Risk & Return

Difference bet^n Risk & Uncertainty

Risk	Uncertainty
→ Risk is ~~final~~ we don't know but we have prob. of outcome We can ~~prob~~ measure prob. in risk.	→ Uncertainty is we don't have any prob. of outcome. We know ~~range~~ range of outcomes but dont know about probability.

⇒ Return & Risk based on Past-Data.

$$R_t = \left[\frac{P_t - P_{t-1} + Div_t}{P_{t-1}}\right] \times 100$$

⇒ Expected Return

$$\bar{R} = \frac{\sum R_i}{n}$$

⇒ Expected Risk

$$\sigma^2 = \frac{\sum (R_i - \bar{R})^2}{n-1}$$

⇒ Risk & Return using probabilities

Expected return $= \sum P_i R_i$

Expected Risk $(\sigma^2) = \sum P_i (R_i - \bar{R})^2$

Q-1

We will calculate the returns from 1988 as ~~0~~ for 1987 we don't have any previous info.

Year	Annual Return $R_t = \left[\frac{P_t - P_{t-1} + Div_t}{P_{t-1}}\right] \times 100$	Return
1988	$= \left[\frac{20.75 - 31.25 + 1.53}{31.25}\right] \times 100$	-28.78 %
1989	$= \left[\frac{30.88 - 20.75 + 1.53}{20.75}\right] \times 100$	56.2 %
1990	$= \left[\frac{67.00 - 30.88 + 2}{30.88}\right] \times 100$	123.45 %
1991	$= \left[\frac{100 - 67 + 2}{67}\right] \times 100$	52.23 %
1992	$= \left[\frac{154 - 100 + 3}{100}\right] \times 100$	57 %

Expected ~~Risk~~ Return $= \frac{\sum R_i}{n} = \frac{260.1}{5} = 52.02$ %

$R_i - \bar{R}$	$(R_i - \bar{R})^2$
80.74	6518.95
4.16	17.31
71.41	5099.39
0.2	0.04
4.96	24.60

$\therefore$ Expected Risk $= \frac{\sum (R_i - \bar{R})^2}{n-1}$

$= \frac{11,660.29}{4}$

$= 2915.07$

$\sigma = \sqrt{2915.07}$

$= 54$ %

Range of Returns = mean ± variance
= 52.04 ± 54 = -1.96 to 106.04

→ We can say that range is very high, so the stock is risky. (For eg. if we invest Rs 100 then range of return is -1.96 to 106.04)

Q-2 The value given is e return, just you have to calculate return & risk.

Q4

Prob	ACC (%)	Hero (%)
0.5	1.94	5.1
0.4	2.74	74.92
0.1	3.37	52.59

$\bar{R}_{ACC} = 2.68$

$\bar{R}_{Hero}$

→ ACC

Prob (P_i)	Return (R_i)	$P_i R_i$	$R_i - \bar{R}$
0.5	1.94	0.97	-0.463
0.4	2.74	1.096	0.337
0.1	3.37	0.337	0.967
		Expected return $\bar{R} = \Sigma P_i R_i$ = 2.403	

$(R_i - \bar{R})^2$	$P_i(R_i - \bar{R})^2$
0.214	0.107
0.114	0.046
0.934	0.247

$\therefore \sigma^2 = \Sigma P_i (R_i - \bar{R})^2 = 0.247$

$\therefore \sigma = 0.5\%$

Hero

Prob	R_i Hero (%)	$P_i R_i$	$R_i - \bar{R}$	$(R_i - \bar{R})^2$	$P_i(R_i - \bar{R})^2$
0.5	5.1	2.55	-32.68	1067.98	534
0.4	74.92	29.97	37.14	1379.38	551.75
0.1	-52.54	5.26	14.81	219.34	21.93
					1107.68

$$\bar{R} = \sum P_i R_i = 2.55 + 29.97 + 5.26$$
$$= 37.78$$

$$\sigma^2 = \sum P_i (R_i - \bar{R})^2 = 1107.68, \quad \sigma = \sqrt{1107.68} = 33.28$$

→ So if the user wants to take risk & but expects return so he should go to Hero.

→ If he wants to take less risk then he should go to

Q5

a) If the expected ($\bar{R}$) returns are +ve then we can say stocks are attractive investments.

⇒ * Expected return & risk of a portfolio (2-Assets)

Expected return $R_p = w_1 R_1 + w_2 R_2$

(weights, Returns)

Expected Risk $\sigma^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$

OR

$$\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 COV_{12}$$ → Co Variance

$$COV_{12} = \sigma_1 \times \sigma_2 \times \rho_{12} \qquad \sigma_p = \sqrt{\sigma_p^2}$$

	X	Y
R_i	12%	15%
σ_i (SD)	15%	20%
	$w_1 = 0.4$	$w_2 = 0.6$

Leave as it is don't convert to decimal

$R_p = w_1 R_1 + w_2 R_2$

$= 0.4 \times 12 + 0.6 \times 15$

$= 13.8\%$

Calculating portfolio risk at different correlation coefficient

$\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{12}$

Here we are assuming perfect correlation bet^n 1 & 2 $\therefore \boxed{\rho_{12} = 1}$

$\sigma_p^2 = 0.16 \times 225 + 0.36 \times 400 + 2 \times 0.4 \times 0.6 \times 15 \times 20$

$= 36 + 144 + 144$

$= 324 \quad \therefore \sigma_p^2 = 324 \quad \therefore \sigma_p = 18\%$

If $\rho_{12} = 0.5$

$\sigma_p^2 = 36 + 144 + 72 = 252 \quad \therefore \sigma_p = \sqrt{252} = 15.87\%$

If $\rho_{12} = 0$

$\sigma_p^2 = 180 = 13.42\%$

If $\rho_{12} = -0.5$

$\sigma_p^2 = 36 + 144 - 72 = 108 \quad 10.39$

If $\rho_{12} = -1$

$\sigma_p^2 = 36 = 6\%$

→ Low standard deviation means less risk.

If I invest 100% in X

Risk = 15%.

Max = 15 + 12 = 27%.

Min = 15 − 12 = 3%. Range = 3 − 27%.

$r_{12} = -0.321$

Q8 Do on your own expected return = 21.5

expected risk = $\sqrt{521.35} = 22.84$

Q10 Same concept.

Q11

P_i	R_x	R_y	$P_i R_x$	$P_i R_y$	$R_x - \bar{R}_x$	$P_i(R_x - \bar{R}_x)^2$
0.1	20	14	2	1.4	~~18.6~~ 19.1	36.48
0.4	-16	-20	-6.4	-8	-16.9	114.24
0.2	14	18	2.8	3.6	13.1	34.2
0.1	9	12	0.9	1.2	8.1	6.56
0.2	8	10	1.6	2	7.1	10.08
			$\bar{R}_x = 0.9$	$\bar{R}_y = 0.2$		201.68

$R_y - \bar{R}_y$	$P_i(R_y - \bar{R}_y)^2$	$P_i(R_x - \bar{R}_x)(R_x - \bar{R}_y)$
13.8	19.04	26.36
-20.2	163.22	136.55
17.8	63.37	46.64
11.8	13.92	9.56
9.8	19.20	13.92
	278.76	233.03

a) $\sigma_x^2 = \sum P_i(R_x - \bar{R}_x)^2 = 201.68 \quad \therefore \sigma_x = 14.20$

$\sigma_y^2 = \quad = 278.76 \quad \therefore \sigma_y = 16.7$

$COV_{12} = \sum P_i(R_1 - \bar{R}_1)(R_2 - \bar{R}_2) = 233.03$ → Covariance

$r_{12} = \dfrac{COV_{12}}{\sigma_x \times \sigma_y} = \dfrac{233.03}{14.20 \times 16.7} = 0.98$ → Correlation

b) $R_p = 0.5 + 0.9 \;(R_x) + 0.5 \times 0.2 \;(R_y) = 0.55\%$

$\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{12}$

$= (0.5)^2(14.2)^2 + (0.5)^2(16.7)^2 + 2\cdot(0.5)(0.5)(14.2)(16.7)(0.98)$

$= x$

c) $\sigma_p = 25$ $\quad \sigma_p^2 = 625$, $\quad \rho_{12} = ?$

$x \times 0.75 =$, $x\rho_{12}$.

Capital Budgeting

→ Capital expenditure means the amount of expenditure made by company for a long period of time.

→ Capital Budgeting is mainly important because of 3 reasons

1) Amount of investment is substantial.
2) Investment doing today have impact for long period of time
3) Capital budgeting decisions are irreversible.

→ Types of proposals

1) Independent proposal (Rarely seen in practical)
:- It is type of proposal in which one event of cash flow does not impact other event of cash flow

2) Mutually exclusive project :- If we select one project out of 2, then ~~2nd~~ other one will be eliminated

→ Our main goal in this chapter is evaluating proposals.

⟹ Capital Budgeting Techniques / Proposal Appraisal techniques

1) Pay-back period

∴ For eg. initial investment (yr 0) - 10,00,000

Cash flow ←	amount
Now in	
yr 1	1,00,000
yr 2	4,00,000
yr 3	3,00,000
yr 4	2,00,000
yr 5	3,00,000

We can say that our pay-back period is 4 yrs as we have gained back all the invested money till then.

2) Discounted Pay - Back period

Eg. Initial Outlay yr 0 - 10,00,000

yr 1	1,00,000
2	4,00,000
3	3,00,000
4	3,00,000
5	3,00,000

Here we will consider time value of money so we will multiply the amt by PVIF factor.

Q1

Year 0 is written negative only (-330 Lakh)

a) Pay Back Period

Yrs	CFAT	Cumilative Cash Flow
0	-330	
1	90	90
2	120	210
3	380	690
4	420	1010
5	310	1320
6	240	1560
7	60	1620

C.F. received by the end of yr 2 → 210 lakh
CF. re. remaining → 120 lakh
CF. received in 3rd yr → 380 lakh

Pay - back period = 2 yrs + $\frac{\text{CF. remaining}}{\text{CF. recd in } n^{th} \text{ yr}}$

= 2 + $\frac{120}{380}$ = 2.32 yrs

b) Discounted pay-back period.

Yrs	CFAT	PVIF @ 15%	P.V of CF / Discounted CF	Cumulative CF
0	-330			
1	90	0.870	78.3	78.3
2	120	0.756	90.72	169.02
3	380	0.658	250.04	419.06
4	420	0.572	240.24	659.30
5	310	0.497	154.07	813.37
6	240	0.432	103.68	917.05
7	60	0.376	22.56	939.61

Pay-back period will be bet^n 2nd & 3rd yrs

Pay back period $= 2 + \frac{330 - 169.02}{250.04}$

$= 2 + 0.64 = 2.64$ yrs.

$\Longrightarrow$ Net Present Value (NPV)

NPV = P.V. of cash inflows - P.V. of cash outflows (outlay / Initial investment)

If NPV = +ve, accept the project
NPV = -ve, reject the project.

→ NPV is better than IRR method because
1) Time value of money
2) Cash flow or answer in terms of amount.

Disadv of NPV 1) It is expressed in absolute terms
For e.g. if in project A, 50K is initial investment & NPV is 5K
B → 500K investment
NPV → 5K

→ So now in case of NPV we cannot decide as NPV of both projects are same, but in reality we will choose project A as it consists of less initial investment.

i) NPV does not consider life of project because it take consideration of PV only

→ Still NPV is better

⇒ Profitability Index (PI)

$$PI = \frac{\text{P.V. of Cash Inflows}}{\text{P.V. of Cash Outflows}}$$

Decision criteria

If PI > 1, accept
If PI < 1, reject.

Q3 Cash Outflow/ Initial investment = 10,00,000

Yr	Cash flow	PVIF @ 12%	P.V. of CF	Cumulative CF
1	1,50,000	0.893	1,33,950	1,33,950
2	2,00,000	0.797	1,59,400	2,93,350
3	3,00,000	0.712	2,13,600	5,06,950
4	4,50,000	0.636	2,86,200	7,93,150
5	5,00,000	0.567	2,83,500	10,76,650
6	4,00,000	0.507	2,02,800	12,79,450
			12,79,450	

a) Discounted Pay-Back period

$$= 4 + \frac{10,00,000 - 7,93,150}{2,83,500}$$

$$= 4 + 0.73 = 4.73 \text{ yrs}$$

b) NPV

$$= 12,79,450 - 10,00,000$$

$$= 2,79,450 \quad \therefore \text{ Accept the project}$$

c) Profitability Index

$$PI = \frac{12,79,450}{10,00,000} = 1.279 > 1 \quad \therefore \text{ Accept the project.}$$

$\Longrightarrow$ Internal Rate of Return

→ Why it is different ?

→ If IRR > Cost of Capital ⟶ Accept
If IRR < Cost of Capital ⟶ Reject.

→ For conventional cash flows both IRR and NPV give same result.

→ For non-conventional and mutually exclusive project. cash flows, IRR may give wrong result, etc

→ IRR is the rate where NPV = 0

⇒ Calculation of IRR

Step 1 :- Average Cash flows = $\frac{\text{Total cash flows}}{\text{No. of years}}$

Step 2 :- $\frac{\text{Initial Investment}}{\text{Avg. Cash flow}}$ = PVIFA

Step 3 :- Check the answer of step-2 in PVIFA table for n-years. (Will find nearest value)
The rate at which that value is connected, assume that rate as IRR.
→ Calculate NPV using IRR,

Step 4 :- If NPV in step-3 is +ve, calculate another ~~rate~~ NPV using Higher rate

If NPV in step-4 is -ve, calculate another NPV using lower rate.
(Take difference of 4 %.)

Step 5 :-

$$IRR = \text{Lower Rate} + \text{Diff bet}^{n} \text{ 2 rate} \left[\frac{\text{PV @ lower rate} - \text{Initial Investment}}{\text{PV @ lower rate} - \text{PV @ Higher rate}} \right]$$

Q5 Project A - Initial Investment = 15 cr

Step 1 :- Avg. Cash flow for proj. A = $\frac{26}{7}$ = 3.71 Cr

Step 2 & 3 :- $\frac{15}{3.71}$ = 4.043, Check 4.043 in PVIFA table for 7 yrs.
It will be 16%.

∴ Find NPV @ 16 %.

Yrs	CFAT	PVIF@ 16%	PV of CF
1	4	0.862	3.448
2	4	0.743	2.972
3	3	0.641	1.923
4	4	0.552	2.208
5	5	0.476	2.380
6	4	0.410	1.640
7	2	0.354	0.708
			15.279

$\therefore$ NPV = 15.279 − 15 (PV of Cash Inflow − PV of Cash outflow)

= 0.279 Cr

Step 4 :- As NPV in step - 3 is +ve, we will calculate another NPV of higher rate (20%.)

Yrs	C.F.	PVIF@ 20%	PV of CF
1	4	0.833	3.332
2	4	0.694	2.776
3	3	0.579	1.737
4	4	0.482	1.928
5	5	0.402	2.01
6	4	0.335	1.34
7	2	0.279	0.558
			13.681

NPV = 13.681 − 15

= −1.319 Cr

IRR = Lower Rate + Diff bet^n 2 Rate [PV @ lower rate − Initial inv / PV @ lower rate − PV @ higher r

= 16 + 4 [15.279 − 15 / 15.279 − 13.681] = 16.69 %.

$\therefore$ IRR > Cost of Capital $\therefore$ Accept Project.

⇒ See Modified IRR from Sir Notes.

Cost of Capital

→ Minimum return that firm would be expecting on a project.

→ CoC is the minimum required rate of returns on funds which are invested in the project & this minimum rate depends on risk of the project/ cash flows.

→ Each project have a different risk & will have different cost of capital.

→ Suppose our total amt. of any organization is 10,00,000, then ~~for~~ cost for each liability is called cost of capital. Some of the liabilities are

	Cost
Equity Capital	- 500,000
Debentures	- 2,00,000
Pref. shares	- 1,00,000
Loans	- 2,00,000

→ Debentures (term) is generally used for private companies, in which one buys security of the respected company or ~~org~~ organization.

* Cost of Debentures

→ Cost of Irredeemable Debt. (Perpetuity)

$$K_d = \frac{\text{Interest} \times (1-t)}{V}$$

Interest = Coupon rate × face value

V = Issue price of premium/ discount

t = tax Rate.

→ Cost of Redeemable Debt (Reedemed at Maturity)

$$K_d = \left[\frac{\text{Int} \cdot (1-t) + \frac{F-P}{N}}{\frac{F+P}{2}} \right] \times 100$$

F = Redeemption value at Par / Premium / Discount
P = Market price
n = no. of years

⇒ Cost of Term ~~not~~ Loan (K_t)

$$K_t = \text{Int} \cdot \text{Rate} \cdot (1-t)$$

* ⇒ Cost of Preference Shares

→ Irredeemabe pref. shares

$$K_p = \frac{\text{Div}}{P_0} \times 100$$

D_0 = Div Rate × Face value
P_0 = Price at Premium / Discount / Par

→ Redeemable Pref. shares

$$K_p = \left[\frac{\text{Div} + \frac{F-P}{n}}{\frac{F+P}{2}} \right] \times 100$$

⇒ Cost of Equity (K_e)

→ Dividend Model

$$K_e = \left[\frac{D_1}{P_0} + g \right] \times 100$$

D_1 = Expected Dividend (Next yr)
(If D_1 not given then calculate by multiplying growth rate of current yr with divident of current yr)
P_0 = Share price
g = growth rate (in decimals)

→ Earnings Model

$$K_e = \frac{EPS}{P_0} \times 100$$

EPS = Earnings per share
= Profit after taxes / No. of equity share

P_0 = Price of share

→ CAP Model

$$K_e = R_f + \beta (R_m - R_f)$$

R_f = Risk-free rate
R_m = Market rate
β = coefficient

* ⟹ Concept of Flotation Cost

→ Floatation cost is the cost incurred by a company while issuing securities.
→ It is a one-time cost incurred at the time of issue.

Examples
→ Underwritting commission
→ Brokerage
→ Issue Charges etc.

→ This floatation cost (f) if given, is to be subtracted from price of a security.

Debentures = V - f
Pref. Shares = Issue price - f
Equity Shares = P_0 - f

→ Underwritting commission means if the share is undersubscribed (or in loss) then the underwritter will compensate & will bring to original price.

Q1 Cost of debt (K_D) = 10%.

Q2 15% Irredeemable debentures

Face Value = Rs 100, t = 50% = 0.5

Commission = 1.5%.
Brokerage = 0.5%.
Other charges = Rs 10,000

Int = 15% × 100 = Rs 15
(100 ↓ Face Value)
→ will always be calculated on face value

Floatation Costs = Commission = 1.5% × 100 = Rs. 1.5
Brokerage = 0.5% × 100 = Rs 0.5
Other Charges = 10000 / 10000 = Rs 1
(10000 ↓ Price of debentures; 10000 → Total debentures.)

∴ Total Floatation Cost = Rs 1.5 + 0.5 + 1 = Rs 3

i) Issued at par

$$K_d = \left[\frac{Int \cdot (1-t)}{V-f}\right] \times 100 = \frac{15(1-0.5)}{100-3} \times 100 = 7.73\%$$

ii) Issued @ 10% discount

V = 100 − 10% ↓ = Rs 90

$$K_d = \left[\frac{15(1-0.5)}{90-3}\right] \times 100 = \boxed{8.62\%}$$

iii) Issued @ 10% premium.

V = 100 × 10% = ~~10 + 1~~ ∴ V = 100 + 10 = 110

$$K_d = \left[\frac{15(1-0.5)}{110-3}\right] \times 100 = \boxed{7.10\%}$$

Q3 F.V. = Rs 100 (→ At par), $t = 0.5$, $n = 7$ yrs, $P = 93$, $Int = 10\%$.

Note:- If in any ques no. of years is given then use reedemable formula.

→ As nothing is given we will assume debentures are redeemed at par.

$$\therefore K_d = \left[\frac{Int(1-t) + \frac{F-P}{n}}{\frac{F+P}{2}}\right] \times 100$$

$$= \left[\frac{10(1-0.5) + \frac{100-93}{7}}{\frac{100+93}{2}}\right] \times 100 = 6.22\%$$

→ ~~If~~ Raise to 5,00,000 will come into picture when we do weighted cost of capital.

Q4 F.V = Rs 100, $t = 0.55$, $n = 10$ yrs, $P = FV - f$ (Floatation)

$Int = 100 \times \frac{10}{100} = 10$ Rs

$= 100 - \frac{4}{100} \times 100$

$= 96$

→ At par

Q5 ~~Similar to Q-2~~

Irredeemable Pref Shares

10% Pref Share @ Rs 100 par

$\therefore$ Div = 10% × 100 = Rs 10

Floatation cost = 4%.

$P = 100 - 4\% = Rs\ 96$

i) $K_p = \frac{Div}{P_0} \times 100 = \frac{10}{96} \times 100 = 10.42\%$

ii) 5% premium

$P = \left(100 + \frac{5}{100} \times 100\right)\left(1 - 0.04\right)$ or (96×1.05)

~~= 9.92 %~~ $k_p = \frac{10}{100.8} \times 100 = 9.92\%$

iii) 5% Discount

$P = 96 \times 0.95 = 91.2$

$\therefore k_p = \frac{10}{91.2} \times 100 = 10.96\%$

Q6 Div = $11\% \times 100 = 11$ Rs

~~F = Price = Rs 100 = $\left(\frac{3000}{1000}\right)$ Rs ~~ , n = 10 yrs

F = 100 − 5% Discount = 95 Rs

P = 95 − 3 (floatation cost) = 92 Rs

$\frac{3000}{1000}$ = Rs 3 / share

$\therefore k_p = \left[\frac{Div + \frac{F-P}{n}}{\frac{F+P}{2}}\right] \times 100$

$= \left[\frac{11 + \frac{95-92}{10}}{\frac{95+92}{2}}\right] \times 100 = 12.09\%$

b) Irredeemable Pref Shares

$K_p = \frac{Div}{P} \times 100 = \frac{11}{92} \times 100 = 11.96\%$

Q7 $P_0 = 50$, $D_1 = 2$, $g = 8\%$

$K_e = \left[\frac{D_1}{P_0} + g\right] \times 100 = \left[\frac{2}{50} + 0.08\right] \times 100 = 12\% = K_e$

Q8 $D_1 = Rs\ 6$

$P_0 = 100 - \frac{4}{100} \times 100 = Rs\ 96$ (4 → floatation cost), $g = 0.05$

$k_e = \left[\frac{6}{96} + 0.05\right] \times 100 = 11.25\%$

Q9 Earnings of company = Rs 3,60,000

No. of shares = 30,000

P_0 = Rs 100

New equity of Rs 9,00,000 at 10% Disc @ 90 Rs (100-10%)

$\therefore$ New shares $= \frac{9,00,000}{90} = 10,000$

$\therefore$ Total shares = 40,000

$P_0 = 90(1 - 0.06) = 84.6$

$EPS = \frac{\text{Earnings}}{\text{No of Eq shares}} = \frac{3,60,000}{40,000} = 9$

$k_e = \frac{EPS}{P_0} \times 100 = \frac{9}{84.6} \times 100 = 10.64\%$

Q10 P_0 = Rs 120, $G = 0.05$, ~~$D_0 = Rs\ 30$~~ D_0 = Rs 30

$\therefore D_1 = D_0(1+g)$

$= 30(1.05) = 31.5$

$k_e = \left[\frac{D_1}{P_0} + g\right] \times 100$

$= \left[\frac{31.5}{120} + 0.05\right] \times 100 = 31.25\%$

CAP

Q11 $\beta = 2$, $R_f = 8.5\%$, $R_m = 15\%$

$k_e = R_f + \beta[R_m - R_f] = 8.5 + 2[6.5]$

$= 21.5\%$