Part-1

Efficient Market Hypothesis (EMH)

⇒ Theory :-

- Definition of Efficient Market -

An efficient market is one where we have a large no. of profit hungry participants who are actively & independently analysing markets such that current market price reflects all information & new information affects price on a random basis.

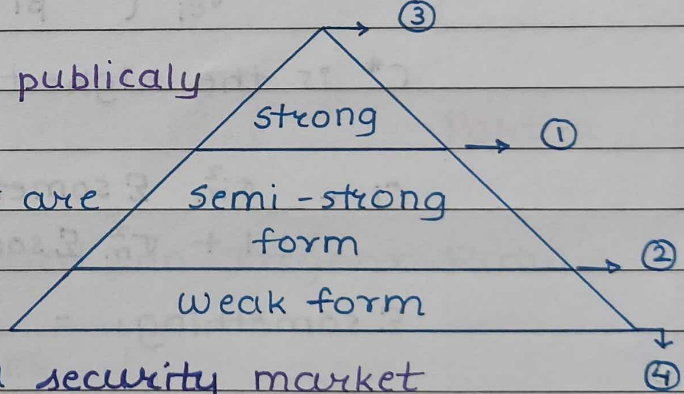
Crux : U cannot earn super-normal returns with certainty

Efficient market me muft ka kamai possible nhi h....

$\alpha = E(R) - Re$ → muft ka kamai.

There are 3 forms of efficiency - weak, semi-strong, strong.

FAMA - There are 3 levels of market efficiency -



① Current mkt price reflects all publicaly available information & ∴ both fundamental & techinical analysis are useless.

② Current mkt price reflects all security market information (Price & Volume) & ∴ Technical analysis is useless.

③ Current mkt reflects all information (public as well as private) such that even insider trading is useless.

④ Technical, fundamental & insider - tino se kama skte h...

(India is at ② mezzanine)   Practical Q. → Class 1

-¦- Sharpe's Optimization Framework :-

Given the following stocks -

Stocks	Expected Return (R_i)	Beta (β_i)	$UR = \sigma e_i^2$
✓	✓	✓	✓
✓	✓	✓	✓

$R_f = 6\%$, $\sigma_m^2 = 110$

Construct optimum portfolio.

Step 1 : Rank the stocks as per Treynor Ratio i.e. $\frac{R_i - R_f}{\beta_i}$ and choose stocks whose Treynor ratio is higher than optimum cut off (C^*).

Step 2 : Weights given to the chosen stocks.

$$w_i = \frac{z_i}{\Sigma z_i}$$

$$z_i = \frac{\beta_i}{\sigma_{e_i}^2}\left[\frac{R_i - R_f}{\beta_i} - C^*\right]$$

C^* is the highest C_i.

$$C_i = \frac{\sigma_m^2 \; \Sigma \text{something}_2}{1 + \sigma_m^2 \; \Sigma \text{something}_1}$$

$$\Sigma \text{something}_1 = \Sigma\left[\frac{\beta_i^2}{\sigma_{e_i}^2}\right]$$

$$\Sigma \text{something}_2 = \Sigma\left[\frac{(R_i - R_f)\beta_i}{\sigma_{e_i}^2}\right]$$

$$C_i = \frac{\sigma_m^2 \; \Sigma\left[\frac{(R_i - R_f)\beta_i}{\sigma_{e_i}^2}\right]}{1 + \sigma_m^2 \; \Sigma\left[\frac{\beta_i^2}{\sigma_{e_i}^2}\right]}$$

Shortcuts -

① something_2 = Treynor Ratio × something_1

② When C_i starts falling, u can do badmashi & fill rest of the figures randomly.

Biggest risk of mistake -
Stocks given → A, B, C, D, E, F.
Stocks on the basis of rank → C, B, A, D, F, E.

Table for calculating C^* -

①	②	③	$2\times3=$④	⑤	⑥	⑦
Stocks in order of rank.	$TR = \frac{R_i - R_f}{\beta_i}$	kuch₁ $= \frac{\beta_i^2}{\sigma_{e_i}^2}$	kuch₂ $\frac{(R_i - R_f)\beta_i}{\sigma_{e_i}^2}$	Cum of ③ $\Sigma\left[\frac{\beta_i^2}{\sigma_{e_i}^2}\right]$	Cum of ④ $\Sigma\left[\frac{(R_i - R_f)\beta_i}{\sigma_{e_i}^2}\right]$	C_i $\frac{\sigma_m^2 \times ⑥}{1 + \sigma_m^2 \times ⑤}$
C						
B						
A						
D						
F						
E						

Self practice : HW. Q.23] pg. 38

Part-2

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Table 1 : Ranking stocks based on Treynor Ratio -

Security No.	$(R_i - R_f)/\beta_i$	Rank
1	14	1
2	12	2
3	12	3
4	10	4
5	8	5
6	8	6
7	6	7

Table 2 : Calculation of C^*

Stocks in order of Rank	$TR = \frac{R_i - R_f}{\beta_i}$	$\frac{\beta_i^2}{\sigma_{e_i}^2}$	$\frac{(R_i-R_f)\beta_i}{\sigma_{e_i}^2}$ (2×3)	$\Sigma\left[\frac{\beta_i^2}{\sigma_{e_i}^2}\right]$ cum.of 3	$\Sigma\left[\frac{(R_i-R_f)\beta_i}{\sigma_{e_i}^2}\right]$ Cum. of 4	$\frac{\sigma_m^2 \Sigma\left[\frac{(R_i-R_f)\beta_i}{\sigma_{e_i}^2}\right]}{1+\sigma_m^2 \Sigma[\beta_i^2/\sigma_{e_i}^2]}$
1	14	0.05	0.7	0.05	0.7	4.67
2	12	0.075	0.9	0.125	1.6	7.11
3	12	0.025	0.3	0.15	1.9	7.60
4	10	0.10	1	0.25	2.9	8.29
5	8	0.05	0.4	0.30	3.3	8.25
6	8	0.005	0.04	0.305	3.304	8.24
7	6	0.075	0.45	0.38	3.754	7.89

∴ Optimum cutoff (C^*) is the highest C_i which is 8.29
So stocks 1, 2, 3 & 4 are selected.

→ Calculation of weights :-

Chosen Stocks	$Z_i = \frac{\beta_i}{\sigma_{e_i}^2}[TR - C^*]$	$W_i = \frac{Z_i}{\Sigma Z_i} \times 100$
1	$\frac{1}{20}[14 - 8.29] = 0.2855$	$\frac{0.2855}{0.7420} \times 100 = 38.48\%$
2	$\frac{1.5}{30}[12 - 8.29] = 0.1855$	$\frac{0.1855}{0.7420} \times 100 = 25\%$
3	$\frac{0.5}{10}[12 - 8.29] = 0.1855$	$\frac{0.1855}{0.7420} \times 100 = 25\%$
4	$\frac{2}{40}[10 - 8.29] = 0.0855$	$\frac{0.0855}{0.7420} \times 100 = 11.52\%$
	$\Sigma Z_i = 0.7420$	

Hence the optimum portfolio comprises of 38.48% of stock 1, 25% of stock 2 & 3 each and 11.52% of stock 4.

-:- Critical Line and Fund of Funds :-

→ Fund of Funds :-

$A : (60 \times 0.3) + (40 \times 0.8) = 50\%$

$B : (60 \times 0.5) + (40 \times 0.2) = 38\%$

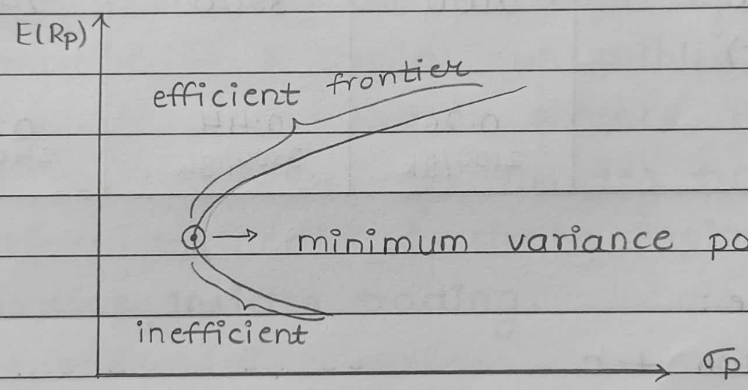
$C : (60 \times 0.2) + 0 = 12\%$

Fund of Funds

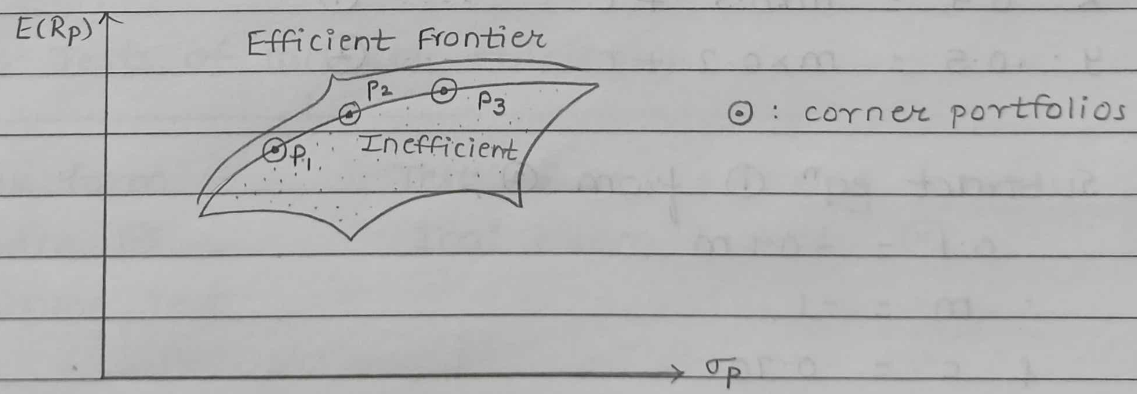
Fund 1			Fund 2	
A	B	C	A	B
30%	50%	20%	80%	20%

→ Critical Line :-

Two stocks



More than 2 stocks



$P_1 \to \omega_A, \omega_B, \omega_C$ $\quad$ $P_2 \to \omega_A, \omega_B, \omega_C$ $\quad$ $P_3 \to \omega_A, \omega_B, \omega_C$

There is a linear relationship b/w the weights of any pair of stock in a corner portfolio.

Suppose, $\omega_B = y$ & $\omega_A = x$

then, $y = mx + c$

$\omega_B = m\,\omega_A + c$ → Critical line

To find out m & c, you need two eqⁿ that will give you the composition of corner portfolio P_1 & P_2 and ask for P_3.

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(i) Computation of weights -

Particulars	A	B	C	Total
Portfolio X [0.3 : 0.4 : 0.3]	1500	2000	1500	5000
Portfolio Y [0.2 : 0.5 : 0.3]	600	1500	900	3000
Combined portfolio (Fund of Funds)	2100	3500	2400	8000
Stock weights	0.26 2100/8k	0.44 3500/8k	0.30 2400/8k	1

(ii) Critical Line:

$$\omega_B = m \cdot \omega_A + c$$

$X: 0.4 = m \times 0.3 + c \quad \ldots (1)$

$Y: 0.5 = m \times 0.2 + c \quad \ldots (2)$

Subtract eqⁿ (1) from (2);

$0.1 = -0.1m$

$\therefore m = -1$

& $c = 0.70$

$\omega_B = -1\,\omega_A + 0.7$

$\therefore \omega_A + \omega_B = 0.7$

Half funds are invested in security A

$\therefore 0.5 + \omega_B = 0.7$

$\therefore \omega_B = 0.2$

Since, $w_A + w_B + w_C = 1$

$0.5 + 0.2 + w_C = 1$

$\therefore w_C = 0.3$

$\therefore$ Allocation of funds $\rightarrow$ Security A $= 4000$

Security B $= 8000 \times 0.2 = 1600$

Security C $= 8000 \times 0.3 = 2400$

Self practice: Extra Q.7 HW. Sol^n. pg. 136