Returns and Risk

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NDGURU

Chapter-4
RETURN AND RISK

* Investment Return

It is the additional income generated by the investment. It is generally expressed in the form of percentage and measured on after tax basis. Return expressed in the form of percentage is called Rate of Return (r) or Holding period Return (HPR).

* Measurement of Investment Return

Generally following three types of investment returns are measured.

1. Realized Rate of Return
2. Expected Rate of Return
3. Required Rate of Return

* Realized Rate of Return

It is that return which had already been achieved or earned. It is also casled past return or historical return or ex-post return and calculated by using following formula:

$$HPR = \frac{\text{Selling price} - \text{purchase price} + \text{Dividend/interest}}{\text{Purchase price}} \times 100$$

$$= \frac{\text{Ending value} - \text{Beginning value} + \text{Dividend}}{\text{Beginning value}} \times 100$$

where,

Ending value - Beginning value = Capital Gain

Alternatively,

$$HPR = \frac{\text{Capital Gain} + \text{Dividend}}{\text{Beginning value}} \times 100$$

$$= \frac{\text{Capital Gain}}{\text{Beginning value}} \times 100 + \frac{\text{Dividend}}{\text{Beginning value}} \times 100$$

= Capital Gain Yield + Dividend Yield

= CGY + DY

* Total Return

Total Return is the total of current income and capital Gain or loss from an investment. It is calculated as follows:

Total Rupee Return = Current income + Capital Gain (or loss)

Percentage Return / Rate of Return = $\frac{\text{Total Rupee Return}}{\text{Beginning value of Investment}}$

Problem 4.1

Soln

Beginning value = Rs. 9500
Ending value = Rs. 10,000
Interest for six months = Rs. 300
Maturity period = 18 months

a. Income = 300 × 3 = Rs. 900

b. Capital Gain = Ending Value − Beginning Value
= Rs. 10,000 − Rs. 9500
= Rs. 500

c. Total Return in Rupee = Income + Capital Gain
= 900 + 500
= Rs. 1400

Percentage Return = $\frac{\text{Total Return in Rupee}}{\text{Beginning value}}$
= $\frac{1400}{9500}$
= 14.74 %

Problem 4.2

Soln

a. Calculation of total Rupee Return and percentage Return

Year	P_1	P_0	D	$CG = P_1 - P_0$	Total Rupee Return = D + CG	Percentage Return = Total Rs. Return / P_0
2012	220	200	10	20	30	15 %
2013	230	220	20	10	30	13.64 %
2014	250	230	25	20	45	19.57 %
2015	280	250	40	30	70	28 %
2016	350	280	20	70	90	32.14 %

b. Average Rate of Return over the period 2012 - 2016

$$= \frac{15\% + 13.64\% + 19.57\% + 28\% + 32.14\%}{5}$$

$$= 21.67\ \%$$

c. We would expect the same average rate of return of 21.67% in 2017 if all others things remain constant.

d.

Beginning value = 150 shares × 200 = Rs. 30,000

Ending value = 150 shares × 250 = Rs. 37,500

Dividend Income (2012-2014) = (10+20+25) × 150 shares = 8250

Total Return in Rupee = (Ending value - beginning value) + Dividend

= (37500 - 30,000) + 8250

= Rs. 15,750

Rate of Return = $\frac{\text{Total Rupee Return}}{\text{Beginning value}}$

$= \frac{15,750}{30,000}$

$= 52.5\%$

Problem 4.3

Soln

Given:

Real Rate of Return (K^*) = 3%

Inflation premium (IP) = 5%

Risk premium of A (RP_A) = 3%

Risk premium of B (RP_B) = 5%

a. Risk free Rate of Return (R_f) = $K^* + IP$

$= 3\% + 5\%$

$= 8\%$

b. Required Rate of Return (R) = $R_f + RP$

$R_A = R_f + RP_A = 8\% + 3\% = 11\%$

$R_B = R_f + RP_B = 8\% + 5\% = 13\%$

c. Investment B. is riskier due to higher risk premium.

Problem 4.4

Soln

a.

	Bond A	Bond B
Interest Received:		
First quarter	Rs.100	Rs.75
Second quarter	100	125
Third quarter	100	125
Fourth quarter	100	275
Total interest received	400	600
Investment Value:		
End of the year	Rs. 5100	Rs.4400
Beginning of the year	5000	4500
Capital Gain or loss	100	(100)
Total Rupee Return	500	500
Holding period Return		
HPR = Total Rupee Return / Beginning value	500 / 5000 = 10%	500 / 4500 = 11.11%

. Capital Gain or loss is not likely to be realized if we continue to hold each of the bonds beyond one year because capital Gain or loss is only realized if we sell the investment.

c. Assuming both the bonds are of equal risk, we would prefer Bond B because it has higher Holding period Return than Bond A.

Problem 4.5

Soln

Given:

Number of shares (N) = 100 shares
Beginning price (P_0) = Rs. 20
Dividend per share (D_1) = Rs. 2
Ending price (P_1) = Rs. 21

a. Total Rupee Return $= [(P_1 - P_0) + D_1] \times N$

$= [(21 - 20) + 2] \times 100$ shares

$= Rs. 300$

b. $HPR = \frac{\text{Total Rupee Return}}{\text{Beginning value}} \times 100$

$= \frac{300}{100 \times 20} \times 100$

$= 15\%$

OR,

$HPR = \frac{P_1 - P_0 + D_1}{P_0} \times 100$

$= \frac{21 - 20 + 2}{20} \times 100 = 15\%$

c. Dividend Yield = $\frac{D_1}{P_0} \times 100$

$= \frac{2}{20} \times 100$

$= 10\%$

Capital Gain Yield = $\frac{P_1 - P_0}{P_0} \times 100$

$= \frac{21-20}{20} \times 100$

$= 5\%$

Problem 4.6

Soln

	ABC	XYZ
Beginning value	Rs. 120,000	Rs. 155,000
Cash flow (Income)	Rs. 15,000	Rs. 16,800
Ending value	Rs. 130,000	Rs. 185,000

a. Calculation of Holding Period Return (HPR)

$$HPR = \frac{(\text{Ending value} - \text{Beginning value}) + \text{Cash flow}}{\text{Beginning value}} \times 100$$

$$HPR_{ABC} = \frac{(130,000 - 120,000) + 15,000}{120,000} \times 100 = 20.83\%$$

$$HPR_{XYZ} = \frac{(185,000 - 155,000) + 16,800}{155,000} \times 100 = 30.19\%$$

b. If the two investments are equally risky, Mr. Thapa should recommend investment XYZ because of higher return.

Problem 4.7

Soln

	Stock 1st	Stock 2nd
Dividend Received		
First quarter	Rs.5	Rs.6
Second quarter	Rs.5	Rs.6
Third quarter	-	Rs.6
Fourth quarter	-	Rs.6
Total Dividend (A)	Rs.10	Rs.24
Investment Value		
Beginning price	Rs.250	Rs.270
Ending price	Rs.270	Rs.300
Capital Gain (B)	Rs.20	Rs.30
Total Rupee Return (A+B)	Rs.30	Rs.54
Percentage Return (HPR) = Total Rupee Return / Beginning price	$\frac{30}{250} = 12\%$	$\frac{54}{270} = 20\%$
Annualized HPR	$12 \times 2 = 24\%$	-

First stock p. will provide better annualized holding period return.

Problem 4.8

Soln

	Nepal Bank LTD.	Nabil Bank LTD.	Total
Beginning value	1000 X 200 = Rs. 200,000	500 X 700 = Rs. 350,000	Rs. 550,000
Dividend in 2014	-	500 X 20 = Rs. 10000	Rs. 10,000
Dividend in 2015	-	500 X 30 = Rs. 15,000	Rs. 15,000
Ending value	1000 X 190 = Rs. 190,000	500 X 800 = Rs. 400,000	Rs. 590,000

1. Calculation of two-year Holding period Return on total Investment assuming that the dividend received in 2014 was not reinvested.

$$\text{Two-Year HPR} = \frac{\text{Ending value} - \text{Beginning value} + Div_{2014} + Div_{2015}}{\text{Beginning value}} \times 100$$

$$= \frac{590,000 - 550,000 + 10,000 + 15,000}{550,000} \times 100$$

$$= 11.8\%$$

b. Calculation of Two-year holding period return, assuming that the dividend received in 2014 was reinvested at 10%.

$$\text{Two-Year HPR} = \frac{\text{Ending value} - \text{Beginning value} + \text{Div}_{2014}(1+i) + \text{Div}_{2015}}{\text{Beginning value}} \times 100$$

$$= \frac{590000 - 550,000 + 10,000(1+0.10)^1 + 15,000}{550,000} \times 100$$

$$= 12\%$$

* Internal Rate of Return (IRR)

The annualized rate of return from an investment with more than one year of holding period, is Internal Rate of Return. IRR or Yield is a return that recognizes the concept of Time value of money.

The internal rate of return is compared against the required rate of return to conclude on the performance of investment. If IRR is greater than or equal to the required return, the investment performance is said to be satisfactory. If IRR is lower than the required rate of return we do not accept such investment as it reduce investment wealth.

- IRR for Single cash Flow

$$FV = PV(1+IRR)^n$$

Where,

PV = Present Value or Beginning Investment
FV = Future value or Ending value
n = Time period

Problem 4.9

Soln

Given:

9. Present value (PV) = Rs. 20,000
Future value (FV) = Rs. 40,000
Maturity period (n) = 5 years
Internal Rate of Return (IRR) = ?

We know that,

$$FV = PV(1+IRR)^n$$

$$40,000 = 20,000(1+IRR)^5$$

$$IRR = \left[\frac{40,000}{20,000}\right]^{1/5} - 1$$

$$= 14.87\%$$

b. Since, the Internal Rate of Return 14.87% is higher than the required rate of return of 12%, so we would accept this offer.

Problem 4.10

Soln

Given:

a. Present value (PV) = Rs. 2500

Future value (FV) = Rs. 6000

Maturity period (n) = 8 years

Internal Rate of Return (IRR) = ?

We know that,

$$FV = PV(1+IRR)^n$$

$$6000 = 2500(1+IRR)^8$$

$$\frac{6000}{2500} = (1+IRR)^8$$

$$\left[\frac{6000}{2500}\right]^{1/8} = 1+IRR$$

$$\therefore IRR = \left[\frac{6000}{2500}\right]^{1/8} - 1$$

$$= 11.56\%$$

b. Since, the Internal Rate of Return 11.56% is higher than the required rate of return of 10%, we should make the proposed investment.

Problem 4.11

Sol^n

Given:

Beginning value (CF_0) = Rs. 7000
Dividend in year 1 = Rs. 65
Dividend in year 2 = Rs. 70
Dividend in year 3 = Rs. 70
Dividend in year 4 = Rs. 65
Ending value = Rs. 7900

Step-1:

Total Return = Capital Gain + Dividend
= (7900 - 7000) + (65 + 70 + 70 + 65)
= 900 + 270
= Rs. 1170

Step-2:

Average Annual Return in Rupee = $\frac{\text{Total Return}}{\text{No. of years}} = \frac{1170}{4}$
= Rs. 292.5

Step-3:

Average percentage Return (Approximate Return) = $\frac{292.5}{7000}$ = 4.17 %

Step-4:

Calculation of Net present Value (NPV)

Year	Cash flow	PVIF@4%	PV	PVIF@3%	PV
1	65	0.9615	62.50	0.9709	63.11
2	70	0.9246	64.71	0.9426	65.98
3	70	0.8890	62.23	0.9151	64.06
4	65+7900=7965	0.8548	6808.52	0.8885	7076.80
		TPV =	6997.96	TPV =	7269.95
		− CFo =	7000	− CFo =	7000
		NPV =	(2.04)	NPV =	269.95

Step-5:

By Interpolation:

Low Rate (LR) = 3%

High Rate (HR) = 4%

NPV_{LR} = 269.95

NPV_{HR} = (2.04)

$$IRR = LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times (HR - LR)$$

$$= 3\% + \frac{269.95}{269.95 + 2.04} \times (4\% - 3\%)$$

$$= 3.99\%$$

Since, the Internal Rate of Return 3.99% is lower than the required rate of return of 5%, the investment is not better.

Problem 4.12

Sol^n

Given:

Initial Investment (CF_0) = Rs. 25,000

Cash flow in Year 1 (CF_1) = 0

Cash flow in Year 2 (CF_2) = 0

Cash flow in Year 3 (CF_3) = Rs. 5000

Cash flow in Year 4 (CF_4) = Rs. 35,000

Step-1:

Total Rupee Return = (35000 - 25,000) + 5000

= Rs. 15,000

Step-2:

Average rupee Return = $\frac{15000}{4}$ = Rs. 3750

Step-3:

Approximate average percentage Return = $\frac{3750}{25,000}$

= 15 %

Step-4:

Calculation of NPV

Year	CashFlows	PVIF@15%	PV	PVIF@12%	PV
1	0	0.8696	0	0.8929	0
2	0	0.7561	0	0.7972	0

3	5000	0.6575	3287.5	0.7118	3558.9
4	35000	0.5718	20013	0.6355	22243.13
		TPV	23300.5	TPV	2580203
		- CFo	25000	- CFo	25000
		NPV	(1699.5)	NPV	802.03

Step-5:

By Interpolation:

Low Rate (LR) = 12%

High Rate (HR) = 15%

NPV_{LR} = 802.03

NPV_{HR} = (1699.5)

$$IRR = LR + \frac{NPV_{LR}}{NPV_{LR} - NPV_{HR}} \times (HR - LR)$$

$$= 12\% + \frac{802.03}{802.03 + 1699.5} \times (15 - 12)$$

$$= 12.96\%$$

Since, the Internal Rate of Return is higher than the Required rate of Return, we would invest in the project.

Problem 4.13

Soln

Stock 'X'

$$Div_{2015} = Div_{2009}(1+g)^6$$

$$5.25 = 4.21(1+g)^6$$

$$\left(\frac{5.25}{4.21}\right)^{1/6} = 1+g$$

$$\therefore g = \left(\frac{5.25}{4.21}\right)^{1/6} - 1$$

$$= 3.75\ \%$$

Stock 'Y'

$$Div_{2015} = Div_{2011}(1+g)^4$$

$$3.20 = 2.69(1+g)^4$$

$$\left(\frac{3.20}{2.69}\right)^{1/4} = 1+g$$

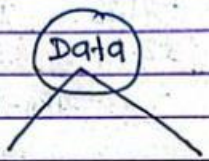
$$g = \left(\frac{3.20}{2.69}\right)^{1/4} - 1$$

$$= 4.43\ \%$$

Stock Y has higher annual compound rate of growth in dividend.

* Expected Rate of Return:

This is the return which is expected to be earned from the given investment in the future. It is largely affected by the change in economic conditions.



Historical Data

Year	Return
1	10%
2	5
3	15
4	-5

Data with probability

Probability	Return
0.3	10%
0.4	5
0.1	15
0.2	-5

Requirements:

1. Expected Rate of Return $E(R)$ / Average Return $(\bar{R})$
2. Standard Deviation (σ)
3. Variance (σ^2)
4. Coefficient of Variation (CV)
5. Covariance between stock A and stock B (COV_{AB})
6. Correlation between stock A and stock B (ρ_{AB})
7. Portfolio
   - i. Portfolio Return
   - ii. Portfolio Risk

Problem 4.14

Soln

Calculation of average return and standard deviation:

Year	R_H	R_B	$R_H - \bar{R}_H$	$R_B - \bar{R}_B$	$[R_H - \bar{R}_H]^2$	$[R_B - \bar{R}_B]^2$
1	10%	14%	-1	+12.67	1	7.13
2	15	-10	4	-21.33	16	454.96
3	8	30	-3	18.67	9	348.57
	$\Sigma R_H = 33$	$\Sigma R_B = 34$			$\Sigma[R_H - \bar{R}_H]^2 = 26$	$\Sigma[R_B - \bar{R}_B]^2 = 810.64$

a. Average Return of HBL stock $(\bar{R}_H) = \frac{\Sigma R_H}{n} = \frac{33}{3} = 11\%$

Average Return of BOK stock $(\bar{R}_B) = \frac{\Sigma R_B}{n} = \frac{34}{3} = 11.33\%$

b. Standard Deviation of HBL stock $(\sigma_H) = \sqrt{\frac{\Sigma[R_H - \bar{R}_H]^2}{n-1}}$

$= \sqrt{\frac{26}{3-1}} = \sqrt{13} = 3.60\%$

Variance of HBL stock $= (\sigma_H)^2 = (3.60)^2 = 13$

Standard Deviation of BOK stock $(\sigma_B) = \sqrt{\frac{\Sigma[R_B - \bar{R}_B]^2}{n-1}}$

$= \sqrt{\frac{810.64}{3-1}} = 20.13\%$

Variance of BOK stock $= (\sigma_B)^2 = (20.13)^2 = 405.34$

Stock BOK has higher variance and standard deviation

c. Calculation of coefficient of variation (CV)

$$CV_H = \frac{\sigma_H}{\bar{R}_H} = \frac{3.60}{11} = 0.32$$

$$CV_B = \frac{\sigma_B}{\bar{R}_B} = \frac{20.13}{11.33} = 1.77$$

Stock BOK is more riskier due to higher CV.

Problem 4.15

Sol"

a. On the basis of a review of the return data, stock A appears to be more risky due to higher fluctuation in return.

b. Calculation of Average Return and standard Deviation:

Year	R_A	R_B	$R_A - \bar{R}_A$	$R_B - \bar{R}_B$	$[R_A - \bar{R}_A]^2$	$[R_B - \bar{R}_B]^2$
2011	19%	8%	7%	-4	49	16
2012	1	10	-11	-2	121	4
2013	10	12	-2	0	4	0
2014	26	14	14	2	196	4
2015	4	16	-8	4	64	16
	$\Sigma R_A = 60$	$\Sigma R_B = 60$			$\Sigma[R_A - \bar{R}_A]^2 = 434$	$\Sigma[R_B - \bar{R}_B]^2 = 40$

Average Return of Investment A $[\bar{R}_A] = \frac{\Sigma R_A}{n} = \frac{60}{5} = 12\%$

Average Return of Investment B $[\bar{R}_B] = \frac{\Sigma R_B}{n} = \frac{60}{5} = 12\%$

c. Calculation of Standard Deviation:

Standard Deviation of Investment A

$$\sigma_A = \sqrt{\frac{\Sigma[R_A - \bar{R}_A]^2}{n-1}} = \sqrt{\frac{434}{5-1}} = 10.42\%$$

Standard Deviation of Investment B

$$\sigma_B = \sqrt{\frac{\Sigma[R_B - \bar{R}_B]^2}{n-1}} = \sqrt{\frac{40}{5-1}} = 3.16\%$$

d. On the basis of our calculation in part 'c', Investment A is more risky due to higher standard deviation. The result in part 'a' is same as in part 'c' because higher fluctuation in returs results highier risk.

Problem 4.16

Soln

a. Calculation of expected Return and standard deviation

State of economy	Prob. (P_j)	R	$P_j \times R$	$R - E(R)$	$P_j[R - E(R)]^2$
Strong growth	0.10	25%	2.5	13.7	18.769
Moderate growth	0.40	15	6	3.7	5.476
Weak growth	0.40	10	4	-1.3	0.676
Recession	0.10	-12	-1.2	-23.3	54.289
			$\Sigma P_j \times R$ = 11.3		$\Sigma P_j[R - E(R)]^2$ = 79.21

∴ Expected Rate of Return, $E(R) = \Sigma P_j \times R = 11.3\%$

b. Variance $= \Sigma P_j[R - E(R)]^2 = 79.21$

c. Standard Deviation $(\sigma) = \sqrt{\Sigma P_j[R - E(R)]^2} = \sqrt{79.21} = 8.9\%$

d. Coefficient of Variation $(CV) = \frac{\sigma}{E(R)} = \frac{8.9}{11.3} = 0.7876$

e. The coefficient of variation is a relative measure of risk. It relates investment risk to the return. It measures risk per unit of return.

Problem 4.17

Soln

Calculation of expected Return and standard deviation:

Prob.(P_j)	R_X	R_Y	$P_j \times R_X$	$P_j \times R_Y$	$R_X - E(R_X)$	$R_Y - E(R_Y)$	$P_j[R_X - E(R_X)]^2$	$P_j[R_Y - E(R_Y)]^2$
0.2	5%	50%	1	10	-7.5	30	11.25	180
0.3	10	30	3	9	-2.5	10	1.875	30
0.3	15	10	4.5	3	2.5	-10	1.875	30
0.2	20	-10	4	-2	7.5	-30	11.25	180
			$\Sigma P_j \times R_X$ = 12.5%	$\Sigma P_j \times R_Y$ = 20%			$\Sigma P_j[R_X - E(R_X)]^2$ = 26.25	$\Sigma P_j[R_Y - E(R_Y)]^2 = 420$

a. Expected Return of stock X, $E(R_X) = \Sigma P_j \times R_X$
$= 12.5\%$

Expected Return of stock Y, $E(R_Y) = \Sigma P_j \times R_Y$
$= 20\%$

b. Standard Deviation of stock X

$$\sigma_X = \sqrt{P_j[R_X - E(R_X)]^2} = \sqrt{26.25} = 5.12\%$$

Standard Deviation of stock Y

$$\sigma_Y = \sqrt{\Sigma P_j[R_Y - E(R_Y)]^2} = \sqrt{420} = 20.49$$

c. Calculation of coefficient of variation (CV)

$$CV_X = \frac{\sigma_X}{E(R_X)} = \frac{5.12}{12.5} = 0.4096$$

$$CV_Y = \frac{\sigma_Y}{E(R_Y)} = \frac{20.49}{20} = 1.0245$$

Stock Y is more riskier due to higher CV. so, we should prefer stock X with lower CV.

Problem 4.18

Sol^n

a. Calculation of Expected Return and standard deviation of stock X

Prob. (P_j)	R_X	$P_j \times R_X$	$R_X - E(R_X)$	$P_j[R_X - E(R_X)]^2$
0.1	-10%	-1	-22%	48.4
0.2	2	0.4	-10%	20
0.4	12	4.8	0	0
0.2	20	4	8	12.8
0.1	38	3.8	26	67.6
		$\Sigma P_j \times R_X = 12$		$\Sigma P_j[R_X - E(R_X)]^2 = 148.8$

$\therefore$ The expected return of stock X, $E(R_X) = \Sigma P_j \times R_X = 12\%$

$\therefore$ Standard Deviation of stock X, $\sigma_X = \sqrt{\Sigma P_j[R_X - E(R_X)]^2}$

$= \sqrt{148.8}$

$= 12.20\%$

b. Calculation of Expected Return and standard deviation of stock Y.

Prob(P_i)	R_Y	$P_j \times R_Y$	$R_Y - E(R_Y)$	$P_j(R_Y - E(R_Y))^2$
0.1	-35%	-3.5	-49%	240.1
0.2	0	0	-14	39.2
0.4	20	8	6	14.4
0.2	25	5	11	24.2
0.1	45	4.5	31	96.1
		$\Sigma P_j \times R_Y = 14\%$		$\Sigma P_j[R_Y - E(R_Y)]^2 = 414$

∴ The expected return of stock Y, $E(R_Y) = \Sigma P_j \times R_Y = 14\%$

∴ Standard deviation of stock Y, $\sigma_Y = \sqrt{\Sigma P_j[R_Y - E(R_Y)]^2}$

$= \sqrt{414} = 20.35\%$

c. Coefficient of variation, $CV_X = \frac{\sigma_X}{E(R_X)} = \frac{12.20}{12} = 1.02$

Coefficient of variation, $CV_Y = \frac{\sigma_Y}{E(R_Y)} = \frac{20.35}{14} = 1.45$

d. No, it is not possible that most of the investors might regard stock Y as being less risky than stock X because stock Y has higher standard deviation and coefficient of variation than stock X.

Problem 4.19

Soln

a. Calculation of Holding Period Return and expected Return (stock A)

Year	D_1	P_0	P_1	$HPR = \frac{P_1 - P_0 + D_1}{P_0} \times 100$
2011	1.6	23	26	20%
2012	1.7	26	25	2.69%
2013	2.0	25	24	4%
2014	2.1	24	27	21.25%
2015	2.2	27	30	19.26%
				$\Sigma HPR = 67.2\%$

$\therefore$ Expected Return, $E(R_A) = \frac{\Sigma HPR_A}{n} = \frac{67.2}{5} = 13.44\%$

For stock B:

Year	D_1	P_0	P_1	$HPR = \frac{P_1 - P_0 + D_1}{P_0} \times 100$
2011	2.0	22	23	13.64%
2012	2.1	23	23	9.13
2013	2.2	23	24	13.91
2014	2.3	24	25	13.75
2015	2.4	25	25	9.6
				$\Sigma HPR = 60.03\%$

$\therefore$ Expected Return, $E(R_B) = \frac{\Sigma HPR_B}{n} = \frac{60.03\%}{5} = 12.01\%$

b. Calcution of standard deviation and CV (stock A)

Year	R_A	$R_A - E(R_A)$	$[R_A - E(R_A)]^2$
2011	20%	6.56%	43.03
2012	2.69	-10.75	115.56
2013	4	-9.44	89.11
2014	21.25	7.81	61
2015	19.26	5.82	33.87
			$\Sigma[R_A - E(R_A)]^2 = 342.57$

∴ Standard deviation $(\sigma_A) = \sqrt{\frac{\Sigma[R_A - E(R_A)]^2}{n-1}} = \sqrt{\frac{342.57}{5-1}} = 9.25\%$

∴ Coefficient of Variation $(CV_A) = \frac{\sigma_A}{E(R_A)} = \frac{9.25}{13.44} = 0.69$

Stock 'B'

Year	R_B	$R_B - E(R_B)$	$[R_B - E(R_B)]^2$
2011	13.64	1.63	2.65
2012	9.13	-2.88	8.29
2013	13.91	1.9	3.61
2014	13.75	1.74	3.03
2015	9.6	-2.41	5.81
			$\Sigma[R_B - E(R_B)]^2 = 23.39$

∴ Standard Deviation $(\sigma_B) = \sqrt{\frac{\Sigma[R_B - E(R_B)]^2}{n-1}} = \sqrt{\frac{23.39}{5-1}} = 2.41\%$

∴ coefficient of Variation $(CV_B) = \frac{\sigma_B}{E(R_B)} = \frac{2.41}{12.01} = 0.20$

c. The expected return of stock A is greater than that of stock B where is standard deviation of stock B is less than stock A. considering rate of return stock A is preferable due to higher return but stock B is also preferable due to lower standard deviation. so there is a conflict between return and risk. Finally we should use the relative measure i.e coeffizien of variation to make the conclusion. Therefore, stock B is preferable due to lower CV.

d. We would recommend Nilima to invest in stock B due to lower coefficient of variation.