

PORTFOLIO CLASS 13

HOME WORK SUPPORT

COVERAGE

Question			Answer			Lecture Time
Q. No	Page no.	Book	Q. No	Page no.	Book	
22	38	HW Q BOOK	22	103	HW ANS BOOK	00:00:34 - 00:17:29
EXTRA Q1	131	HW ANS. BOOK	EXTRA Q1	132	HW ANS BOOK	00:17:30 - 00:18:53
EXTRA Q2	133	HW ANS. BOOK	EXTRA Q2	133	HW ANS BOOK	00:18:54 – 00:19:27
EXTRA Q3	133	HW ANS. BOOK	EXTRA Q3	134	HW ANS BOOK	00:19:28 – 00:20:41
EXTRA Q4	135	HW ANS. BOOK	EXTRA Q4	135	HW ANS BOOK	00:20:42 - 00:21:11
EXTRA Q5	135	HW ANS. BOOK	EXTRA Q5	136	HW ANS BOOK	00:21:12 - 00:22:48

PART III: ALTERNATES TO CMT

Topic 16 APT

Question 22: SSEI Book HW Page No. 38

Mr. Kapoor owns a portfolio with the following characteristics:

	Security X	Security Y	Risk Free Security
Factor 1 sensitivity	0.75	1.50	0
Factor 2 sensitivity	0.60	1.10	0
Expected Return	15%	20%	10%

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

- Analyse the sensitivity of Mr. Kapoor's portfolio to the two factors if he has Rs. 1,00,000 to invest and sells short Rs. 50,000 of security Y and purchases Rs. 1,50,000 of security X.
- Evaluate the sensitivity of the portfolio to the two factors if Mr. Kapoor borrows Rs. 1,00,000 at the risk free rate and invests the amount he borrows along with the original amount of Rs.1,00,000 in security X and Y in the same proportion as described in part (i).
- Determine the expected return premium of factor 2?

(Source: ICAI)

ANSWER:

- Mr. Kapoor's position in the two securities is +1.50 in security X and -0.5 in security Y. Hence the portfolio sensitivities to the two factors:**

$$b \text{ prop. 1} = 1.50 \times 0.75 + (-0.50 \times 1.50) = 0.375$$

$$b \text{ prop. 2} = 1.50 \times 0.60 + (-0.50 \times 1.10) = 0.35$$

- Mr. Kapoor's current position:**

$$\text{Security XRs. } 3,00,000 / \text{Rs. } 1,00,000 = 3$$

$$\text{Security Y-Rs. } 1,00,000 / \text{Rs. } 1,00,000 = -1$$

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

$$b \text{ prop. 1} = 3.0 \times 0.75 + (-1 \times 1.50) + (-1 \times 0) = 0.75$$

$$b \text{ prop. 2} = 3.0 \times 0.60 + (-1 \times 1.10) + (-1 \times 0) = 0.70$$

- 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

$$15 = 10 + 0.75 \lambda_1 + 0.60 \lambda_2$$

$$20 = 10 + 1.50 \lambda_1 + 1.10 \lambda_2$$

On solving equation, the value of λ_1 and λ_2 comes 6.67 and 0 respectively.

Accordingly, the expected risk premium for the factor 2 shall be Zero and whatever be the risk the same shall be on account of factor 1.

Alternatively, the risk premium of

Securities X & Y can be calculated as follows:

Security X

Total Return = 15%

Risk Free Return = 10%

Risk Premium = 5%

Security Y

Total Return = 20%

Risk Free Return = 10%

Risk Premium = 10%

PART III: ALTERNATES TO CMT

EXTRA QUESTION

Topic 16 APT

Question 1: HW ANS BOOK PAGE 131

Mr. Sanjay Saraf 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. Sanjay Saraf 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 (market index)	Factor II (Book Price)	Factor III (Inflation)
Small cap growth	20%	1.20	1.70	1.60
Small cap value	10%	1.40	1.30	1.90
Large cap growth	30%	0.90	2.10	5.30
Large cap value	40%	0.60	1.50	4.10
Risk Premium		6.2%	-2.40%	0.90%

The rate of return on treasury bonds is 5.5%

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. Sanjay Saraf 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 1.2

(Source: FOD)

ANSWER:

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

$$\text{Stock's return Small cap growth} = 5.5 + 1.20 \times 6.20 + 1.70 \times (-2.40) + 1.60 \times 0.90 = 10.30\%$$

$$\text{Small cap value} = 5.5 + 1.40 \times 6.20 + 1.30 \times (-2.40) + 1.90 \times 0.90 = 12.77\%$$

$$\text{Large cap growth} = 5.5 + 0.90 \times 6.20 + 2.10 \times (-2.40) + 5.30 \times 0.90 = 10.81\%$$

$$\text{Large cap value} = 5.5 + 0.60 \times 6.20 + 1.50 \times (-2.40) + 4.10 \times 0.90 = 9.31\%$$

Expected return on market index

$$0.20 \times 10.30 + 0.10 \times 12.77 + 0.30 \times 10.81 + 0.40 \times 9.31 = 10.304\%$$

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

$$\text{Small cap growth} = 5.5 + 6.20 \times 1.20 = 12.94\%$$

$$\text{Small cap value} = 5.5 + 6.20 \times 1.40 = 14.18\%$$

$$\text{Large cap growth} = 5.5 + 6.20 \times 0.90 = 11.08\%$$

$$\text{Large cap value} = 5.5 + 6.20 \times 0.60 = 9.22\%$$

Expected return on market index

$$= 0.20 \times 12.94 + 0.10 \times 14.18 + 0.3 \times 11.08 + 0.40 \times 9.22 = 11.018\%$$

- iii. Let us assume that Mr. Sanjay will invest $X_1\%$ in small cap value stock and $X_2\%$ in large cap growth stock

$$X_1 + X_2 = 1$$

$$1.40 X_1 + 0.90 X_2 = 1.20$$

$$1.40 X_1 + 0.90(1 - X_1) = 1.20$$

$$1.40 X_1 + 0.90 - 0.90 X_1 = 1.20$$

$$0.30 = 0.5 X_1$$

$$0.60 = X_1, X_2 = 0.40$$

Advise: Thus, Mr. Sanjay should invest 60% of his funds in small cap value and balance 40% in large cap growth.

PART III: ALTERNATES TO CMT

EXTRA QUESTION

Topic 16 APT

Question 2: **HW ANS BOOK PAGE 133**

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

Factor	Risk Premium associated with the Factor	β_i
Market	6.40%	1.5
Growth Rate of GDP	2.00%	0.5
Inflation	-5%	0.8

Risk Free Rate of Return is 6%.

(Source: FOD)

ANSWER:

Expected Return

$$\begin{aligned}
 &R_f + \lambda_1\beta_1 + \lambda_2\beta_2 + \lambda_3\beta_3 \\
 &= 6\% + 1.5 \times 6.40\% + 0.5 \times 2\% + 0.8 \times (-5\%) \\
 &= 6\% + 5.2\% + 0.3\% - 0.8\% \\
 &= 12.6\%
 \end{aligned}$$

PART III: ALTERNATES TO CMT

EXTRA QUESTION

Topic 16 APT

Question 3: HW ANS BOOK PAGE 133

Mr. Raghav 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
Zomato Ltd	20	10	14	-10
Shantha Biotech	35	-8	10	15
Infosys	90	15	18	20

Mr. Raghav 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: FOD)

ANSWER:

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

Short Sell 1 shares of Zomato

Short Sell 2 Shares of Shantha

Buy 1 share of Infosys

Therefore $\text{inflow} = 1 \times 20 + 2 \times 35 = 90$

$\text{Outflow} = 90$

$\therefore \text{Net Investment} = 0$

Recession

Loss from short position in Zomato

$10\% \times 20 \times 1 = 2$

profit from short position in Shantha

$8\% \times 35 \times 2 = 5.6$

Profit on long position in Infosys

$15\% \times 90 \times 1 = 13.50$

Overall profit = 17.10

Moderate Growth

loss from short position in Zomato

$$= 14\% \times 20 \times 1 = 2.8$$

loss from short position in Shantha

$$= 10\% \times 35 \times 2 = 7$$

Profit from long position in Infosys

$$= 90 \times 18\% \times 1 = 16.20$$

Overall profit = 6.40

Boom

Loss from short position in Shantha

$$= 15\% \times 35 \times 2 = 10.50$$

Profit from short position in Zomato

$$= 10\% \times 20 \times 1 = 2$$

Profit from long position in Infosys

$$= 90 \times 20\% \times 1 = 18$$

Overall Profit = 9.50

PART III: ALTERNATES TO CMT

EXTRA QUESTION

Topic 17 MULTI FACTOR MACRO ECONOMIC MODEL

Question 4: HW ANS BOOK PAGE 135

Mr. Ravi 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	1.40	8.10	8.40
Inflation	2.10	7.00	7.00
Interest rate	1.40	6.40	7.30
Stock market index	3.10	10.80	11.40
Industrial production	1.70	6.50	9.60

The risk-free rate of interest be 6.20%,

Calculate the return of the share as per Arbitrage Pricing Theory

(Source: FOD)

ANSWER:

Return of the stock under APT

Factor	Actual value in %	Expected value in %	Difference	Beta	Diff. x Beta
GNP	8.40	8.10	0.30	1.40	0.42
Inflation	7.00	7.00	0.00	2.10	0.00
Interest rate	7.30	6.40	0.90	1.40	1.26
Stock index	11.40	10.80	0.60	3.10	1.86
Ind. Production	9.60	6.50	3.10	1.70	5.27
					8.81
Risk free rate in %					6.20
Return as per APT					15.01

Question 5: HW ANS BOOK PAGE 135

One factor APT

$$R_e = 5 + 4\beta$$

Stock	Beta	€R
K	1.80	12.2%
L	1.20	9.8%
M	0.90	10%

Show the process of arbitrage.

(Source: FOD)

ANSWER:

Let us construct a hypothetical portfolio (P) comprising K and M such that Beta is equal to that of L i.e., 1.20

$$W_k \times 1.80 + W_m \times 0.90 = 1.20$$

$$1.80 W_k + 0.90 (1 - W_k) = 1.20$$

$$1.80 W_k + 0.90 - 0.90 W_k = 1.20$$

$$0.90 W_k = 0.30$$

$$W_k = \frac{1}{3} \quad W_m = \frac{2}{3}$$

$$E(R) \text{ of portfolio P} = W_k \times E(R_k) + W_m \times E(R_m)$$

$$= \frac{1}{3} \times 12.2 + \frac{2}{3} \times 10$$

$$= 10.733\%$$

Let us now compare P with L

Stock/Portfolio	Beta	E(R)
L	1.20	9.8%
P	1.20	10.733%

So law of one price is violated

Arbitrage involves going long on P and short on L

- Net investment = 0
- Net Beta = 0
- Expected return = 10.733 – 9.8
= 0.933%