

Question Paper

Portfolio Management and Mutual Funds ñ I (251) : April 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. If investment A is better than investment B and investment B is in turn better than investment C, the investor should prefer A to both B and C. Which of the following axioms of investor's behavior better suits the above statement? [< Answer >](#)

- (a) Comparability (b) Transitivity (c) Independence
(d) Certainty Equivalent (e) Plausibility.

2. Consider the following information about the portfolio of a fund manager: [< Answer >](#)

Existing:	
Market value	Rs.200 crore
Beta of portfolio	1.2
Futures contract available on NIFTY:	
Market value	1900
Multiple	200

To achieve a target beta as 0.8 of the portfolio, the fund manager should

- (a) Sell 2,105 futures (b) Sell 3,822 futures
(c) Buy 3,077 futures (d) Buy 2,105 futures
(e) Buy 3,822 futures.

3. In reality, the SML is a band instead of a thin line because of [< Answer >](#)

- I. The effect of taxes.
II. The inefficiency of stock markets.
III. The existence of transaction costs.
- (a) Only (I) above (b) Only (III) above
(c) Both (I) and (II) above (d) Both (II) and (III) above
(e) All (I), (II) and (III) above.

4. Assume that the assets below are correctly priced according to the SML: [< Answer >](#)

$$E(r_1) = 12\% \quad \beta_1 = 0.5$$

$$E(r_2) = 24\% \quad \beta_2 = 1.5$$

The expected return on an asset with a beta of 2 is equal to

- (a) 24% (b) 28% (c) 30% (d) 32% (e) 40%.

5. A high ratio of net selectivity to total selectivity for a portfolio indicates [< Answer >](#)

- (a) High risk appetite of investor
(b) Poorly diversified portfolio
(c) Superior stock selection skills
(d) Low beta of the portfolio
(e) High risk averse nature of investor.

6. Which of the following statements is **true** regarding formula plans in portfolio revision? [< Answer >](#)

- (a) In dollar-cost-averaging, the investor must fix predetermined action points called revaluation points
(b) 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
(c) Dollar-cost-averaging works well over short periods such as one to two years
(d) Variable ratio plan requires less accurate forecasting than other plans and hence is less

- complicated
- (e) The constant dollar value plan does not require forecast of the level to which stock prices may fall. [< Answer >](#)
7. The change from a straight to a kinked capital market line is the result of [< Answer >](#)
- Increasing return- to- variability ratio
 - Borrowing rate exceeding the lending rate
 - Decreasing investor's risk tolerance
 - Increasing proportion of funds invested in risk-free asset
 - Decreasing risk averse nature of the investor.
8. The current price of a stock is Rs.80 and it is expected that stock price after one year will be either Rs.96 or Rs.72. The risk free rate is 6%. The probability of price fall using single period Binomial model is given by [< Answer >](#)
- (a) 0.33 (b) 0.40 (c) 0.47 (d) 0.67 (e) 0.75.
9. The best measure of a portfolio manager's performance, when there are frequent inflows and outflows of funds in the portfolio is [< Answer >](#)
- Time weighted rate of return
 - Linked internal rate of return
 - Money weighted rate of return
 - Realised compound yield
 - Current yield on the bond portfolio.
10. In a market, the universe of available risky securities consists of a large number of stocks, identically distributed with expected return of 15%, standard deviation of 60% and a common correlation coefficient of 0.5. The expected return and standard deviation of an equally weighted risky portfolio of 25 stocks respectively are [< Answer >](#)
- 11%, 13.27%
 - 12%, 22.45%
 - 15%, 23.27%
 - 12%, 33.37%
 - 15%, 43.27%.
11. You are working as a portfolio manager of an asset management company that is considering to construct a portfolio with following cash flows: [< Answer >](#)

Years	Cash Flow (In millions of rupees)
0	- 40
1-10	15

- The portfolio's beta is 1.8. Assuming that the return on treasury bills is 6% and expected return on market portfolio is 16%, what is the highest possible beta estimate for the portfolio before its net present value of cash flows becomes negative?
- 1.62
 - 1.88
 - 2.28
 - 2.98
 - 3.04.
12. Which of the following bonds has the longest duration? [< Answer >](#)
- A bond with a coupon payment @ 7% per annum and 10 year term to maturity
 - A bond with a coupon payment @ 8% per annum and 10 year term to maturity
 - A bond with a coupon payment @ 7% per annum and 11 year term to maturity
 - A bond with a coupon payment @ 6% per annum and 12 year term to maturity
 - A bond with a coupon payment @ 5% per annum and 12 year term to maturity.
13. If markets are efficient, the correlation coefficient between stock returns for two non-overlapping time periods is [< Answer >](#)
- + 1
 - 0
 - 1
 - + 0.5
 - 0.5.
14. Convexity is a better measure of bond volatility because [< Answer >](#)
- The percentage price change approximates a linear function of percentage change in YTM of the bond
 - The percentage price change approximates a non-linear function of percentage change in YTM of the bond
 - It works well in explaining changes in price for small shifts in the yield curve
 - It assumes percentage price change is proportional to the percentage change in one plus the interest rate

(e) All bonds react to interest rate changes by the same degree across the board.

15. Consider the following information:

[< Answer >](#)

	Return (%)	Risk (%) ²	Beta (Sensitivity of security X's return)	
			With Sensex	With Telecom index
X (A telecom major)	18	576	1.23	1.45
Sensex	15	324		
Telecom Index	22	490		

What is the approximate unsystematic risk of security X?

- (a) 49%² (b) 86%² (c) 454%² (d) 490%² (e) 527%².

16. The critical variable in the determination of the success of the active portfolio is

[< Answer >](#)

- (a) Jensen's Alpha / Non-Systematic Risk
 (b) Jensen's Alpha / Systematic Risk
 (c) Gamma / Non-Systematic Risk
 (d) Gamma / Systematic Risk
 (e) Indexing tactics.

17. The portfolio rebalancing should ensure that

[< Answer >](#)

- (a) The systematic risk remains constant
 (b) The unsystematic risk remains at unity
 (c) The systematic risk remains at unity
 (d) The systematic risk remains at zero
 (e) The total risk does not exceed unity.

18. The rate of return on Treasury bills is 6% and the market rate of return is 12%. In addition, Santha Pharmaceuticals, which has an equity beta of 2, surprisingly just won a lawsuit that awards it Rs.3 million this year. If the market had expected Santha Pharmaceuticals to win Rs.5 million and the original value of it's equity is Rs.100 million, what could be the expected rate of return of it's stock this year?

[< Answer >](#)

- (a) 12% (b) 15% (c) 16% (d) 18% (e) 21%.

19. You know that firm ABC is very inefficiently managed. On a scale of 1(worst) to 10 (best), you would give it a score of 3. The market's consensus is that the management score is only 2. Your decision should be

[< Answer >](#)

- (a) To sell the stock, as every one in the market believes the firm to be worse than you believe
 (b) To buy the stock, as in your view, the firm is undervalued by the market
 (c) To hold the stock, till the conflict of ranking is resolved
 (d) To sell the stock, as the firm is not as bad as the market believes it to be
 (e) To hold the stock, as you strongly believe that the firm is not the worst.

20. The writer of a straddle anticipates

[< Answer >](#)

- (a) Major fluctuations in the price of the underlying asset, however, he is not able to predict the direction of the fluctuations
 (b) Minor fluctuations in the price of the asset and he is able to predict the direction of the fluctuations
 (c) No major fluctuations in the price of the underlying asset and he is not able to predict the direction of the fluctuations
 (d) Major fluctuations in the price of the asset and that there is greater scope for some upward price movement
 (e) Major fluctuations in the price of the asset and that there is greater scope for some downward price movement.

21. Two bonds have identical times to maturity and coupon rates. One is callable at Rs.105 and the other at Rs.110. Which bond should have the higher yield to maturity and why?

[< Answer >](#)

- (a) The bond callable at Rs.110, since it sells at a higher price
 (b) The bond callable at Rs.105, since it sells at a higher price
 (c) The bond callable at Rs.110, since it sells at a lower price
 (d) The bond callable at Rs.110, since it pays more redemption value at the time of call
 (e) The bond callable at Rs.105, since it sells at a lower price.

22. Consider the single index model of the form $R_i = \alpha_i + \beta_i R_m + e_i$ for all stocks $i = 1, 2, 3, \dots$. Which of the following is/are not an assumption(s) underlying this model?

[< Answer >](#)

the following is/are **not** an assumption(s) underlying this model?

- I. $\text{Var}(e_i) = 0$.
 - II. $\text{Cov}(e_i, R_m) = 0$.
 - III. $\text{Cov}(e_i, e_j) = 0$, for $i \neq j$.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (I) and (III) above.

23. Which of the following is **not** the portfolio strategy, where index futures can be used?

[< Answer >](#)

- (a) Laddering
- (b) Yield enhancement
- (c) Modification of portfolio risk
- (d) Futures as a substitute for indexing
- (e) Hedging.

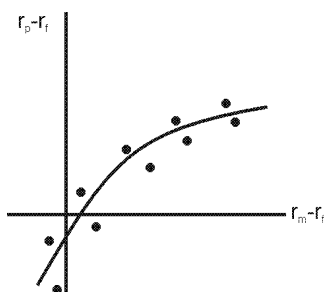
24. Goldman Sachs Asset Management (GSAM) factor model uses nine factors, which are categorized into three measures-value, growth and momentum and risk. Which of the following factors represent growth and momentum measure?

[< Answer >](#)

- (a) Book value per share/Price
- (b) Retained EPS/Price
- (c) Estimate revisions
- (d) Beta
- (e) Disappointment risk.

25. Consider the following figure:

[< Answer >](#)



In the figure given above, the market timing ability of the portfolio manager is

- (a) Very good
- (b) Good
- (c) Average
- (d) Bad
- (e) Cannot be determined.

26. In which of the following spread strategies, the number of options bought differs from the number of options sold to form a spread?

[< Answer >](#)

- (a) Box spread
- (b) Butterfly spread
- (c) Ratio spread
- (d) Condor spread
- (e) Calendar spread.

27. Which of the following is/are likely to be major problems with static portfolio insurance?

[< Answer >](#)

- I. The maximum maturity quoted is often much shorter than the desired horizon for the protection.
 - II. The underlying asset used for the options may differ from the portfolio to be insured.
 - III. Option on the desired underlying asset may not exist.
 - IV. Liquidity on the desired options may fall short.
- (a) Only (II) above
 - (b) Only (IV) above
 - (c) Both (I) and (III) above
 - (d) (I), (III) and (IV) above
 - (e) All (I), (II), (III) and (IV) above.

28. For an open-ended mutual fund scheme following information has been collected:

[< Answer >](#)

	Rs. in million
Value of investments	125.0
Receivables	9.4
Accrued income	3.1
Other current assets	37.5
Liabilities	28.1
Accrued expenses	6.3

The number of outstanding units is 125 lakh.

If the fund charges 3% as sales charge (as entry load), the public offer price will be approximately

- (a) Rs.10.5 (b) Rs.11.6 (c) Rs.12.5 (d) Rs.13.0 (e) Rs.13.8.
29. The objective of a floating rate fund is to align the dividend (under dividend plan) or yield (under growth plan) on a continuous (daily) basis with a selected benchmark rate. On a simple analysis, it has the features similar to that of a floating rate bond. Such a scheme has a target audience of [< Answer >](#)
- The investors who want to get the maximum from the fluctuation in interest rates.
 - Corporate having short-term surpluses.
 - The investors who are very sensitive to the NAV of their investment.
- Only (I) above
 - Only (II) above
 - Both (I) and (II) above
 - Both (II) and (III) above
 - All (I), (II) and (III) above.
30. At the prevailing environment, [< Answer >](#)
- The CML equation for a portfolio i is given as
- $$E(r_i), \% = 8 + 0.36 \sigma_i$$
- The ex-ante SML equation for the same portfolio i is
- $$E(r_i), \% = 8 + 5.50 \beta_i$$
- Therefore, the variance of market portfolio is approximately
- $30(\%)^2$
 - $64(\%)^2$
 - $126(\%)^2$
 - $233(\%)^2$
 - Data insufficient.

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. Consider the following information for the companies Powergas and Supertech:

Company	Standard Deviation	Covariance with the market	Coefficient of Determination
Power Gas	45%	0.0135	-
Supertech	40%	-	0.36
Market Portfolio	15%	-	-

The expected return on the market index is 15% and the risk free rate of interest is 6%. Assume that you can borrow and lend at the risk free rate.

You are **required** to

- Construct a portfolio of Powergas and Supertech that has exactly the same expected rate of return as the market.
- Construct a portfolio of Powergas and Supertech that has a rate of return of 24%. Also calculate the risk of this portfolio, if the correlation between Powergas and Supertech is 0.5.
- Construct a portfolio that has the same expected return as the portfolio formed in part (b), but lower standard deviation. What is the lowest risk you have to assume for this expected return?

(3 + 3 + 4 = 10 marks) [< Answer >](#)

2. Mr. Aman Varma is considering investing in two mutual funds with the following parameters:

	Fund 1	Fund 2
Beta	0.8	1.2
Standard Deviation	20%	32%

The funds are valued in a market where investors can borrow and lend at the risk free rate of 5% and require a risk premium above this risk free rate of 8% for holding the market portfolio. Assuming that the assumptions of capital market theory hold good, you are **required** to

- Determine which fund Mr. Varma should select, if he can borrow and lend at the risk free rate of interest.
- Determine the lowest risk portfolio that will give Mr. Varma an expected return of 14.6%. What is its standard deviation? (Assume that the investment in Fund 1 and the investment in Fund 2 are mutually exclusive).
- Determine the lowest risk portfolio with an expected return of 14.6%, if Mr. Varma can invest at the risk free rate of 5%, but he can only borrow at the higher rate of 7% (Assume that the investment in Fund 1 and the investment in Fund 2 are mutually exclusive).

(3 + 3 + 4 = 10 marks) [< Answer >](#)

3. Mr. Bhagat Singh has forecasted that the market return follows the following relationship:

R_m = Risk free rate + Risk premium of 7%. The market return historically has shown a variance of $25\%^2$. He has zeroed in on the following stocks with the parameters given below:

Stock	Alpha (%)	Beta	Residual Variance (%) ²
ITC	1.72	0.89	9.35
SBI	0.89	0.97	5.92
Satyam	0.46	1.24	9.79
HLL	1.52	1.04	5.36
BPL	0.96	1.11	4.52

The 180-day T-bills rate is 7% p.a.

You are **required** to construct an optimum portfolio using the Sharpe's optimization method.

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

4. Mr. Avinash Agarwal has the following debt obligations to be repaid in the near future. The details of the debt obligations are:

Maturity (in years)	Debt amount (Rs.)	Price (Rs.)
1	8,50,000	93.25
2	9,65,000	94.85
3	10,50,000	95.25
4	15,60,000	97.85
5	21,35,000	104.50

Cost of funds for the debt amount is 9% p.a.

Mr. Agarwal wants to construct a bond portfolio so that the future debt obligations can be exactly met with the amount of the inflows available from this portfolio. Mr. Ashutosh Shukla, a financial adviser of Mr. Agarwal has chosen the following bonds for this purpose.

	Annual Coupon (%)	Maturity (in years)
Bond A	6.25	1
Bond B	6.75	2
Bond C	7.00	3
Bond D	7.50	4
Bond E	8.25	5

The face value of these bonds is Rs.100 each.

Mr. Agarwal has asked Mr. Shukla to prepare a plan for dedicated investments that will meet the forthcoming liabilities.

You are **required** to

- Calculate the amount of funds to be allocated to each of the bonds so that future liabilities (consider only principal payments and ignore interest payments) can be met with the coupon inflow and redemption value of the bonds. Also show the total amount invested in the five bonds.
- If bonds A, B and C are not available, calculate the proportion of funds to be invested in the remaining two bonds so that the portfolio is perfectly immunized.

(8 + 4 = 12 marks) [< Answer >](#)

5. The stock options on Dr. Reddy's Labs shares are presently trading as under:

Instrument	Expiry date	Strike price (Rs.)	Option premium (Rs.)
Call option	April 28, 2005	690	10
Call option	April 28, 2005	720	5
Put option	April 28, 2005	690	20
Put option	May. 26, 2005	690	25

Current market price of Dr. Reddy's Lab share is Rs.700. Considering expiration day stock price may take any value from Rs.650 to Rs.750, you are **required** to show the pay off with maximum loss and break even points for the strategy an investor should follow, if he expects that there will be significant price move, but

- The stock price is more likely to fall than to rise.
- The stock price is more likely to rise than to fall.

(3 + 3 = 6 marks) [< 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.

6. World over, the institutional investors have exerted an important influence on capital markets. Typically, the market turns buoyant under the influence of institutional buying; likewise under the pressure of institutional selling, the market becomes depressed. Explain the key drivers of investment policies of institutional investors.

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

7. The CAPM says that the expected return on a security is determined by its covariance with the market portfolio. Hence, it is possible that security A has a lower expected return than security B, even though the standard deviation of A is double that of B. Does this make sense? Explain the rationale behind the CAPM.

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

END OF SECTION C

END OF QUESTION PAPER

Suggested Answers Portfolio Management and Mutual Funds - I (251): April 2005

Section A : Basic Concepts

1. Answer : (b)

[< TOP >](#)

Reason : Given two investments, the investor should be able to state his preference to one of them or his indifference to both of them. This is called comparability. Hence, alternative (a) is not answer.

If investment A is better than investment B and investment B is in turn better than C, the investor should prefer A to both B and C. This is called transitivity (b). Hence, alternative (b) is answer.

If there are three investments – X, Y and Z, which provide return x, y and z respectively and an i

- A return of x with a probability p and a return of z with a probability (1-p)
- A return of y with a probability p and a return of z with a probability (1-p).

That is, the investor may choose both or reject both- he should be indifferent between the

According to the axiom of Certainty Equivalent (d), for every uncertain investment outcome (a 'gamble'), there is a certain value of outcome (which does not carry uncertainty), which makes the investor feel indifferent between uncertain outcome and certain outcome. Plausibility (e) means understandability, which is no way related with the present case.

2. Answer : (a)

[< TOP >](#)

Reason : The present β is more than 1.0 hence the portfolio manager should sell the Nifty futures. If he/she sells x number of contracts to arrive the target $\beta = 0.8$ then

$$200 \times 1.2 - \frac{1900 \times 200 \times x \times 1}{10^7} = 200 \times 0.8$$

$$\Rightarrow x = \frac{200(1.2-0.8) \times 10^7}{1900 \times 200} = 2,105 \text{ futures.}$$

3. Answer : (e) [< TOP >](#)

Reason : Stocks plotting off the security market line provide the evidence of mispricing in the market. In reality there is always bound to be some mispricing because of presence of transaction cost, taxes and information asymmetry. Therefore, in practice, the SML is a band instead of a thin line.

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

Reason : $E(r_1) = R_f + \beta_1 (R_m - R_f)$

$$\Rightarrow 12 = R_f + 0.5 (R_m - R_f) \quad \text{--- I}$$

similarly,

$$E(r_2) = 24 = R_f + 1.5 (R_m - R_f) \quad \text{--- II}$$

By subtracting I from II,

$$12 = 1 \times (R_m - R_f)$$

$$\text{Hence, } R_f \text{ from I, } R_f = 12 - 0.5 \times 12 = 6\%$$

$$E(r) \text{ at } \beta=2 \text{ will be } = 6 + 2 \times 12 = 30\%.$$

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

Reason : A high ratio of net selectivity to total selectivity for a portfolio indicates that the return required for inadequate diversification is less. This indicates superior stock selection skills.

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

Reason : Dollar cost averaging works out well over a long period. In it a fixed amount is invested every time irrespective the prevailing price of the share. Hence (a) and (c) are not correct. Further, (d) is not correct, as variable ratio plan is more complicated. Similarly (e) is not correct, as one requires the forecast of the level to which stock prices may rise or fall.

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

Reason : Capital market line changes from straight line to kinked line, when borrowing risk free rate exceeds lending rate. In reality, borrowing risk free rate exceeds lending rate, since individual investors cannot borrow at the rate the government can borrow.

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

Reason : Probability of price rise in Binomial Model is given by

$$p = \frac{R - d}{u - d}$$

$$R = 1.06$$

$$u = 96/80 = 1.2$$

$$d = \frac{72}{80} = 0.9$$

$$p = \frac{1.06 - 0.9}{1.2 - 0.9} = 0.53.$$

$$\text{Probability of price fall} = 1 - 0.53 = 0.47.$$

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

Reason : Money weighted rate of return is a satisfactory measure of individual fund's performance taken in isolation. But as a test of the fund manager's investment skill, it is not meaningful, because, it is strongly influenced by the timing and the magnitude of cash flows, which are beyond the control of the Fund Manager. In such scenario Time Weighted Rate of Return is better. Linked internal rate of Return is used when the fund is valued at regular interval and not at each time when the cash flow occurs.

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

Reason : The portfolio expected return is invariant to the size of the portfolio because all stocks have identical expected returns.

Hence, expected return is 15%.

Variance of the portfolio with 25 stocks:

$$= W_1^2 \sigma_1^2 + W_2^2 \sigma_2^2 + \dots + W_n^2 \sigma_n^2$$

$$+ 2 W_1 W_2 \sigma_1 \sigma_2 \rho_{12} + 2 W_2 W_3 \sigma_2 \sigma_3 \rho_{23} \dots 2 W_{n-1} W_n \sigma_{n-1} \sigma_n \rho_{n(n-1)}$$

The number of variance terms in a portfolio consisting of n securities = n

In the given case, the number of variance terms = 25

The number of covariance terms = $n(n-1)/2 = (25 \times 24)/2 = 300$

The number of weight terms = $n = 25$

Here, $W_1 = W_2 = \dots = W_{25} = 1/25 = 0.04$

$\sigma_1^2 = \sigma_2^2 = \dots = \sigma_{25}^2 = 0.6$

$\rho_{1,2} = \rho_{2,3} = \dots = \rho_{24,25} = 0.5$

(Since all stocks are equally weighted, the weight of each stock = $(1/25) = 0.04$)

The above formulae can be segregated in to the following sub parts:

i. $W_1^2 + W_2^2 + \dots + W_n^2 = n \times W^2 = 25 \times (0.04)^2$ (number of weights = 25)

$\sigma_1^2 + \sigma_2^2 + \dots + \sigma_n^2 = n \times \sigma^2 = 25 \times (0.60)^2$ (number of standard deviations = 25)

$= 25 \times [(0.04)^2 \times (0.60)^2] = 0.0144$

ii. $2 W_1 W_2 \sigma_1 \sigma_2 \rho_{12} + 2 W_2 W_3 \sigma_2 \sigma_3 \rho_{23} \dots 2 W_{n-1} W_n \sigma_{n-1} \sigma_n \rho_{n(n-1)}$

$2 \times (0.04)^2 \times (0.6)^2 \times 0.5 \times 300 = 0.1728$ (number of covariance terms = 300)

iii. $\sigma_p^2 = 0.0144 + 0.1728 = 0.1872$ $\sigma_p = (0.1872)^{0.5} = 0.432666 = 43.27\%$.

11. Answer : (d)

[< TOP >](#)

Reason : The net present value of cash flows is equal to initial investment at YTM. Hence, YTM

$$40 = 15 \text{PVIFA}(r\%, 10)$$

at $r = 32\%$

$$40 = 15 \times 2.9304 = 43.956$$

at $r = 36\%$

$$40 = 15 \times 2.6495 = 39.7425$$

By interpolation

$$= 32\% + [(43.956 - 40)/(43.956 - 39.7425)] \times 4\%$$

$$= 32\% + 3.755\% = 35.755\%.$$

Net present value of net cash flows becomes negative, when discount rate exceeds YTM. The highest value that beta can take before the discount rate exceeds YTM is

$$35.755\% = 6\% + \beta (16\% - 6\%)$$

$$29.755\% = 10\% \beta$$

$$= 2.9755 \approx 2.98.$$

12. Answer : (e)

[< TOP >](#)

Reason : A bonds' duration is higher when the coupon rate is lower and its duration increases with increase in time to maturity. Therefore, bond E with the lowest coupon rate and highest term to maturity will have the longest duration.

13. Answer : (b)

[< TOP >](#)

Reason : If markets are efficient, the correlation coefficient between stock return for two nonoverlapping time periods is zero. If not, one could use returns from one period to predict returns in later periods and make abnormal profits.

14. Answer : (b)

[< TOP >](#)

Reason : Convexity measures the sensitivity of duration of a bond with respect to change in interest rate scenario. Duration of zero coupon bonds is insensitive to the interest rate changes. However, as the coupon increases the sensitivity of duration increases thereby implying non linear relationship.

15. Answer : (b) [< TOP >](#)
Reason : $\text{Unsystematic Risk} = \text{Total risk} - \text{Systematic risk}$
 $= 576 - (1.23^2 \times 324)$
 $= 576 - 490.18 = 85.8\%^2 \text{ i.e., } 86\%^2$
16. Answer : (a) [< TOP >](#)
Reason : Jensen's Alpha on a portfolio, $\alpha_p = R_p - [R_f + \beta_p (R_m - R_f)]$ i.e., excess return over the returned return for the systematic risk undertaken. Therefore the excess return per unit of unsystematic risk decides the success of the active portfolio.
17. Answer : (a) [< TOP >](#)
Reason : The portfolio balancing should always ensure that systematic risk of portfolio remains constant.
18. Answer : (c) [< TOP >](#)
Reason : Based on the broad market trends, the CAPM suggests that Santha Pharmaceuticals stock should have the return of $6\% + 2(12\% - 6\%) = 18\%$. If the market had expected nothing about its law suit, its firm-specific (non-systematic) return due to the lawsuit is Rs.3 million per Rs.100 million initial equity or 3%. Therefore, the total return should be 21%.
However, market had expected that the settlement would be for Rs.5 million, but the actual settlement was Rs.3 million disappointment and so the firm-specific return would be $((3-5)/100) - 2\%$ for a total return of $18\% - 2\% = 16\%$.
19. Answer : (b) [< TOP >](#)
Reason : The decision should be to buy the stock. It is because, in your view, the firm is not as bad as everyone else believes it to be. Therefore, you view the firm as undervalued by the market. You are less pessimistic about the firm's prospects than the beliefs built into the stock price.
20. Answer : (c) [< TOP >](#)
Reason : Writer of the straddle does not expect any major fluctuation of price. Nor is he able to predict the direction of fluctuation. Therefore Alternative (c) is answer.
21. Answer : (e) [< TOP >](#)
Reason : The bond callable at Rs.105 should sell at a lower price because the call provision is more valuable to the firm, as it can be called at lower price of Rs.105 when compared with the bond callable at Rs.110. Therefore, its YTM should be higher.
22. Answer : (a) [< TOP >](#)
Reason : e_i is the error term in single index model. The expected value, $E(e_i)$ is considered zero not the variance of it.
Statement II implies that error term is uncorrelated with the market, which is in fact an assumption of single index model.
Statement III is a unique and crucial assumption underlying the single index model. The assumption implies that the only reason for stock i and j to vary together is on account of a common co-movement with the market. There is no effect beyond the market, which account for such co-movement between the two stocks.
23. Answer : (a) [< TOP >](#)
Reason : Fund managers can use index futures in the following five portfolio strategies.
i. Asset allocation
ii. Yield enhancement
iii. Modification of portfolio risk
iv. Futures as a substitute for indexing
v. Hedging.
Hence, laddering (a) is not a strategy, where index futures can be used.
24. Answer : (c) [< TOP >](#)
Reason : Goldman Sachs Asset Management factor model uses the following three measures.
(i). Value
(ii). Growth and momentum
(iii). Risk

The factors used in this model are

Value	Growth and Momentum	Risk
i. Book/Price	i. Estimate revisions	i. Beta
ii. Retained EPS/Price	ii. Price momentum	ii. Residual risk
iii. EBITD/Enterprise value	iii. Sustainable growth	iii. Disappointment risk

Book/Price, retained EPS/Price are the value measures. Hence, (a) and (b) are not correct. Beta and disappointment risk are risk measures and therefore (d) and (e) are also not correct.

25. Answer : (d)

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Reason : Timing ability is indicated by the curvature of the plotted line. Steeper the slope as you move to the right of the given graph higher the market timing ability. The steeper slope shows that the manager maintained higher portfolio sensitivity to market swings (i.e. higher Beta) in periods when the market performed well. This ability to choose more market sensitive securities in anticipation of market upturns is the essence of good timing skill. As given in the graph, a declining slope as you move to the right means that portfolio was more sensitive to the market when the market did poorly and less sensitive when the market did well. This indicates bad timing.

26. Answer : (c)

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Reason : In a ratio spread, the number of options bought differs from the number of options sold to form a spread. Hence, alternative (c) is answer.

In all other alternatives mentioned, the number of options bought will be the same as that of sold.

27. Answer : (e)

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Reason : All the options mentioned are likely problems in static portfolio insurance.

28. Answer : (b)

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$$\begin{aligned} \text{Reason : NAV of the fund unit} &= \frac{125.0 + 9.4 + 3.1 + 37.5 - 28.1 - 6.3}{12.5} \\ &= 11.248 \end{aligned}$$

$$\text{The public offer price (POP)} = \frac{11.248}{1 - 0.03} = \text{Rs.}11.59587 \approx \text{Rs.}11.6.$$

29. Answer : (d)

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Reason : As the simple analysis says the fund resembles the floating rate bond. It means that when the interest rate goes up the investors gets more return and vice-versa. As the dividend yield is getting aligned on the continuous basis the corpus or NAV of the fund will remain more or less same. Therefore, it will attract the short-term surpluses from corporates as well as the investors who are very sensitive to fluctuations of NAV of their investments.

30. Answer : (d)

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$$\begin{aligned} \text{Reason : Form of CML is } E(R_i) &= R_f + \left(\frac{R_m - R_f}{\sigma_m} \right) \sigma_i \\ \text{\& of ex-ante SML is } E(R_i) &= R_f + (R_m - R_f) \beta_i \end{aligned}$$

$$\begin{aligned} \text{Therefore, } \frac{R_m - R_f}{\sigma_m} &= 0.36 \\ (R_m - R_f) &= 5.50 \end{aligned}$$

$$\text{From the above equations, } \sigma_m^2 = (5.5/0.36)^2 = 233.4 \text{ i.e., } 233(\%)^2.$$

Section B : Problems

1. a. In order to get the expected return of the market, investment should be made in a portfolio that has a beta of 1

$$\text{Beta of Powergas} = \beta_G = \text{Cov}_{GM} / \sigma_M^2 = 0.0135 / 0.15^2 = 0.6$$

Beta of Supertech :

$$\begin{aligned} \text{Correlation Coefficient} &= (\text{Coefficient of Determination})^{1/2} \\ &= (0.36)^{1/2} = 0.6 \end{aligned}$$

$$= \beta_S = \text{Cov}_{SM} / \sigma_M^2 = (\sigma_S \sigma_M \text{Cor}_{SM}) / \sigma_M^2 = (0.4 \times 0.15 \times 0.6) / 0.15^2 = 1.6$$

W_S = Portfolio weight of Supertech.

$$\beta_P = W_S \times 1.6 + (1 - W_S) \times 0.6 = 1.0 \quad \text{This implies } W_S = 0.4$$

Hence invest 40% in Supertech and 60% in Powergas.

Verification:

$$\text{Hence, Portfolio Beta} = \beta_P = 0.4 \times 1.6 + 0.6 \times 0.6 = 1.0.$$

$$\begin{aligned} \text{Expected Return from the Portfolio} &= R_P = R_f + \beta_P (R_M - R_f) \\ &= 6\% + 1 \times (15\% - 6\%) = 15\% \end{aligned}$$

- b. A portfolio of Powergas and Supertech with an expected rate of return of 24% needs to have a beta such that

$$\begin{aligned} \text{Return from Portfolio} &= R_P = R_f + \beta_P (R_M - R_f) = 6\% + \beta_P \times (15\% - 6\%) = 24\%. \\ &= \beta_P \times 9 = 18 \quad \text{This implies } \beta_P = 2.0 \end{aligned}$$

Using the same approach as above:

$$\beta_P = W_S \times 1.6 + (1 - W_S) \times 0.6 = 2.0$$

$$W_S = 1.4 \text{ and } W_G = -0.4$$

We have to invest 1.4 times our portfolio value in Supertech and finance the extra 40% by shorting Powergas.

The variance of this portfolio is equal to:

$$\sigma_P^2 = 1.4^2 \times 0.4^2 + (-0.4)^2 \times 0.45^2 + 2 \times 1.4 \times -0.4 \times 0.5 \times 0.4 \times 0.45 = 0.2452$$

Hence, the standard deviation of the portfolio return is equal to 49.52%

- c. The expected return on the portfolio is 24%. We have established in part (b) that this implies a beta of 2.0. The least risky portfolio is the one that invests only in the market portfolio and the risk free asset.

$$\text{Expected Return} = W_M \times R_M + W_{RF} \times R_{RF} = 24\%$$

To obtain the expected return of 24%, the portfolio beta should be 2.

Since the beta of risk free asset is 0, to obtain the beta of 2, we should invest 200% of the portfolio value in the market and finance the extra 100% by borrowing at the risk free rate of interest. The risk of this portfolio is

$$\text{Var}(\text{Portfolio}) = \sigma_P^2 = \beta_P^2 \times \sigma_M^2 = 2.0^2 \times 0.15^2 = 0.09 = 9 (\%)^2$$

Hence, the standard deviation of the portfolio return is equal to 30%

We can easily see that while obtaining the same return of 24%, this portfolio reduces risk (30%) dramatically relative to the two-asset portfolio (49.52%) in part (b).

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2. a. Mr. Varma should select the fund that offers the same expected return for lower risk. Hence, he has to compare the riskiness of the two funds with the same beta by leveraging the portfolio.

Let the investment in the risk free asset be 1-x and

The investment in fund be x

Therefore,

$$x \times \beta + (1-x) \times \beta_{rf} = 1.0,$$

$$x \times \beta + (1-x) \times 0 = 1.0$$

$$\text{Hence, } x = 1/\beta$$

Target beta: 1.0

	Beta	Proportion of investment Fund ($x=1/\beta$)	Fund Risk (S.D)	Proportion of investment in risk free asset (1-x)	Portfolio variance ($W_f^2 \sigma_f^2$)* (%) ²	Portfolio Standard deviation (%)
Fund1	0.8	$1/0.8 = 1.25$	20%	-0.25	625	25
Fund2	1.2	$1/1.2 = 0.83$	32%	0.17	705.4336	26.56

$$* \text{ Portfolio variance} = W_f^2 \sigma_f^2 + W_{rf}^2 \sigma_{rf}^2 + 2 W_f \sigma_f W_{rf} \sigma_{rf} \rho_{f1rf}$$

Since standard deviation of risk free security and its correlation with fund are zero, the above formulae will be reduced to $W_f^2 \sigma_f^2$

Hence, portfolio consisting of risk free asset and Fund 2 is riskier. The conclusion is independent of the assumption that the target beta is 1, since he would simply increase/reduce the riskiness of both portfolios by the same factor.

- b. For having an expected return of 14.6%, he needs a beta of

$$R_p = R_f + \beta_p \times (R_m - R_f) = 5\% + \beta_p \times 8\% = 14.6\%$$

$$\text{Hence, } \beta_p = 9.6/8 = 1.2$$

Option 1: Since $\beta_p = 1.2$,

$$1.2 = W_{f1} \times \beta_{f1} + W_{rf} \times \beta_{rf}$$

$$1.2 = W_{f1} \times 0.8 + (1 - W_{f1}) \times 0$$

$$W_{f1} = 1.5$$

Hence, he can invest 150% of portfolio value in fund 1 and borrow 50% at risk free rate of 5%,

$$\text{Var}(P) = \sigma_p^2 = W_{f1}^2 \times \sigma_{f1}^2 = 1.5^2 \times 20^2 = 900 (\%)^2$$

$$\sigma_p = 30\%$$

Option 2: He can invest in fund 2 that has a β of 1.2

Since β of fund 2 is 1.2, which is the target β , he has to invest 100% of portfolio value in fund 2 and nothing in risk free security.

Therefore, the portfolio risk is equal to funds risk i.e., $\sigma_{f2} = 32\%$

Fund 1 combined with risk free rate gives a lower standard deviation (30%) than fund 2 considered alone (32%). Hence, fund 1 with risk free rate would be the correct choice.

- c. In this case, borrowing risk free rate and lending risk free rate are different.

In case of Fund 2, 100% investment will be made in fund 2 exclusively. The problem of borrowing does not arise. Fund 2 : $14.6\% = 5\% + 1.2 \times 8\%$

$$\sigma_p = \sigma_{f2} = 32\%$$

However, the problem of borrowing arises in case of Fund 1. It is because he needs to borrow at risk free rate to invest more than 100% of portfolio value in Fund 1.

If he is borrowing ($x > 100\%$), the value of x can be solved as follows (for fund 1):

$$W_{f1} \times R_{f1} + (1 - W_{f1}) \times R_{rf} = 14.6$$

$$\text{Since, } R_{f1} = 5\% + 0.8 \times 8\% = 11.4\%$$

$$W_{f1} \times 11.4 + (1 - W_{f1}) \times 7 = 14.6$$

$$\text{Hence } W_{f1} \times 4.4 = 7.6, \text{ or } W_{f1} = 7.6/4.4$$

$$W_{f1} = 1.73$$

$$\text{Then the risk is now equal to } W_{f1}^2 \times \sigma_{f1}^2 = 1.73^2 \times 20^2 = 1,197.16 (\%)^2$$

$$\sigma_p = 34.6\%$$

Fund 2 gives a lower standard deviation (32%) than the portfolio consisting of fund 1 and risk free asset (34.6%). Hence, fund 2 would be the correct choice.

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3. The return on the market = 7 + 7 = 14%.

The market variance = $25 (\%)^2$

Stock	α_i	β_i	$R_i = \alpha_i + \beta_i (R_m)$	σ_{ei}^2	$R_i - R_f$	$(R_i - R_f) / \beta_i$	Rank
ITC	1.72	0.89	14.18	9.35	7.18	8.067	4
SBI	0.89	0.97	14.47	5.92	7.47	7.701	5
Satyam	0.46	1.24	17.82	9.79	10.82	8.726	2
HLL	1.52	1.04	16.08	5.36	9.08	8.731	1
BPL	0.96	1.11	16.50	4.52	9.50	8.559	3

Rank	Stock	σ_{ei}^2	β_i	$R_i - R_f$	$(R_i - R_f) \times \beta_i$	$(R_i - R_f) \beta_i / \sigma_{ei}^2$
1.	HLL	5.36	1.04	9.08	9.443	1.76
2	Satyam	9.79	1.24	10.82	13.417	1.37
3	BPL	4.52	1.11	9.50	10.545	2.33
4	ITC	9.35	0.89	7.18	6.390	0.68
5	SBI	5.92	0.97	7.47	7.246	1.22

Stock	$\frac{(R_i - R_f) \beta_i}{\sigma_{ei}^2}$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$\frac{(R_i - R_f) \beta_i}{\sigma_{ei}^2}$	$\frac{\beta_i^2}{\sigma_{ei}^2}$	$C_i = \frac{\sigma_m^2 \sum \frac{(R_i - R_f) \beta_i}{\sigma_{ei}^2}}{1 + \sigma_m^2 \sum \frac{\beta_i^2}{\sigma_{ei}^2}}$
HLL	1.76	0.202	1.76	0.202	7.2727
Satyam	1.37	0.157	3.13	0.359	7.8446
BPL	2.33	0.273	5.46	0.632	8.1250
ITC	0.68	0.085	6.14	0.717	8.1123
SBI	1.22	0.159	7.36	0.876	8.0360

$$C^* = 8.125$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2} \left(\frac{R_i - R_f}{\beta_i} - C^* \right)$$

$$Z_{HLL} = \frac{1.04}{5.36} (8.731 - 8.125) = 0.1176$$

$$Z_{satyam} = \frac{1.24}{9.79} (8.726 - 8.125) = 0.0761$$

$$Z_{BPL} = \frac{1.11}{4.52} (8.559 - 8.125) = 0.1066$$

$$Z_i = 0.1176 + 0.0761 + 0.1066 = 0.3003$$

$$\%_{HLL} = \frac{0.1176}{0.3003} = 0.3916 \text{ i.e. } 39.16\%$$

$$\%_{Satyam} = \frac{0.0761}{0.3003} = 0.2534 \text{ i.e., } 25.34\%$$

$$\%_{BPL} = \frac{0.1066}{0.3003} = 0.3550 \text{ i.e., } 35.50\%$$

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4. a. To begin with, we should start investing in bond E so that the cash flow from this bond consisting of coupon

payments and principal redemption within 5 years matches the liability. For this purpose, an investment of $21,35,000/1.0825 = 19,72,286.00$ (face value) is required in bond E. The amount of the cash flow from this bond in the final year will meet the obligation of the company in the final year. The following table indicates the obligation of the company in the next 5 years:

Maturity	Debt obligation	Cash inflows from Bond E	Remaining Liabilities
1	8,50,000	7,38,132 (Face value)	6,87,286

Now an investment in bond D is required so that the cash flows in the fourth year matches the liability of the 4th year.

$$\frac{13,97,286}{1.075}$$

Amount of Investment in bond D should be = 1.075 = Rs.12,99,801. (Face value)

E	19,72,286 x 1.045 =	20,61,039
Total		Rs.50,52,333

b.

Maturity (in years)	Liabilities (Rs.)	PVIF @9%	PV of Liabilities (Rs.)	PV of liabilities × n
1	8,50,000	0.917	779450	779450
2	9,65,000	0.842	812530	1625060
3	10,50,000	0.772	810600	2431800
4	15,60,000	0.708	1104480	4417920
5	21,35,000	0.650	1387750	6938750
			4894810	16192980

$$\frac{16192980}{4894810}$$

Duration of the debt portfolio = $\frac{16192980}{4894810} = 3.31$ years

We need to find out the weights to be allocated to bonds D and E so that the resulting duration of the bond portfolio will be equal to the duration of the debt portfolio.

For this purpose we have to find out the duration of the individual funds.

YTM of Bond D

$$97.85 = 7.5 \times PVIFA(r, 4) + 100 \times PVIF(r, 4)$$

$$\text{At } r = 8\%, \text{ RHS} = 7.5 \times 3.312 + 100 \times 0.735 = 98.34$$

$$\text{At } r = 9\%, \text{ RHS} = 7.5 \times 3.240 + 100 \times 0.708 = 95.10$$

Interpolating, we get

$$\frac{98.34 - 97.85}{98.34 - 95.10}$$

$$\text{YTM} = 8 + \frac{98.34 - 97.85}{98.34 - 95.10} \times 100 = 8.15\% \approx 8\%$$

YTM of bond E

$$104.50 = 8.25 \times PVIFA(r, 5) + 100 \times PVIF(r, 5)$$

$$\text{At } r = 7\%, \text{ RHS} = 8.25 \times 4.10 + 100 \times 0.713 = 105.125$$

$$\text{At } r = 8\%, \text{ RHS} = 8.25 \times 3.993 + 100 \times 0.681 = 101.04$$

Interpolating, we get

$$\frac{105.125 - 104.50}{105.125 - 101.04}$$

$$\text{YTM} = 7 + \frac{105.125 - 104.50}{105.125 - 101.04} \times 100 = 7.15\% \approx 7\%$$

$$\text{Current yield of bond S} = 7.5/97.85 = 7.66\%$$

$$\text{Current yield of bond T} = 8.25/104.50 = 7.89\%$$

$$\text{Duration of the bond} = \frac{\frac{r_c}{1+r_c}}{\frac{r_d}{1+r_d}} \times PVIFA(r_d, n) \times (1+r_d) + \left(1 - \frac{r_c}{r_d}\right) \frac{1}{(1+r_d)^n}$$

$$\text{Duration of bond D} = \frac{0.0766}{0.080} \times PVIFA(0.08, 4) \times (1+0.08) + \left(1 - \frac{0.0766}{0.080}\right) \frac{1}{(1+0.08)^4} = 3.595 \text{ years.}$$

$$\text{Duration of bond E} = \frac{0.0789}{0.070} \times PVIFA(0.070, 5) \times (1+0.070) + \left(1 - \frac{0.0789}{0.070}\right) \frac{1}{(1+0.070)^5}$$

$$= 4.31 \text{ years.}$$

$$3.595x + 4.31(1-x) = 3.31$$

$$x = 1.3986$$

Therefore to immunize the portfolio Bond E should be short sold and the amount should be invested in bond D.

Bond E worth of 39.86% of the PV liabilities should be sold and 139.86% of the PV of the liabilities should be invested in bond D.

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5.

i.

If the investor expects that there will be significant price move but the share price is more likely to fall than to rise, the appropriate strategy is strip. A strip consists of a long position in one call and two puts with the same exercise price and expiration date
- ii.

If the investor expects that there will be significant price move but the share price is more likely to rise than to fall, the appropriate strategy is strap. A strap consists of a long position in two calls and one put with the same exercise price and expiration date.

Buy one April 690 Call	0
Buy two April 690 Puts	-100
Total cash outflow	-50

:

:

730	80	–	80	40
740	100	–	100	60
750	120	–	120	80

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Section C: Applied Theory

6. Drivers of investment policies

The key drivers of the investment policy of an insurance company are as follows:

- Asset Liability Matching
- Regulatory and Legal considerations
- Tax considerations
- Liquidity needs
- Unique Needs, Circumstances and references.

Asset-Liability Matching

An important principle of insurance investment is to “match” assets with liabilities. Absolute matching would mean choosing assets to produce a stream of cashflows identical to the investor’s emerging liabilities. Unfortunately, absolute matching is unattainable for many institutional investors due to the non-existence of assets which fit the characteristics of the liabilities. But where liabilities are fixed in monetary terms and are not of too long maturities, it is possible to ensure that the present value of assets and liabilities are influenced by the same and exactly matching liabilities. This process is known as immunization. In general immunization requires the following conditions to be fulfilled.

1.	Duration (Assets)	Duration (Liabilities)
2.	PV (Assets)	PV (Liabilities)
3.	Dispersion (Assets)	Approximately equal to the duration of assets.
4.	Dispersion (Liabilities)	Approximately equal to the duration of liabilities.

Regulatory and Legal Considerations

Most institutional investors are regulated regarding the eligible class of assets, the minimum and/or maximum amount that can be placed in a particular asset class, and the maximum amount that can be invested in a given asset. Within an asset class, there can be restrictions on the particular assets eligibility for investment.

Regulatory restrictions on investment patterns and on the inclusion of certain types of investment vehicles obviously reduce the insurance companies’ investor’s ability to achieve a better risk-return trade off. For example, strategies involving futures and options may allow the insurance company to achieve unique risk-return speculative by the regulators. These derivative instruments may not qualify as eligible investment vehicles. Fortunately, in the recent years, more and more regulators have become familiar with the economic role of these instruments, and they have broadened their position regarding the use of new financial products by the institutions they regulate. In fact, there is a trend to replace traditional “laundry lists” of approved investments by the “Prudent Man Rule” which allows the insurance companies the much needed flexibility to keep up with the ever changing array of investment alternatives.

Tax Considerations

Institutional investors like Pension Funds are basically tax-exempt entities; and would therefore; tilt their portfolios to high-yield stocks if the high-yield stocks offer higher pre-tax returns. In the Indian context, we are aware that approved mutual funds are exempt from taxes under Sec. 10(23-D) of the Income Tax Act. But there are other institutional investors such as banks and insurance companies which are subject to income taxes. Therefore, the investment policies of such investors must consider the tax factor and the nuances of the tax code applicable to them.

Liquidity Considerations

The degree of liquidity required by an insurance company varies significantly. For example, the liquidity needs of a life assurance company are considerably less than those of a non-life insurance company transacting marine or fire insurance business. Even among companies transacting non-life insurance business, mature companies may be less concerned with liquidity than newly created companies. In the pension area, the liquidity needs of a pension fund will depend upon the current age distribution of future beneficiaries, with relatively young plans of growing firms having less need for liquidity than older plans where considerable benefits must be paid in the near future. In the mutual funds industry, open-ended schemes need to have more liquidity in their portfolios than close-ended schemes. A need for liquidity implies a need to tilt the portfolio to the most readily marketable and liquid types of bonds and money-market instruments such as Treasury Bills and Commercial Paper.

Unique Needs, Circumstances and Preferences

Portfolio construction would be sterile without a provision for the special requirements of each investor like social responsibility, issues that may preclude investing in firms that make objectionable products or do business, in certain countries. The investment committee of the institution may have a pre-defined portfolio structure where the quality and/or the maturity range of the portfolio holdings are restricted. Such considerations must be taken into account while framing the investment policy.

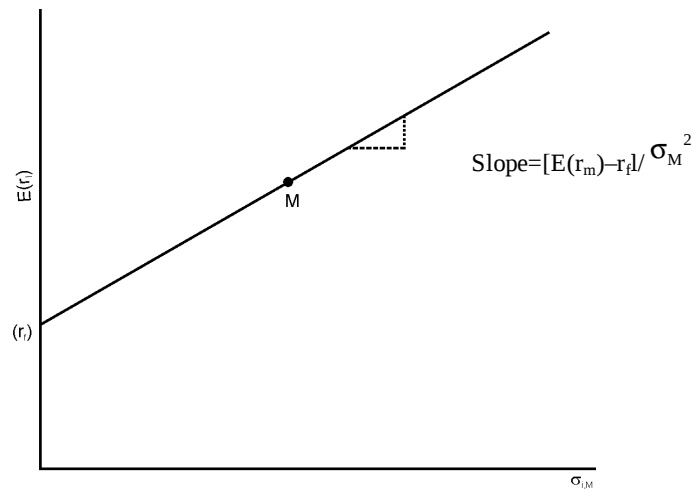
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7. As per the explanation contributed by CAPM, it makes sense for security A to have less expected return than security B, even though its standard deviation is double to that of B, provided that its covariance with the market is more than that of B. In other words, As per CAPM, the investors should be compensated for only systematic risk measured by β . Hence, even though total risk measured by standard deviation is more, if the proportion of systematic risk is less the expected return on this security is less. This can be explained as below.

Whenever the investor adds a security to an existing portfolio, that new security affects expected portfolio risk in two ways. **First**, it affects the average variance value. Thus, if the variance of the new security is greater (less) than the average variance across the other securities already in the portfolio, then the level of average variance value will increase (decrease) when the new security is added. However, if n is sufficiently large, the impact of a single security's variance on the overall risk of the portfolio is negligible. Furthermore, since the investor should hold the market portfolio M , n is very large and the impact of a single security's variance on the total risk of the market portfolio is negligible. The **second**, and more important, impact of a security on the expected risk of an investor's portfolio is through the average covariance element. Whenever a security is added to the portfolio, it affects the average covariance component through its relationship with all the other $(n-1)$ securities in the portfolio. If, the covariance of the new security is greater (less) than the existing average covariance among the securities in the portfolio, the security can significantly raise (lower) the overall portfolio risk. Therefore, effective diversification involves adding new securities whose returns have low-levels of covariance or correlation with the returns of those securities already included in the portfolio. Thus, securities whose returns have low or even negative levels of covariance with the returns of the other securities will be in great demand and sought by investors who choose to diversify their holdings. Conversely, securities whose returns are highly correlated with the other securities returns will be required to offer more expected return in exchange for their potential to add to the overall risk of the investor's portfolio.

On the basis of these arguments, it can be concluded that a security's expected return should be positively related to the level of covariance between that security's return and the return on the investor's personal portfolio. The greater the covariance, the higher the required return. As stated previously, since all investors should hold the same portfolio, market portfolio M , and the required return should be a function of the covariance between the security's return and the market portfolio. The equilibrium relationship between security's expected return and their covariance with the market portfolio is called the Security Market Line (SML), which is commonly referred to as the Capital Asset Pricing Model (CAPM).

On the basis of these arguments, it can be concluded that a security's expected return should be positively related to the level of covariance between that security's return and the return on the investor's personal portfolio. The greater the covariance, the higher the required return. As stated previously, since all investors should hold the same portfolio M , the required return should be a function of the covariance between the security's return and the market portfolio. The equilibrium relationship between securities expected returns and their covariance with the market portfolio is called the Security Market Line (SML), which is commonly referred to as the Capital Asset Pricing Model (CAPM)



This equation can be formulated by recognizing that market portfolio M must also lie on the line. Using the relationship $y = a + bx$ and recognizing that $(\sigma_{MM}) = (\sigma_M^2)$, the CAPM is given by:

$$E(r_i) = r_f + \left\{ [E(r_M) - r_f] / (\sigma_M^2) \right\} \sigma_{iM}$$

The above equation states that the expected return on any security or portfolio i, $E(r_i)$, is the sum of two components: (1) the risk-free rate of return, r_f and (2) a market risk premium, $\{[E(r_M) - r_f] / \sigma_M^2\} \sigma_{iM}$ which is proportional to the covariance of the security's rate of return with the market's return. The slope of the CAPM is given by $[E(r_M) - r_f] / \sigma_M^2$ and is same for all securities. The magnitude of the covariance, σ_{iM} determines how much additional return, over and above r_f security of portfolio I, must be provided in order to compensate the investor for its covariance with market portfolio, M.

When analyzing these results, it is important to recognize that since all investors can and should diversify by holding market portfolio M, the relevant measure of risk in the pricing of security expected returns is the security's systematic risk, as measured by σ_{iM} . Thus, the CAPM says that unsystematic risk should not be priced, since investors can and should cost lessly diversify or eliminate this portion. The CAPM relationship depicted can also be expressed in term of a security's (or portfolio's) beta, β_i .

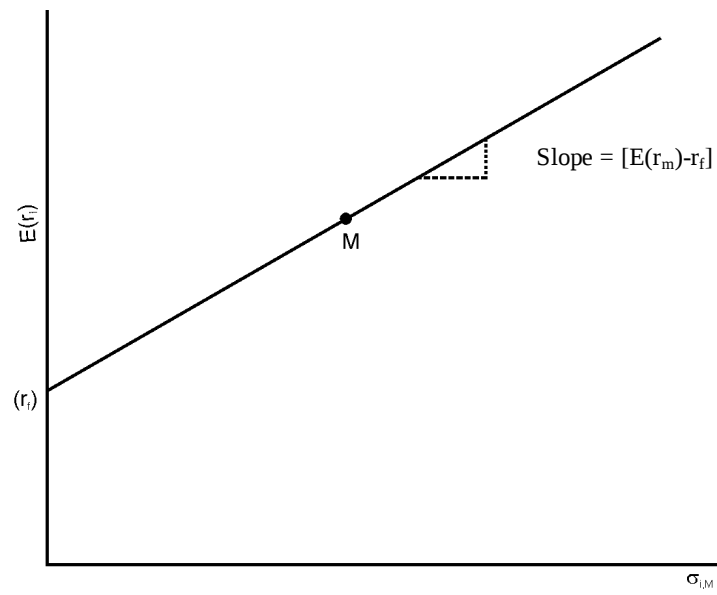
As we know,

$$\beta_i = \sigma_{iM} / \sigma_M^2$$

Substituting β_i for σ_{iM} / σ_M^2 in the CAPM relation above, the beta version of CAPM is:

$$E(r_i) = r_f + [E(r_M) - r_f] \beta_i$$

This equation says that the risk premium for security or portfolio equals the market price of risk, $E(r_M) - r_f$ times the security's systematic risk as measured by its beta. The greater the bets, the higher should be required return, assuming of course, $E(r_M) > r_f$.



The CAPM Relationship in Terms of Beta

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