

PORTFOLIO MANAGEMENT

CLASS 13

CLASS WORK COVERAGE

To streamline our learning process, I've categorized the questions we'll tackle in class into four distinct groups:

1. **Classic:** These questions are exactly as presented in your book, providing a familiar foundation.
2. **Transformed:** Here, we've converted book questions into multiple-choice format to enhance your analytical skills.
3. **Adapted:** These are similar to book questions but with altered numbers or names, presented as multiple-choice questions for varied practice.
4. **Original:** These are entirely new questions not found in your book, designed to challenge and expand your understanding.

This structure will help us navigate through a range of problems, ensuring a comprehensive grasp of the material. Looking forward to our next session!

Q. No.	Type	Book	Page No.
45	Classic	CW Q BOOK	60
46	Classic	CW Q BOOK	61
47	Classic	CW Q BOOK	61
48	Classic	CW Q BOOK	61
49	Classic	CW Q BOOK	62

PART III: ALTERNATES TO CMT

Topic 16 APT

Question 45: SSEI CW Book Page No. 60

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

- i. Small cap growth stocks
- ii. Small cap value stocks
- iii. Large cap growth stocks
- iv. Large cap value stocks

Mr. Nirmal Kumar also estimated the weights of the above categories of stocks in the market index. Further, the sensitivity of returns on these categories of stocks to the three important factor are estimated to be:

Category of Stocks	Weight in the Market Index	Factor I (Beta)	Factor II (Book Price)	Factor III (Inflation)
Small cap growth	25%	0.80	1.39	1.35
Small cap value	10%	0.90	0.75	1.25
Large cap growth	50%	1.165	2.75	8.65
Large cap value	15%	0.85	2.05	6.75
Risk Premium		6.85%	-3.5%	0.65%

The rate of return on treasury bonds is 4.5%

Required:

- i. Calculate the expected return on the market index using Arbitrage Pricing Theory.
- ii. Calculate the expected return on the market index using Capital Asset Pricing Model (CAPM).
- iii. Advise the composition of a portfolio if Mr. Nirmal Kumar wants to construct a portfolio constituting only the 'small cap value' and 'large cap growth' stocks and if the target beta for the desired portfolio is 1.

(Source: ICAI)

ANSWER:

- i. To calculate expected return on Market Index first using APT we shall compute the each Stock's return as follows:

$$\text{Stock's return Small cap growth} = 4.5 + 0.80 \times 6.85 + 1.39 \times (-3.5) + 1.35 \times 0.65 = 5.9925\%$$

$$\text{Small cap value} = 4.5 + 0.90 \times 6.85 + 0.75 \times (-3.5) + 1.25 \times 0.65 = 8.8525\%$$

$$\text{Large cap growth} = 4.5 + 1.165 \times 6.85 + 2.75 \times (-3.5) + 8.65 \times 0.65 = 8.478\%$$

$$\text{Large cap value} = 4.5 + 0.85 \times 6.85 + 2.05 \times (-3.5) + 6.75 \times 0.65 = 7.535\%$$

Expected return on market index

$$0.25 \times 5.9925 + 0.10 \times 8.8525 + 0.50 \times 8.478 + 0.15 \times 7.535 = 7.7526\%$$

Alternatively, it can also be calculated as follows:

Expected return on the market index

$$\begin{aligned} &= 4.5\% + [0.1 \times 0.9 + 0.25 \times 0.8 + 0.15 \times 0.85 + 0.50 \times 1.165] \times 6.85 + [(0.75 \times 0.10 + 1.39 \times 0.25 + 2.05 \\ &\times 0.15 + 2.75 \times 0.5)] \times (-3.5) + [(1.25 \times 0.10 + 1.35 \times 0.25 + 6.75 \times 0.15 + 8.65 \times 0.50)] \times 0.65 \\ &= 4.5 + 6.85 + (-7.3675) + 3.77 = 7.7525\%. \end{aligned}$$

- ii. To calculate expected return on Market Index first using CAPM we shall compute the each Stock's return as follows:

$$\text{Small cap growth} = 4.5 + 6.85 \times 0.80 = 9.98\%$$

$$\text{Small cap value} = 4.5 + 6.85 \times 0.90 = 10.665\%$$

$$\text{Large cap growth} = 4.5 + 6.85 \times 1.165 = 12.48\%$$

$$\text{Large cap value} = 4.5 + 6.85 \times 0.85 = 10.3225\%$$

Expected return on market index

$$= 0.25 \times 9.98 + 0.10 \times 10.665 + 0.50 \times 12.45 + 0.15 \times 10.3225 = 11.33\%$$

- iii. Let us assume that Mr. Nirmal will invest X1% in small cap value stock and X2% in large cap growth stock

$$X_1 + X_2 = 1$$

$$0.90 X_1 + 1.165 X_2 = 1$$

$$0.90 X_1 + 1.165(1 - X_1) = 1$$

$$0.90 X_1 + 1.165 - 1.165 X_1 = 1$$

$$0.165 = 0.265 X_1$$

$$0.165/0.265 = X_1$$

$$0.623 = X_1, X_2 = 0.377$$

Advise: Thus, Mr. Nirmal should invest 62.3% of his funds in small cap value and balance 37.7% in large cap growth.

Question 46: SSEI CW Book Page No. 61

With the help of following data determine the return on the security X.

Factor	Risk Premium associated with the Factor	β_i
Market	4%	1.3
Growth Rate of GDP	1%	0.3
Inflation	-4%	0.2

Risk Free Rate of Return is 8%.

(Source: ICAI)

ANSWER:**Expected Return**

$$\begin{aligned}
 R_f + \lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3 \\
 &= 8\% + 1.3 \times 4\% + 0.3 \times 1\% + 0.2 \times (-4\%) \\
 &= 8\% + 5.2\% + 0.3\% - 0.8\% \\
 &= 12.7\%
 \end{aligned}$$

Question 47: SSEI CW Book Page No. 61

Mr. X owns a portfolio with the following characteristics:

	Security A	Security B	Risk Free security
Factor 1 sensitivity	0.80	1.50	0
Factor 2 sensitivity	0.60	1.20	0
Expected Return	15%	20%	10%

It is assumed that security returns are generated by a two factor model.

- If Mr. X has ₹ 1,00,000 to invest and sells short ₹ 50,000 of security B and purchases ₹ 1,50,000 of security A what is the sensitivity of Mr. X's portfolio to the two factors?
- If Mr. X borrows ₹ 1,00,000 at the risk free rate and invests the amount he borrows along with the original amount of ₹ 1,00,000 in security A and B in the same proportion as described in part (i), what is the sensitivity of the portfolio to the two factors?
- What is the expected return premium of factor 2?

(Source: ICAI)

ANSWER:

- Mr. X's position in the two securities are +1.50 in security A and -0.5 in security B. Hence the portfolio sensitivities to the two factors:-

$$b \text{ prop. 1} = 1.50 \times 0.80 + (-0.50 \times 1.50) = 0.45$$

$$b \text{ prop. 2} = 1.50 \times 0.60 + (-0.50 \times 1.20) = 0.30$$

- Mr. X's current position:-

$$\text{Security A } ₹ 3,00,000 / ₹ 1,00,000 = 3$$

Security B $-\text{₹ } 1,00,000 / \text{₹ } 1,00,000 = -1$

Risk free asset $-\text{₹ } 100000 / \text{₹ } 100000 = -1$

b prop. 1 $= 3.0 \times 0.80 + (-1 \times 1.50) + (-1 \times 0) = 0.90$

b prop. 2 $= 3.0 \times 0.60 + (-1 \times 1.20) + (-1 \times 0) = 0.60$

iii. Expected Return = Risk Free Rate of Return + Risk Premium

Let λ_1 and λ_2 are the Value Factor 1 and Factor 2 respectively.

Accordingly

$$15 = 10 + 0.80 \lambda_1 + 0.60 \lambda_2$$

$$20 = 10 + 1.50 \lambda_1 + 1.20 \lambda_2$$

On solving equation, the value of $\lambda_1 = 0$, and risk premium of factor 2 for Securities A & B shall be as follows:

Using Security A's Return

$$\text{Total Return} = 15\% = 10\% + 0.60 \lambda_2$$

$$\text{Risk Premium } (\lambda_2) = 5\% / 0.60 = 8.33\%$$

Alternatively using Security B's Return

$$\text{Total Return} = 20\% = 10 + 1.20 \lambda_2$$

$$\text{Risk Premium} = 10\% / 1.20 = 8.33\%$$

Question 48: SSEI CW Book Page No. 61

Mr. Sunil Mukharjee has estimated probable returns under different macroeconomic conditions for the following three stocks:

Stock	Current Price (₹)	Rates of return (%) during different Macroeconomic scenarios		
		Recession	Moderate Growth	Boom
Him Ice Ltd	12	-12	15	35
Kalahari Biotech	18	20	12	-5
Puma Softech	60	18	20	15

Mr. Sunil Mukherjee is exploring if it is possible to make any arbitrage profits from the above information.

Required :

Using the above information construct as arbitrage portfolio and show the payoffs under different economic scenarios.

(Source: ICAI)

ANSWER:

We find that only Puma has positive return under all economic scenarios. Hence, Arbitrage involves going long on Puma by short selling H & K. Given their current prices, one possible arbitrage portfolio could be -

Short Sell 2 shares of H

Short Sell 2 Shares of K

By 1 share of Puma

Therefore inflow = $2 \times 12 + 2 \times 18 = 60$

Outflow = 60

$\therefore$ Net Investment = 0

Recession

Profit from short position in H

$$12\% \times 12 \times 2 = 2.88$$

Loss from short position in K

$$20\% \times 18 \times 2 = -7.2$$

Profit on long position in PUMA

$$18\% \times 60 \times 1 = 10.8$$

Overall profit = 6.48

Moderate Growth

loss from short position in H

$$= 15\% \times 12 \times 2 = 3.6$$

loss from short position in K

$$= 18 \times 12\% \times 2 = -4.32$$

Profit from long position in PUMA

$$= 60 \times 20\% \times 1 = 12$$

Overall profit = 4.08

Boom

Loss from short position in H

$$= 12 \times 35\% \times 2 = -8.4$$

Profit from short position in K

$$= 18 \times 5\% \times 2 = 1.8$$

Profit from long position in PUMA

$$= 60 \times 15\% \times 1 = 9$$

Overall Profit = 2.4

Topic 17 MULTI FACTOR MACRO ECONOMIC MODEL

Question 49: SSEI CW Book Page No. 62

Mr. Tamarind intends to invest in equity shares of a company the value of which depends upon various parameters as mentioned below:

Factor	Beta	Expected value in %	Actual value in %
GNP	1.20	7.70	7.70
Inflation	1.75	5.50	7.00
Interest rate	1.30	7.75	9.00
Stock market index	1.70	10.00	12.00
Industrial production	1.00	7.00	7.50

The risk-free rate of interest be 9.25%,

Calculate the return of the share as per Arbitrage Pricing Theory.

(Source: ICAI)

ANSWER:

Return of the stock under APT

Factor	Actual value in %	Expected value in %	Difference	Beta	Diff. x Beta
GNP	7.70	7.70	0.00	1.20	0.00
Inflation	7.00	5.50	1.50	1.75	2.63
Interest rate	9.00	7.75	1.25	1.30	1.63
Stock index	12.00	10.00	2.00	1.70	3.40
Ind. Production	7.50	7.00	0.50	1.00	0.50
					8.16
Risk free rate in %					9.25
Return as per APT					17.41