + (12 - 12.5)^2 \\ &\times 0.20 + (13 - 12.5)^2 \times 0.30 + (14 - 12.5)^2 \times 0.30]^{1/2} \\ &= \sqrt{2.25} = 1.5\% \end{aligned}$$

$$\text{Expected utility} = 12.5 - \frac{(1.5)^2}{50} = 12.455\%$$

As the expected utility for investment C is highest a moderately risk averse investor should invest in C.

29. Answer : (c)

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Reason : For benefit of diversification.

$$\rho_{AB} < \frac{\sigma_A}{\sigma_B} \text{ where } \sigma_A < \sigma_B$$

Clearly if $\rho_{AB} = +1$

The above condition cannot be fulfilled and hence no benefit of diversification. The covariance between two stock's return will be

$$\text{positive. The slope of efficient frontier of the stock is } \frac{E(R_A) - E(R_B)}{\sigma_A - \sigma_B}.$$

30. Answer : (e)

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Reason : Due to absence of true risk-less return, the CAPM is modified as the efficient frontier is arrived by joining global minimum – variance portfolio (MVP), and portfolio z. The MVP which is least sensitive with market is known as zero beta portfolio and return, on this is the same (r_z) which replace risk free return (r_f) of CAPM.

Section B : Problems

1. a. Yield to Maturity for HLL

$$\text{Rs. } 103 = 12.5 \text{ PVIFA } (R_{\text{HLL}}, 10) + 100 \text{ PVIF } (R_{\text{HLL}}, 10)$$

$$@ R_{\text{HLL}} = 12\%$$

$$= 12.5 \times 5.65 + 100 \times 0.322 = \text{Rs. } 102.825 \approx \text{Rs. } 103$$

Yield to Maturity for Infosys

$$\text{Rs. } 108 = 13.6 \text{ PVIFA } (R_i, 7) + 100 \text{ PVIF } (R_i, 7)$$

$$@ R_i = 12\%$$

$$= 13.6 \times 4.56 + 100 \times 0.4523 = 107.246 \approx \text{Rs. } 108$$

Yield to Maturity for Ranbaxy

$$V = \sum_{t=1}^{2n} \frac{I/2}{(1 + K_d/2)^t} + \frac{F}{(1 + K_d/2)^{2n}}$$

$$= I/2 \text{ PVIFA}_{(K_d/2, 2n)} + F \times \text{PVIF}_{(K_d/2, 2n)}$$

On substituting values

$$101 = \frac{11.85}{2} \text{ PVIFA}_{(K_d/2, 2n)} + 100 \times \text{PVIF}_{(K_d/2, 2n)}$$

Consider $K_R = 12\%$

$$\begin{aligned} \text{RHS} &= 5.925 \times \text{PVIFA}_{(6\%, 10)} + 101 \times \text{PVIF}_{(6\%, 10)} \\ &= 5.925 \times 7.36 + 100 \times 0.5584 = 99.45 \approx \text{Rs. } 101 \end{aligned}$$

Therefore $R_R \approx 12\%$

We have the short cut formula for duration,

$$D = \frac{r_c}{r_d} \text{ PVIFA}(r_d, n) \times (1 + r_d) + \left(1 - \frac{r_c}{r_d}\right) \times n$$

Where, r_c = current yield of the bond

r_d = yield to maturity

n = term to maturity

For HLL

$$\begin{aligned} D_{\text{HLL}} &= \left[\frac{\left(\frac{12.5}{103}\right)}{0.12} \right] \times \text{PVIFA}(12\%, 10) \times (1 + 0.12) + \left[1 - \frac{\left(\frac{12.5}{103}\right)}{0.12} \right] \times 10 \\ &= 6.4 - 0.11 = 6.29 \text{ years} \end{aligned}$$

For Infosys

$$\begin{aligned} D_i &= \left[\frac{\left(\frac{13.6}{108}\right)}{0.12} \right] \times \text{PVIFA}(12\%, 7) \times (1 + 0.12) + \left[1 - \frac{\left(\frac{13.6}{108}\right)}{0.12} \right] \times 7 \\ &= 5.36 - 0.35 = 5.01 \text{ years} \end{aligned}$$

For Ranbaxy with semi-annual coupon payment

$$D_R = \left[\frac{\left(\frac{11.85}{2} \right) / 101}{0.06} \right] \times \text{PVIFA}(6\%, 10) \times (1.06) + \left[1 - \frac{\left(\frac{11.85}{2} \right) / 101}{0.06} \right] \times 10$$

$$= 7.63 + 0.22 = 7.85 \text{ half yearly periods}$$

$$\Rightarrow D_R = 3.93 \text{ years}$$

Now consider the proportions invested in HLL, Infosys and Ranbaxys' bonds are x_1, x_2, x_3 respectively

Given, $x_1 = 0.4$

$$0.4 \times D_{HLL} + x_2 D_I + x_3 D_R = 5$$

$$0.4 \times 6.29 + x_2 \times 5.01 + x_3 \times 3.93 = 5$$

$$2.516 + 5.01 x_2 + 3.93 x_3 = 5$$

$$5.01 x_2 + 3.93 x_3 = 2.484$$

$$x_2 + 0.784 x_3 = 0.4958 \quad \dots\dots\dots(I)$$

$$\text{Further } x_1 + x_2 + x_3 = 1$$

$$\text{i.e. } x_2 + x_3 = 1 - 0.40 = 0.60 \quad \dots\dots\dots(II)$$

$$\text{From (I) and (II) } 0.216 x_3 = 0.1042$$

$$\Rightarrow x_3 = 0.4824$$

$$x_2 = 1 - 0.4 - 0.4824 = 0.1176 \text{ i.e. } 11.76\%$$

- b. No, for the coupon paying bond duration changes as the interest rates change. The higher the coupon, the more the sensitivity. Convexity measures this sensitivity.

For perfect immunization following conditions are pre-requisite:

- Investment made in default free bonds
- Adopting buy and hold strategy
- Instantaneous changes in interest rates
- The term structure of interest rate is flat
- The duration of the bond or portfolio of bonds is matched with investment horizon.

The above conditions can hardly exist in reality. Therefore, perfect immunization of investment is not possible.

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2. Assume the proportion invested in Dr.Reddys' Labs, Gujarat Ambuja and I-Flex are X_A, X_B and X_C respectively. Minimize (Total risk of portfolio)

$$Z = 289 X_A^2 + 400 X_B^2 + 225 X_C^2 + (2 \times 90 \times X_A X_B) + (2 \times 140 \times X_A X_C) + (2 \times 195 X_C X_B) \quad (I)$$

Subject to:

$$18X_A + 20X_B + 13X_C = 16 \quad (II)$$

$$X_A + X_B + X_C = 1 \quad (III)$$

We have to incorporate the return constraint (II) as part of the objective function (I) using the langrarian constraint λ . For this, first we express X_C in terms of X_A and X_B as $(1 - X_A - X_B)$, using constraint (III) in both the equations (I) and (II) and this replacement will transform the equation (I) into two variable equations.

$$\begin{aligned} Z &= 289 X_A^2 + 400 X_B^2 + 225 (1 - X_A - X_B)^2 + (2 \times 90 \times X_A X_B) + 2 \times 140 X_A \times (1 - X_A - X_B) \\ &\quad + 2 \times 195 X_B (1 - X_A - X_B) \\ &= 289 X_A^2 + 400 X_B^2 + 225 (1 + X_A^2 + X_B^2 + 2X_A X_B - 2X_A - 2X_B) + 280 X_A (1 - X_A - X_B) \\ &\quad + 390 X_B (1 - X_A - X_B) + 180 X_A X_B \\ &= 289 X_A^2 + 400 X_B^2 + 225 + 225 X_A^2 + 225 X_B^2 + 450 X_A X_B - 450 X_A - 450 X_B + 280 X_A \\ &\quad - 280 X_A^2 - 280 X_A X_B + 390 X_B - 390 X_A X_B - 390 X_B^2 + 180 X_A X_B \\ &= 289 X_A^2 + 225 X_A^2 - 280 X_A^2 + 400 X_B^2 + 225 X_B^2 - 390 X_B^2 + 450 X_A X_B - 280 X_A X_B \\ &\quad - 390 X_A X_B + 180 X_A X_B - 450 X_A + 280 X_A - 450 X_B + 390 X_B + 225 = 0 \end{aligned}$$

$$= 234 X_A^2 + 235 X_B^2 - 40 X_A X_B - 170 X_A - 60 X_B + 225 = 0$$

Expressing X_C in terms of X_A and X_B equation II above is modified as

$$18X_A + 20X_B + 13(1 - X_A - X_B) = 16$$

$$18X_A + 20X_B + 13 - 13X_A - 13X_B = 16$$

$$= 5X_A + 7X_B = 3$$

$$\text{or } 5X_A + 7X_B - 3 = 0 \quad (\text{IV})$$

Using lagrangian multiplier, the revised objective function is

$$Z = 234 X_A^2 + 235 X_B^2 - 40 X_A X_B - 170 X_A - 60 X_B + 225 + \lambda (5X_A + 7X_B - 3)$$

$$= 234 X_A^2 + 235 X_B^2 - 40 X_A X_B - 170 X_A - 60 X_B + 225 + 5X_A\lambda + 7X_B\lambda - 3\lambda$$

Now for optimization setting first derivatives with respect to X_A , X_B & λ equal to zero we get

$$\frac{\partial Z}{\partial X_A} = 468X_A - 40X_B - 170 + 5\lambda = 0 \quad (\text{V})$$

$$\frac{\partial Z}{\partial X_B} = 470X_B - 40X_A - 60 + 7\lambda = 0 \quad (\text{VI})$$

$$\frac{\partial Z}{\partial \lambda} = 5X_A + 7X_B - 3 = 0 \quad (\text{VII})$$

$$\text{From (V)} \times 7 \text{ we get } 3276X_A - 280X_B + 35\lambda = 1190$$

$$\begin{array}{rcl} \& \text{(VI)} \times 5 \text{ we get} & -200X_A + 2350X_B + 35\lambda = 300 \\ & + & - & - \end{array}$$

$$\text{On subtracting } 3476X_A - 2630X_B = 890 \quad (\text{VIII})$$

Taking (VII) and (VIII) we have:

$$3476X_A - 2630X_B = 890$$

$$5X_A + 7X_B = 3$$

$$\text{From (VIII)} \times 5 \text{ we get } 17380X_A - 13150X_B = 4450$$

$$\& \text{(VII)} \times 3476 \text{ we get } 17380X_A + 24332X_B = 10428$$

$$\begin{array}{rcl} \text{On subtracting} & & -37482X_B = -5978 \\ & & X_B = 15.95\% \end{array}$$

$$5X_A + 7X_B = 3$$

$$3 - 7(0.1595)$$

$$X_A = \frac{5}{5}$$

$$X_A = 37.67\%$$

$$X_C = 1 - 0.1595 - 0.3767$$

$$= 46.38\%$$

$$R_p = 0.3767 \times 18 + 0.1595 \times 20 + 13 \times 0.4638$$

$$= 6.78 + 3.19 + 6.03 = 16.00\%$$

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3. a. SD of returns on an individual security is not relevant for determining expected return according to CAPM, since only systematic risk adds to the total portfolio risk. Hence, only β matters.

$$\text{Expected return} = R_f + \beta (R_m - R_f) = 6\% + 2 \times (15\% - 6\%) = 24\%$$

- b. According to CAPM, all efficient portfolios are the combinations of the market portfolio and the risk free rate. Hence, expected return on an efficient portfolio =

$$R_f + ((R_m - R_f) / \sigma_m) \times \sigma_p = 6\% + ((15\% - 6\%) / 15\%) 15\% = 15\%$$

Because the portfolio has the standard deviation equal to standard deviation of market, it must be the market portfolio. Market portfolio has the beta =1, by definition, Using this information expected

return on Portfolio can also be calculated as $R_f + \beta (R_m - R_f) = 6\% + 1 \times (15\% - 6\%) = 15\%$

- c. Since the portfolio is efficient and $\sigma_p = 2\sigma_m = 30\%$

Expected return = $R_f + ((R_m - R_f) / \sigma_m) \sigma_p$

$$= 6\% + ((15\% - 6\%) / 15\%) \times 30\% = 24\%$$

Note that this portfolio places 200% in the market and -100% in the risk free asset. Since, this portfolio moves 2 for 1 with the market, the β on this portfolio is equal to 2. We can also confirm this using SML equation

$$R_f + \beta_p (R_m - R_f) = 6\% + 2 \times (15\% - 6\%) = 24\%$$

- d. SML can give the proper expected return for any risky asset, whether it is an individual security (that is inefficient by itself) or an efficient risky portfolio. However, CML can be used only for efficient portfolios. This is clear once we recognize that if we used CML equation to get the expected return on individual security from a with a standard deviation of 0.5, we would have gotten the following:

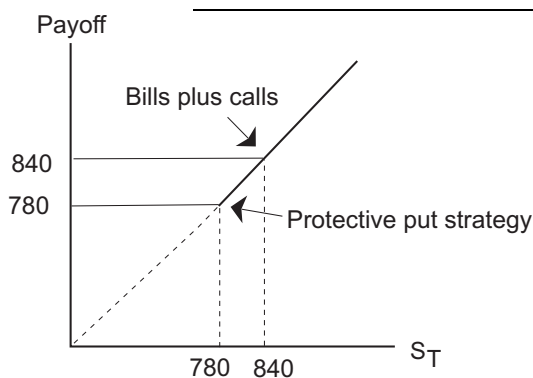
$$R_p = 6\% + ((15\% - 6\%) / 15\%) \times 50\% = 36\%$$

Thus, expected return from CML equation is too high for the individual security. As we saw in part (a), expected return for security using SML equation is only 24%. Part of its total risk (0.5) gets diversified away and only the systematic i.e., beta related risk is priced by SML. Thus, according to CAPM, expected return depends on the systematic risk only.

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4. a.

Protective Put	$S_T < 780$	$S_T > 780$
Index	S_T	S_T
Put	$780 - S_T$	0
Total	780	S_T
Bills and Call	$S_T < 840$	$S_T > 840$
Bills	840	840
Call	0	$S_T - 840$
Total	840	S_T



The bills plus call strategy has a greater payoff for some values of S_T and never a lower payoff. Since its payoffs are always at least as attractive and sometimes greater, it must be more costly to purchase.

- b. The initial cost of the index plus put position is

Market price of index	=	Rs.900
Market price of put option	=	Rs.6
Initial cost	=	Rs.906

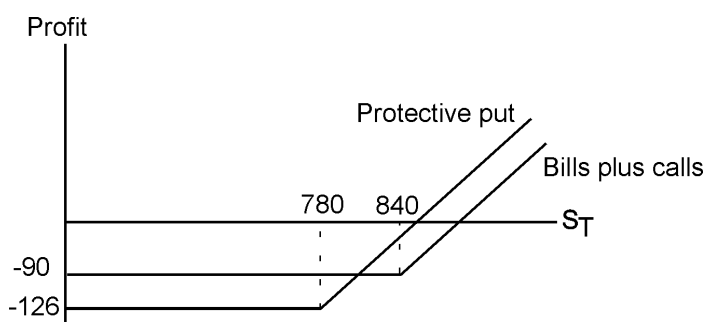
The initial cost of the bills plus call position is

Market price of Treasury Bills	=	Rs.810
Market price of call option	=	Rs.120
Initial cost	=	Rs.930

Index	700	840	900	960
+Put option	80	0	0	0
Payoff	780	840	900	960
Profit	-126	-66	-6	54

T-Bill	840	840	840	840
+Call option	0	0	60	120
Payoff	840	840	900	960
Profit	-90	-90	-30	+30

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- c. The stock and put strategy is riskier. It does worse when the market is down and better when the market is up. Therefore, its beta is higher.
- d. Parity is not violated because these options have different exercise prices. Parity applies only to puts and calls with the same exercise price and expiration date.

5. a. Total value added

$$\text{Manager return} = 0.30 \times 20 + 0.10 \times 15 + 0.40 \times 10 + 0.20 \times 5 = 12.50\%$$

$$\text{Benchmark} = 0.15 \times 12 + 0.30 \times 15 + 0.45 \times 14 + 0.10 \times 12 = 13.80$$

$$\text{Added value} = -1.30\%$$

b. Added value from country allocation

Country	(1) Excess weight : (Manager – Benchmark)	(2) Index return minus total expected index return	(3) = (1) × (2) Contribution to performance
U.K	0.15	- 1.8%	-0.27%
Japan	- 0.20	1.2	-0.24
U.S.	-0.05	0.2	-0.01
Germany	0.10	- 1.8	-0.18
Contribution of country allocation			-0.70%

c. Added value from stock selection

Market	(1) Differential return Within country (Manager – index)	(2) Manager's country weight	(3) = (1) × (2) Contribution to performance
U.K	8%	0.30	2.4%
Japan	0	0.10	0
U.S.	- 4	0.40	-1.6
Germany	-7	0.20	-1.4
Contribution of stock selection			- 0.60%

$$\text{Total value added} = \text{Contribution of country allocation} + \text{Contribution of stock selection}$$

$$= -0.7 + (-0.6) = -1.3\%$$

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Section C: Applied Theory

6. APT and Active Management

- i. One of the important uses of multi-index model in active management of portfolios is making factor bets. If one's expectations are against the market expectations with respect to some factor, one can take a position so as to benefit by one's expectations. Suppose inflation expected by the market is 6 percent but you believe it to be 8 percent. By increasing your exposure to stocks/portfolios whose returns are positively related with inflation. One can increase your returns. By increasing the number of factors in the model, betting opportunities can be increased.
- ii. Another application of APT is in identifying mispriced securities. This is similar to the CAPM model. APT is used to estimate the required return on a stock based on the various return generating factors and sensitivity of the security to these factors. Along with the required rate of return, expected return on the stock is also estimated. If the required return is greater than the expected return, the security is overpriced and one can go short on the stock. On the other hand, if the required return is less than the expected return the security is underpriced and one can go long on this stock. This way APT can be used to identify the mispriced securities and adopt a suitable strategy. The advantage of APT over CAPM is that the required return can be more accurately estimated with the APT model. This is because, two securities having same sensitivity to the market index (beta) might have different sensitivities to other factors, which are important in determining the equilibrium return.
- iii. Finally, multi-index model can be used in long-short investment strategy or risk neutral investment strategy. This is nothing but the arbitrage mechanism illustrated above. If you are able to correctly identify underpriced and overpriced assets using the APT you can construct zero risk, zero investment portfolios with a positive net return.

APT and Passive Management

- i. Index fund is a widely used strategy of passive management of a portfolio. Under this strategy, a portfolio of stocks is created such that performance of this portfolio closely reflects the performance of the underlying index. Such a portfolio can be created using the single-index model by finding a portfolio that has a beta of one with the index and that has minimum residual variance (risk) for a given portfolio size.
Using a multi-index model rather than a single index model in construction of the index portfolio can help in better tracking the performance of the index. This is because there can be more than one source of return generation. By using multi-index model the portfolio can be matched with the index in terms of all important sources of return movements. That is, the correlation between the returns on the portfolio and the index can be improved, thereby capturing the performance of the index through our portfolio. If the source of return is only one factor, market factor, then multi-index model is to better than the single index model. But it is safe to assume that returns are generated by more than one factor.
- ii. Another application where APT comes handy is construction of index-portfolios where some of the stocks in the index are deliberately kept out. Suppose, as a matter of policy a fund manager would like to avoid exposure to some sectors. If single index is used to construct the portfolio, sensitivity of the portfolio to other important factors may be missed and multi-index model can improve tracking an index. Same is the case when a fund manager, as a matter of policy, must include certain stocks in the portfolio.
- iii. Some times it may be desired by the fund manager to track the performance of the index and take position with respect to some additional risks, which are not captured in the index. This objective can be achieved only through a multi-index model. Take the case of a pension fund whose cash outflows are indexed to inflation. If inflation increases, cash outflow also increases. Manager of such a fund would like to have cash flows positively related to inflation. He might wish to hold a portfolio that has a zero or preferably positive sensitivity to inflation. He could form a portfolio that has more or less same response to all the factors affecting the index except the inflation and had a minimal residual risk.

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7. Dynamic strategies for asset allocation are as follows:

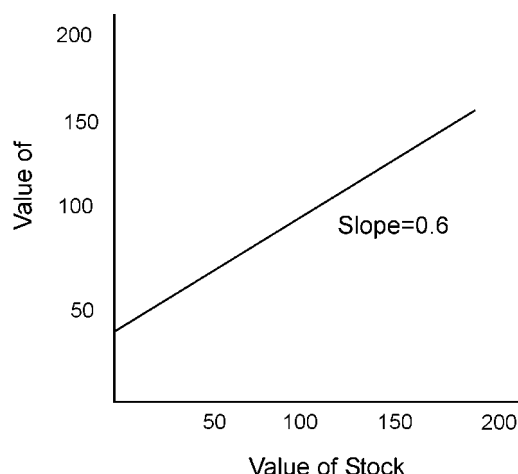
1. Buy-and-hold
2. Constant mix
3. Constant-proportion portfolio insurance
4. Option-based portfolio insurance.

Buy-and-hold strategies

A buy-and-hold strategy is featured by an initial mix, say, 60 percent stock and 40 percent treasury bills, which is initially bought and then held. These can be termed as minimum risk and maximum return strategies. In fact,

these strategies do not require regular rebalancing, and they are even easy to analyze.

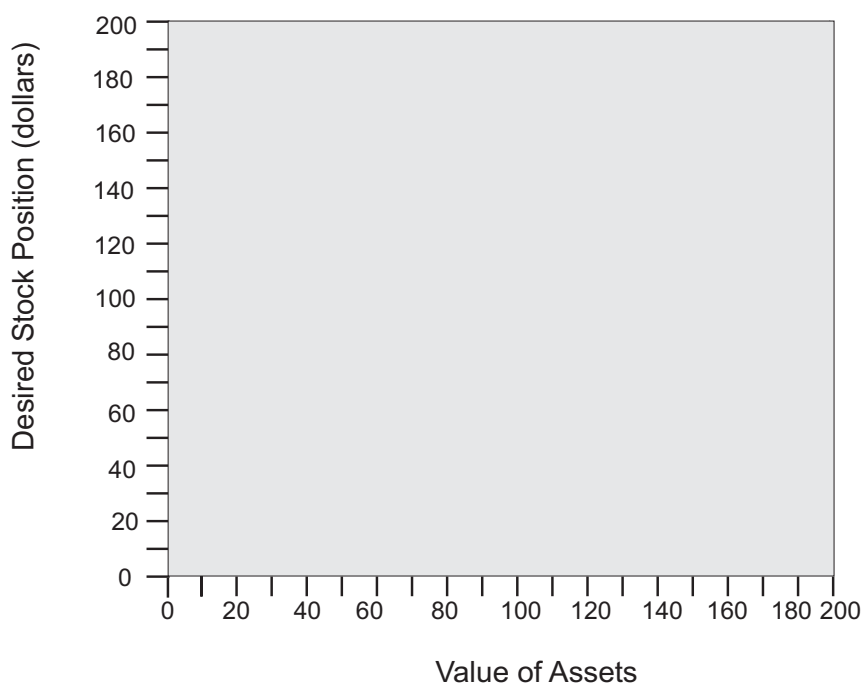
Pay-off for 60/40 Stock/Bill Buy-and-Hold Strategy



Let us now focus on the above. It represents a buy and hold strategy with 60/40 mix of stocks and bills. Say, the investor's portfolio is worth Rs.1,000 and the current level of the stock market is 100. the figure explains the following points:

- The relationship between the portfolio's value and the stock market's value is linear.
- The value of the portfolio is directly proportional to the value of the stock market, the slope being equal to the proportion of stock in the mix i.e., 60 percent which is 0.6.
- The value of the portfolio will not fall below the value of initial investment in bills.
- With the increase in proportion of the stocks in the portfolio mix, better will be the performance of the buy and hold strategies, when the stocks outperform the bills and when stocks underperform bills.

Exposure for 60/40 Stock/Bill Buy-and-Hold Strategy



In the above figure, the asset mix remains same i.e., 60/40 stocks and bills respectively. Below 60 percent of initial wealth of the investor, his risk-tolerance becomes zero. In fact, the graphs for other buy and hold strategies have a slope of one and differ only in terms of the asset level at which the investor's tolerance for risk becomes zero.

Constant mix strategies

These strategies are more dynamic in nature. Investors adopting these strategies tend to maintain an exposure to

stocks that is in constant proportion of their wealth. The risk-tolerance level of the investors varies proportionately with the level of their wealth. At the time of changes in the values of the assets, it is required to either purchase or sell the required assets. Normally, rebalancing of the portfolio involves purchase of stocks as they fall in their value. The implementation of dynamic strategies actually involves the environment under which the act of rebalancing can take place. It has been statistically found that rebalancing of a constant mix requires the sale of stocks as they rise in value.

It is found in the real world that the stock markets are perfectly capable of reversing themselves, and such reversals favor constant mix strategies over the buy and hold strategies. Let us take the case where the value of stocks fall from Rs.100 and hold strategies. Let us take the case where the value of stocks fall from Rs.100 to Rs.90 and bounces back to Rs.100. In this case, while an investor going for a buy and hold strategy will face no change in his wealth, the one following the constant mix strategy will. In essence, the buy and hold strategy is the simple up and down movement along a single straight line in a pay-off diagram, whereas in case of a constant mix strategy, each of the rebalancings changes the number of stocks the investor holds. It involves buying of shares when stock prices fall and selling of shares when stock prices rise. The value of a constant mix investor's assets after several rebalancings depends on the final level of the stock market as well as the way in which the stocks move from one period to the other before they reach a final level of the stock market.

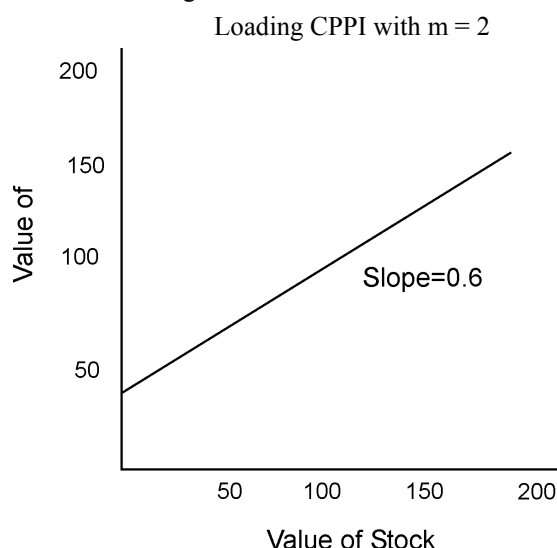
Constant proportion portfolio insurance

The constant proportion theory can be written as:

$$\text{Amount in stocks} = m (\text{Assets} - \text{Floor})$$

Where, m = fixed multiplier

The Constant proportion Portfolio Insurance (CPPI) strategy is a constant proportion strategy with multipliers greater than one. The implementation of this strategy calls for selection of the multiplier and a floor below which he does not want the portfolio value to fall. The floor actually grows at the rate of return on bills, and should be less than one at the initial stage.



The above figure reveals a floor of Rs.75 and multiplier of two. Investors who like CPPI strategies have zero risk-tolerance level. But, at the same time the risk-tolerance increases more quickly above the floor than with buy and hold strategies. Consider following example. Say, the investor has wealth of Rs.200, and a floor of Rs.150, so the investment in stocks would be Rs.100, since the multiplier is two. Now, say, the markets fall from 200 to 180, the stocks fall by 10 percent, i.e., from Rs.100 to Rs.90. The total assets would then be Rs.190, and cushion of Rs.40, i.e., Rs.40 (i.e., Rs.2 x 20). This involves the sale of stocks. When the market is bullish, the CPPI strategy performs well. It involves buying stocks as their prices rise with each marginal purchase paying off a good sum.

Let us now look at the pay-off curves for three kinds of rebalancing.

- i. Do nothing
- ii. Buy stocks as their value falls, and sell them as they rise.
- iii. Sell stocks as their value falls, and buy them as they rise.

The first strategy, i.e., buy and hold results in pay-off diagrams that are straight lines. The strategies that involve buying of stocks as their prices fall and selling them when their prices rise results in concave pay-off curves. These strategies do well in flat markets. The last strategy results in convex pay-off curves. They tend to perform poorly in flat markets, but they provide good downside protection and the simplest examples of concave and convex strategies respectively. There exists a relationship between the shape of the pay-off diagram and the slope of the exposure diagram.

Option-based portfolio insurance strategies

The Option-Based Portfolio Insurance (OBPI) strategies begin by specifying an investment horizon and a designed floor value at that horizon. It involves a floor value at every prior time to the horizon. Say, for example, the horizon is one year, and the floor at the year end is Rs.75, then the floor at any prior time is the present value of Rs.75. With the strategy, the exposure diagram depends on the time remaining before the horizon is reached. With traditional OBPI strategies, the exposure to stocks increases as the time passes, reaching 100 percent of the asset value at the horizon.

Dynamic strategies call for resetting the parameters. This is due to the type of strategy chosen. Say, for example, with option-based strategies one has to reset at the horizon. One of the most favored resetting involves beginning with some portfolio insurance strategy and abiding by the rules if the market is flat or is declining. Resetting can change characteristics of the strategies. Thus, resetting rules should be considered as an integral part of the dynamic strategies.

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