Risk Free Rate of Interest is 7.50%.

Round off to 2 decimal.

You are required to calculate:

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

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

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

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

(Exam November – 2023)

Solution:

(i) Expected Return on Market

Factor 1

= (6.70 × 0.20) + (4.50 × 0.30) + (6.75 × 0.15) + (7 × 0.35)

= 6.15%

Factor 2

= (10 × 0.20) + (7 × 0.30) + (9 × 0.15) + (8.85 × 0.35)

= 8.55%

(ii) Expected Return as per APT

ER	$= R_f + FRP_1 B_1 + FRP_2 B_2$	
Small cap	= 7.5 + (0 × 1.20) + (0.5 × 0.80)	= 7.90%
Medium cap	= 7.5 + (1.5 × 1.75) + (1 × 0.90)	= 11.03%
Lange Cap	= 7.5 + (1.25 × 1.30) + (1 × 1. 165)	= 10.29%

Flexi Cap = 7.5 + (-0.5 × 1.70) + (0.9 × 0.85) = 7.42%

Expected return of market

(7.90 × 0.20) + (11.03 × 0.3) + (10.29 × 0.15) + (7.42 × 0.35) = 9.03%

(iii) Expected Return (Equal Weights)

ER = (7.90 × 0.25) + (11.03 × 0.25) + (10.29 × 0.25) + (7.42 × 0.25)

= 9.16%

(iv) Equal weights (Portfolio 2) is better due to higher return.

PORTFOLIO REBALANCING

Question – 48

Ms. Sunidhi is working with an MNC at Mumbai. She is well versant with the portfolio management techniques and wants to test one of the techniques on an equity fund she has constructed and compare the gains and losses from the technique with those from a passive buy and hold strategy. The fund consists of equities only and the ending NAVs of the fund he constructed for the last 10 months are given below:

Month Ending	NAV (₹/unit)	Month Ending	NAV (₹/unit)
December 2008	40.00	May 2009	37.00
January 2009	25.00	June 2009	42.00
February 2009	36.00	July 2009	43.00
March 2009	32.00	August 2009	50.00
April 2009	38.00	September 2009	52.00

Assume Sunidhi had invested a notional amount of ₹ 2 lakhs equally in the equity fund and a conservative portfolio (of bonds) in the beginning of December 2008 and the total portfolio was being rebalanced each time the NAV of the fund increased or decreased by 15%.

You are required to determine the value of the portfolio for each level of NAV following the Constant Ratio Plan.

Solution:

Constant Ratio Plan

NAV	Bonds	Equity	Total	Rebalancing	Balance (units)
40	100,000	1,00,000	2,00,000	-	2,500
25	100,000	62,500	1,62,500	-	2,500
	81,250	81,250	1,62,500	Buy 750 unit	3,250
36	81,250	1,17,000	1,98,250	-	3,250
	99,125	99,125	1,98,250	Sell 496.53 unit	2,753.47
32	99,125	88,111.04	1,87,236.04	-	2,753.47
38	99,125	1,04,631.86	2,03,756.86	-	2,753.47
	1,01,878.43	1,01,878.43	2,03,756.86	Sell 72.46 Unit	2,681.01
37	1,01,878.43	99,197.37	2,01,075.80	-	2,681.01
42	1,01,878.43	1,12,602.42	2,14,480.85	-	2,681.01
43	1,01,878.43	1,15,283.43	2,17,161.86	-	2,681.01
50	1,01,878.43	1,34,050.50	2,35,928.93	-	2,681.01
	1,01,878.43	1,17,964.47	2,35,928.93	Sell 321.72 Unit	2,359.29
52	1,17,964.47	1,22,683.08	2,40,647.54	-	2,359.29

Buy & Hold

Bond = 100000

Equity = $\frac{1,00,000}{40}$ = 2,500 Units

Sep 2009

Bond	= 1,00,000
Equity (2,500 × 52)	= 1,30,000
	2,30,000

Gain due to adoption of Constant Ratio (2,40,647.54 – 2,30,000) = 10,647.54

Question – 49

Indira has a fund of ₹ 3 lacs which she wants to invest in share market with rebalancing target after every 10 days to start with for a period of one month from now. The present NIFTY is 5326. The minimum NIFTY within a month can at most be 4793.4. She wants to know as to how she should rebalance her portfolio under the following situations, according to the theory of Constant Proportion Portfolio Insurance Policy, using "2" as the multiplier:

(1) Immediately to start with.

(2) 10 days later-being the 1st day of rebalancing if NIFTY falls to 5122.96.

(3) 10 days further from the above date if the NIFTY touches 5539.04.

For the sake of simplicity, assume that the value of her equity component will change in tandem with that of the NIFTY and the risk free securities in which she is going to invest will have no Beta.

Solution:

Floor

% Fall in Nifty $= \frac{5{,}326 - 4{,}793.40}{5{,}326} \times 100$

$= 10\%$

Floor $= 3{,}00{,}000 \times 90\% = 2{,}70{,}000$

Today Investment

E $= M\ (A - F)$

$= 2\ (3{,}00{,}000 - 2{,}70{,}000) = 60{,}000$

Bonds $= 3{,}00{,}000 - 60{,}000 = 2{,}40{,}000$

After 10 days

Equity $= \left(\frac{60{,}000}{5326} \times 5{,}122.96\right) = 57{,}712.65$

Bond $= 2{,}40{,}000$

A $= 2{,}97{,}712.65$

Rebalancing

Equity = 2 (2,97,712.65 – 2,70,000) = 55,425.31

Bonds = 2,97,712.65 – 55,425.31 = 2,42,287.34

Sell equity & buy bonds (57,712.65 – 55,425.31) ₹ 2,287.34

Next 10 days

Equity = $\frac{55,425.31}{5,122.96} \times 5,539.04$ = 59,926.88

Bonds = 2,42,287.34

A = 302214.22

Rebalancing

Equity = 2 (3,02,214.22 – 2,70,000) = 64,428.44

Bonds = (3,02,214.22 – 64,428.44) = 2,37,785.78

Buy equity & sell bonds (64,428.44 – 59,926.88) ₹ 4501.56

Question – 50

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

(i) Buy and Hold strategy

(ii) Constant Ratio

(iii) CPPI

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

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

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

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

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

(MTP March – 2024)

Solution:

(i) Buy & Hold

Fund = ₹ 3,00,000

= % fall in nifty $= \frac{5{,}326 - 4{,}193.40}{5{,}326} \times 100 = 10\%$

Floor = 3,00,000 × 90% = 2,70,000

Bonds = 2,70,000

Equity = 30,000

After 10 days

Equity $= \frac{30{,}000}{5{,}326} \times 5{,}122.96$

= 28,856

Bond = 2,70,000

= 2,98,856

After 10 days

Equity $= \frac{28{,}856}{5{,}122.96} \times 5{,}539.64$

= 31,199.65

Bond = 2,70,000

= 3,01,199.65

(ii) Constant Ratio

Fund = 3,00,000

Equity (60%) = 1,80,000

Bond (40%) = 1,20,000

After 10 days

$$\text{Equity} = \frac{1,80,000}{5326} \times 5,122.96$$

= 1,73,138

Bond = 1,20,000

2,93,138

$$\text{Change in Nifty} = \frac{5,122.96 - 5,326}{5,326} \times 100 = 3.81\%$$

Since Nifty changed by less than 5% hence no rebalancing.

After next 10 days

$$\text{Equity} = \frac{1,73,138}{5,122.96} \times 5,539.04$$

= 1,87,200

Bond = 1,20,000

3,07,200

$$\text{Change in nifty} = \frac{5,539.04 - 5,122.96}{5,12,296} \times 100 = 8.12\%$$

Rebalancing

Equity (3,07,200 × 60%) = 1,84,320

Bond (3,07,200 × 40%) = 1,22,880

= 3,07,200

Sell equity and buy bonds (1,87,200 – 1,84,320) = ₹ 2,880

(iii) CPPI

Today fund = 3,00,000

Floor = 2,70,000

Equity = M (A – E)

Equity = 2 (3,00,000 – 27,000) = 60,000

Bonds = (3,00,000 – 60,000) = 2,40,000

After 10 days

Equity $= \left(\frac{60,000}{5,326} \times 5,122.96\right)$ = 57,713

Bond = 2,40,000

A = 2,97,713

No Rebalancing

Next 10 days

Equity $= \left(\frac{57,713}{5,122.96} \times 5,539.40\right)$ = 62,400

Bond = 2,40,000

3,02,400

Rebalancing

Equity = 2 (3,02,400 – 2,70,000) = 64,800

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

Buy equity and sell bonds (64,800 – 62,400) = ₹ 2,400

EFFICIENT MARKET HYPOTHESIS

Question – 51

The closing value of Sensex for the month of October, 2007 is given below:

Date Closing	Sensex Value
01/10/2007	2800
03/10/2007	2780
04/10/2007	2795
05/10/2007	2830
08/10/2007	2760
09/10/2007	2790
10/10/2007	2880
11/10/2007	2960
12/10/2007	2990
15/10/2007	3200
16/10/2007	3300
17/10/2007	3450
19/10/2007	3360
22/10/2007	3290
23/10/2007	3360
24/10/2007	3340
25/10/2007	3290
29/10/2007	3240
30/10/2007	3140
31/10/2007	3260

You are required to test the weak form of efficient market hypothesis by applying the run test at 5% and 10% level of significance.

Following value can be used :

Value of t at 5% is 2.101 at 18 degrees of freedom

Value of t at 10% is 1.734 at 18 degrees of freedom

Solution:

Sensex Value	Sign	
2800		
2780	–	1
2795	+	2
2830	+	
2760	–	3
2790	+	4
2880	+	
2960	+	
2990	+	
3200	+	
3300	+	

3450	+	
3360	–	5
3290	–	
3360	+	6
3340	–	7
3290	–	
3240	–	
3140	–	
3260	+	8

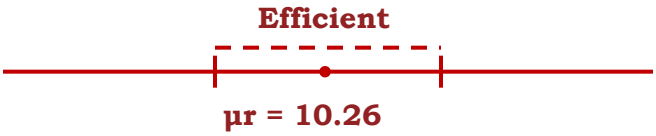
No. of sign change (r) = 8

n_1 (No. of plus) = 11

n_2 (No. of minus) = 8

$$\mu r = \frac{2n_1n_2}{n_1+n_2} + 1$$

$$= \frac{2 \times 11 \times 8}{11+8} + 1 = 10.26$$



Standard Deviation

$$\sigma r = \sqrt{\frac{2n_1n_2\,(2n_1n_2 - n_1 - n_2)}{(n_1+n_2)^2\,(n_1+n_2-1)}}$$

$$= \sqrt{\frac{2 \times 11 \times 8\,(2 \times 11 \times 8 - 11 - 8)}{(11+8)^2\,(11+8-1)}}$$

= 2.06

or

$$\sigma r = \sqrt{\frac{(\mu r - 1)\,(\mu r - 2)}{n_1 + n_2 - 1}}$$

= 2.06