28/2/23

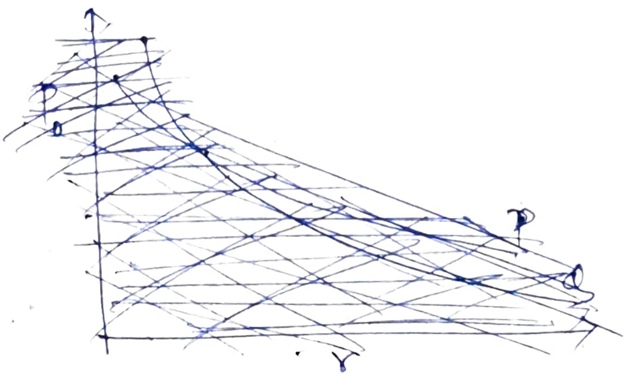
→

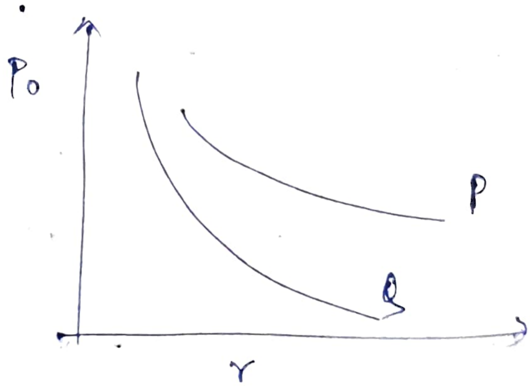
	P	Q
Face Value (Rs.)	1,000	1,000
Coupon (Annual)	10%	8%
N (Years)	5	5
YTM	9%	9%
P_0	?	?
	1038.89	961.10

	100	v/s 80
Interest Rate	P	Q
7%	1,123.01	1,041.00
9%	1,038.89	961.10
11%	963.40	889.12

	P	Q
% change in price (9% to 11%)	7.26%	7.49%

Slope for Q > Slope for P.

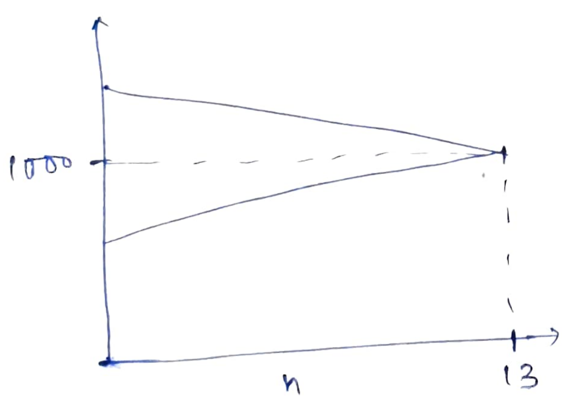




	X	Y
FV(Rs.)	1,000	1,000
Coupon	8%	6%
YTM	6%	8%
N	13	13
P_0 ?		

	X	Y
P_0	1,177.05	841.92
P_1	1,167.68	849.28
P_3	1,147.20	865.79
P_8	1,084.25	920.15
P_{12}	1,018.87	981.48
P_{13}	1,000	1,000

Pull to Par.



Book - Q11

Face Value / Par Value	Rs. 5000/-
Coupon	3.70%, payable semi-annually
YTM	3.90%
N	16 years

$P_0 = ?$

Coupon = Rs. 92.5 (for 6 months)

$P_0 = 92.5 \times PVIFA(1.95\%, 32) + 5000 \times PVIF(1.95\%, 32)$

$= 2186.67 + 2695.13$

$= 4881.80$

→ Book Q.21

Par Value 1,000

Coupon , 6.4% paid semi-annually.

Price = 106.81 % of par

N = 18 yrs.

Find YTM

$1068.1 = 32 \times PVIFA(r, 36) + 1000 \times PVIF(r, 36)$

$= \frac{32}{r}\left(1 - \frac{1}{(1+r)^{36}}\right) + \frac{1000}{(1+r)^{36}}$

$r = 2.89\%$

$YTM = 2.89 \times 2 = 5.78\%$

Effective yield $= \left(1 + \frac{2.89}{100}\right)^2 - 1 = 5.86\%$

→ Book Q.23

Price = 1,035.00

Coupon = 5.90% , semi-annually

Par Value = 1,000.00

4 months left to maturity.

2 months interest = Rs. 9.83

Dirty Price = Rs. 1,035

Clean Price = Rs. 1,035 − 9.83

= Rs. 1,025.17

→ Book Q.25

Coupon - annual = 8%

YTM = 7.20%

Par Value = 1,000

Current Yield = 7.55%

$$\boxed{CY = \frac{\text{Coupon}}{\text{Current Price}}}$$

Find N.

$$\text{Price} = \frac{80}{7.55} \times 100 = 1059.60$$

$$1059.60 = \frac{80}{0.072}\left(1 - \frac{1}{(1+0.072)^n}\right) + \frac{1000}{(1.072)^n}$$

$n = 11.0575$

→ Book Q33

Annual coupon = 7%

Price = 1,060

N = 17

Face Value = 1,000

$$1060 = 70 \times PVIFA(r,17) + 1000 \times PVIF(r,17)$$

$r = 6.41\%$ (Rate of return)

2 year hence, YTM falls by 1% = 5.41%

$$\text{Price }(P_2) = 70 \times PVIFA(5.41\%, 15) + 1000 \times PVIF(5.41, 15)$$

$= \text{Rs. } 1160.56$

$$1060 = \frac{70}{(1+r)^1} + \frac{70}{(1+r)^2} + \frac{1160.56}{(1+r)^2}$$

$r = 11.10\%$

↑

(Holding Period Yield) (assuming that the Rs. 70s are re-invested at 11.10%.)

6/3/23

Risk, Return Portfolio

→ Stock A   Stock B

Scenario	Exp P	Return (A)	Return (B)
1 (Optimistic)	0.30	8%	6%
2 (Average)	0.40	10%	12%
3 (Pessimistic)	0.30	13%	16%

Expected Return:

$$(A)\ \bar{r}_x = \overset{P_i}{0.30} \times \overset{r_i}{0.08} + 0.40 \times 0.10 + 0.30 \times 0.13 = 10.30\%$$

$$(B)\ \bar{r}_y = 11.40\%$$

→ For Stock A, Range = 5%,
For Stock B, Range = 10%

→ Variance & Std. Deviation

A	B
$(0.08 - 0.103)^2 \times 0.3$	$(0.06 - 0.114)^2$
$(0.10 - 0.103)^2 \times 0.4$	$(0.12 - 0.114)^2$
$(0.13 - 0.103)^2 \times 0.3$	$(0.16 - 0.114)^2$

→

	A	B
$\bar{r}$	10.30%	11.40%
Var	$6.33\%^2$	$25.33\%^2$
σ	2.51%	5.03%
Coefficient of Variation $\left(\frac{\sigma}{\bar{x}}\right)$	0.243	0.441

Risk per Return.

→

	$\bar{r}$	σ	
A	12%	4%	
$\boxed{B}$	13%	4%	Same ~~return~~ risk, more return
$\boxed{P}$	11%	6%	same return, less risk
Q	11%	8%	

→ Say, a portfolio with 0.50 A, 0.50 B,

$r_p = 0.5 \times 0.103 + 0.50 \times 0.114 = 10.85\%$ (Portfolio Return)

→ One way to calculate variance :-

$(7 - 10.85)^2 \times 0.3 + (11 - 10.85)^2 \times 0.4 + (14.5 - 10.85)^2 \times 0.3$

avg. of returns

→ $\sigma_p = \sum_{i=1}^{n} w_i \times \sigma_i$ ✗ ← (Not correct)

$Var_p = \sum_{i=1}^{n} w_i \times \sigma_i^2$ ✗

→ Portfolio Risk :-
(for a Two - Security Portfolio).

$$\boxed{\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 \rho_{12} w_1 w_2 \sigma_1 \sigma_2}$$

→ Generic Formula :-

$$\boxed{\sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} \rho_{ij} \times w_i \times w_j \times \sigma_i \times \sigma_j}$$

→ 3 stock portfolio :-

	1	2	3
w	✓	✓	✓
σ	✓	✓	✓

ρ_{12} ρ_{23}

ρ_{13}

→

Stock	A	B	C
$\bar{r}$	12%	14%	16%
w	30%	40%	30%
σ	4%	6%	8%

$\rho_{12} = 0.60$, $\rho_{13} = 0.80$, $\rho_{23} = 0.40$

$\bar{r}_p = 0.3 \times 12 + 0.4 \times 14 + 0.3 \times 16$
$= 14\%$

$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + w_3^2 \sigma_3^2 +$
$2(\rho_{12} w_1 w_2 \sigma_1 \sigma_2 + \rho_{23} w_2 w_3 \sigma_2 \sigma_3 + \rho_{13} w_1 w_3 \sigma_1 \sigma_3)$

$= 12.96 + 2 \times 6.336$
$= 25.632$

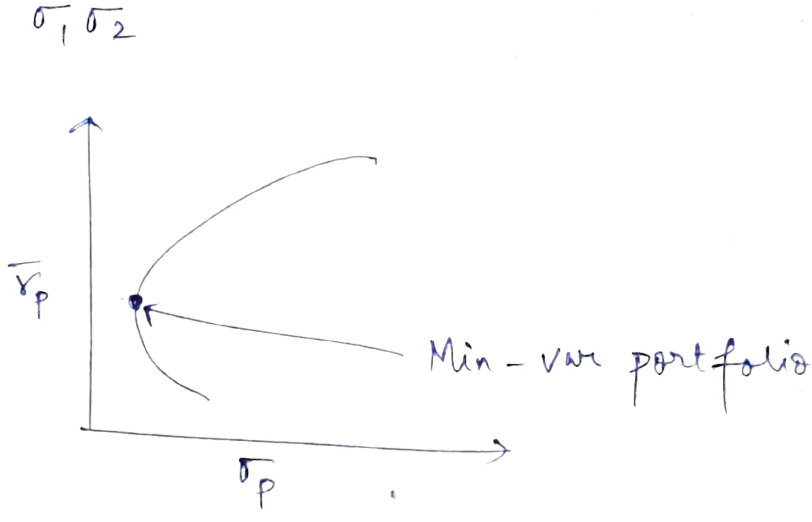
$\sigma_p = 5.0628$

7/3/23

→ Two - security Portfolio:-

$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 \rho_{12} w_1 w_2 \sigma_1 \sigma_2$

$\rho_{12} = \dfrac{\text{Covariance}_{1,2}}{\sigma_1 \sigma_2}$



→ $w_1 = ?$
for σ_p to be the least ?

$$\boxed{W_x = \frac{\sigma_y^2 - Cov_{x,y}}{\sigma_x^2 + \sigma_y^2 - 2\,Cov_{x,y}}}$$

$(Cov_{xy} = \rho_{xy}\,\sigma_x\,\sigma_y)$

→ $\sigma_x = 8\%$, $\sigma_y = 10\%$, $\rho = 0.6$

$Cov_{xy} = 8 \times 10 \times 0.6 = 48$

$$W_x = \frac{10^2 - 48}{8^2 + 10^2 - 2 \times 48} = 0.7647 = 76.47\%$$

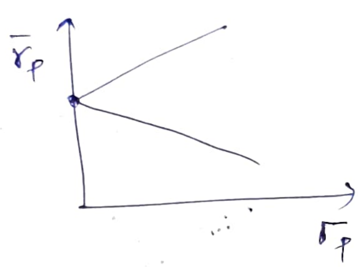
$W_y = 0.2453 = 24.53\%$

→ If $\rho_{xy} = 0$, then,

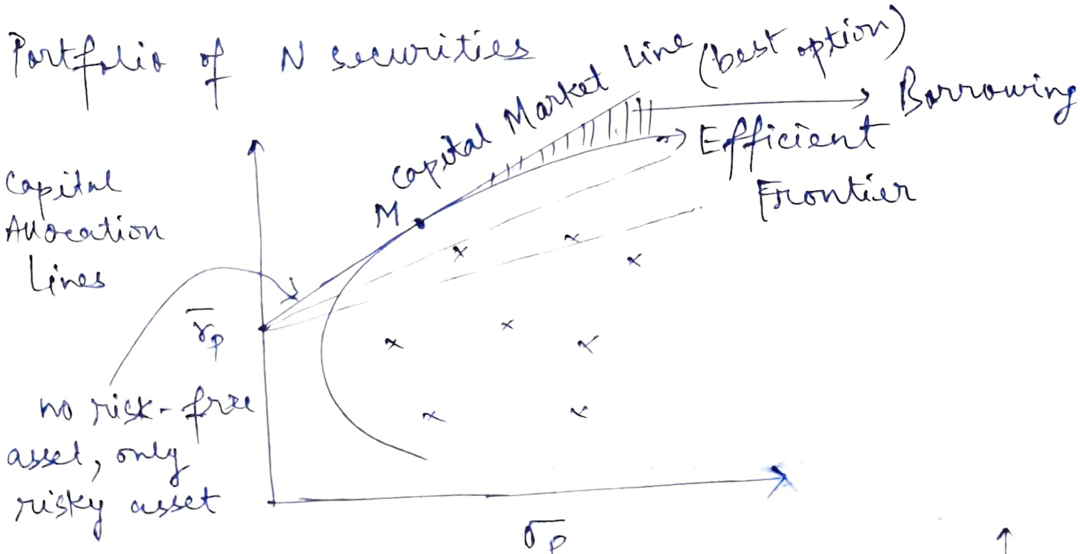
$$W_x = \frac{\sigma_y^2}{\sigma_x^2 + \sigma_y^2}$$

→ If $\rho_{xy} = -1$,

$$W_x = \frac{\sigma_y}{\sigma_x + \sigma_y}$$



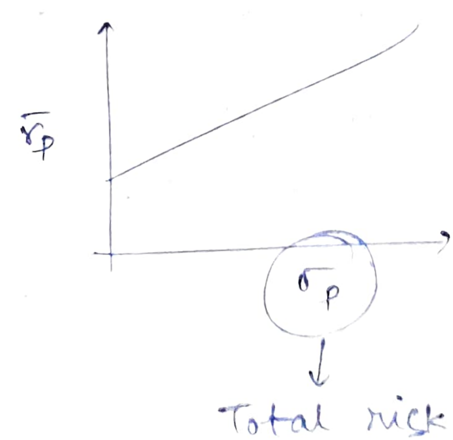
→ Portfolio of N securities



$R_f = 8\%$

$R_m = 18\%$ (market)

$\sigma_m = 6\%$



→ $R_f = 8\%$, $R_m = 18\%$, $\sigma_m = 6\%$

$R_p = 15\%$

$15 = w_f \times 8 + (1 - w_f) \cdot 18$

$\Rightarrow 15 = 18 - 10\,w_f$

$\Rightarrow w_f = \frac{3}{10} = 30\%$

$w_m = 70\%$

Say $R_p = 20\%$

$20 = W_m \times 18 + (1 - W_m) \times 8$

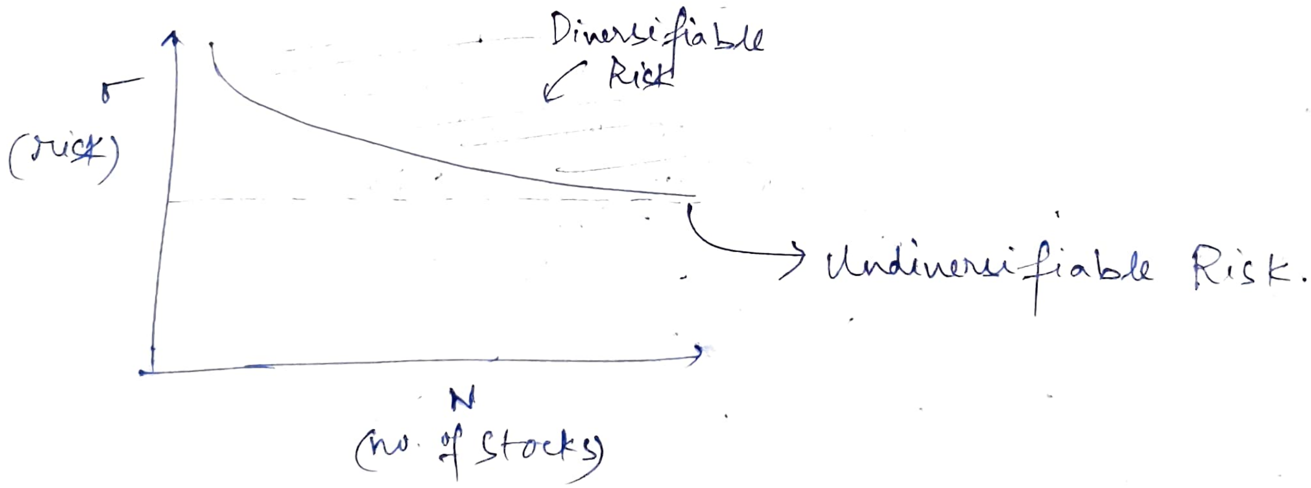
$\Rightarrow 20 = 10\,W_m + 8$

$\Rightarrow W_m = 1.2$

$W_f = -0.2$

→ Concept of Security Market Line

- Relationship between return and systematic risk.



N = 30 - 40 is the best practical option (not worth the effort for more N)

→ Non-diversifiable risk is also known as market risk or systematic risk.

→ Total Risk = Systematic Risk + Unsystematic Risk

→ Stock return is dependent on the market return.

→ Say, $r = 0.6$ (correlation b/w stock return & market return)

How much of the variation in stock return is explained by variation in market return?

→ r^2 = coefficient of determination

36% non-diversifiable, 64% diversifiable.

→ 1% change in market (means market return = ±1%)

what will be the change in stock?

$$\boxed{r_i = \alpha + \beta r_m + e}$$

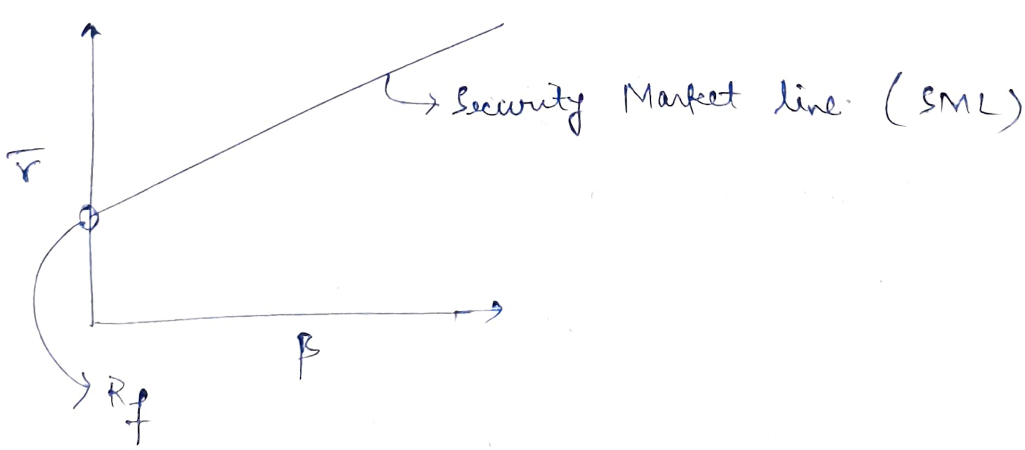
β represents systematic risk.

If $\beta = 0.8$, 1% change in market ⇒ 0.8% change in stock.

$\beta < 1$ (Defensive)

$\beta > 1$ (Aggressive)

→



So, $R_i = R_f + \beta \underbrace{(R_m - R_f)}_{\text{Risk premium}}$. (CAPM)

→ $R_m = 17\%$, $R_f = 8\%$, R.P. = 9%

$R_i = 8\% + 1.30 \times 9\% = 19.7\%$

expected rate of return from equity investor's POV.

→ Stock $\beta = 1.14$

Expected return on stock = 10.5%

Risk-free rate of return = 2.4%

a) If weights are equal between stock & risk free asset, find $\bar{R}_p$

b) If portfolio β is 0.92, what are the weights?

c) If portfolio return = 9%, what is its β?

d) " " $\beta = 2.8$, what are the weights?

$$\boxed{\beta_p = \sum_{i=1}^{n} w_i \beta_i}$$

a) $\bar{R}_p = \dfrac{10.5 + 2.4}{2} = 6.45\%$

b) $0.92 = 1.14 \times w_s$

$\Rightarrow w_s = 0.8070 = 80.70\%$

$w_f = 19.30\%$

$$\boxed{\beta_{(\text{Risk-free})} = 0}$$

c) $9 = w_s \times 10.5 + (1 - w_s) \times 2.4$

$\Rightarrow 9 = 8.1 \times w_s + 2.4$

$\Rightarrow w_s = \dfrac{6.6}{8.1} = 0.8148 = 81.48\%$

$\beta = 0.8148 \times 1.14 = 0.9289$

d) $w_s = \dfrac{2.8}{1.14} = 2.4561 = 245.61\%$

$w_f = -145.61\%$