CHAPTER 12

Solved Problems

P.12.11 Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of Rs 50,00,000. The expected cash flow after tax for the next three years is as follows:

(Amount in Rs lakh)

Year 1		*Year 2*		*Year 3*	
CFAT	*Probability*	*CFAT*	*Probability*	*CFAT*	*Probability*
14	0.1	15	0.1	18	0.2
18	0.2	20	0.3	25	0.5
25	0.4	32	0.4	35	0.2
40	0.3	45	0.2	48	0.1

The Company wishes to take into consideration all possible risk factors relating to an airline operations. The Company wants to know:

(i) The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.

(ii) The possible deviation in expected value

(iii) How would standard deviation of the present value distribution help in capital budgeting decisions.

Solution

(i) Determination of expected CFAT (*Amount in lakh of rupees*)

	Year 1			*Year 2*			*Year 3*		
	CFAT	P_j	*Cash flow* $(CF \times P_j)$	*CFAT*	P_j	*Cash flow* $(CF \times P_j)$	*CF*	P_j	*Cash flow* $(CF \times P_j)$
	Rs 14	0.1	1.4	Rs 15	0.1	1.5	Rs 18	0.2	3.6
	18	0.2	3.6	20	0.3	6	25	0.5	12.5
	25	0.4	10	32	0.4	12.8	35	0.2	7
	40	0.3	12	45	0.2	9	48	0.1	4.8
Mean		27			29.3			27.9	

Determination of expected NPV

CFAT	*PV factor (0.06)*	*Total PV*
27	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
Total PV of CFAT		74.974
Less: Cash outflows		50.000
NPV		24.974

(ii) Determination of standard deviation for each year

	(x)	P_{j1}	P_{j1}
Year 1			
169	x	0.1	16.9
81	x	0.2	16.2
4	x	0.4	1.6
169	x	0.3	50.7
			85.4
			σ_1 = = 9.24

	(x)	P_{j2}	P_{j2}
Year 2			
204.49	x	0.1	20.449
86.49	x	0.3	25.947

7.29	x	0.4	2.916
246.49	x	0.2	49.298
			98.61
			σ_2 = = 9.93

	(x)	P_{j3}	P_{j3}
Year 3			
98.01	x	0.2	19.602
8.41	x	0.5	4.205
50.41	x	0.2	10.082
404.01	x	0.1	40.401
			74.29
			σ_3 = = 8.61

Standard deviation about the expected value =

σ =

(iii) Standard deviation enables to make use of the normal probability distribution to have more insight about the element of risk in capital budgeting. The use of the normal probability distribution will enable the decision-maker to have an idea of the probability of different expected values of NPV, that is the probability of having the value of zero or less; greater than zero and within the range of two values. The formula is Z = (Expected value – NPV)/σ. If the probability of having NPV of zero or less is considerably low, say 0.005, it implies that the risk in the project is negligible and the project is worth accepting.

P.12.12 A company is evaluating three proposed projects. You are required to rank the projects with respect to both risk and returns. The relevant data are given as follows:

A		*B*		*C*	
NPV	*Probability*	*NPV*	*Probability*	*NPV*	*Probability*
Rs (3,500)	0.05	(Rs 2,000)	0.01	Rs (4,500)	0.03
(1,000)	0.10	0	0.04	(1,500)	0.07
0	0.15	500	0.15	0	0.10
2,000	0.20	1,500	0.20	3,000	0.50
4,000	0.25	2,000	0.30	4,000	0.25
6,000	0.15	2,500	0.20	5,000	0.05
11,000	0.08	3,000	0.06	—	—
17,500	0.02	3,750	0.04	—	—

Solution

Expected NPV

Project A			*Project B*			*Project C*		
NPV	P_i	$(NPV \times P_i)$	*NPV*	P_i	$(NPV \times P_i)$	*NPV*	P_i	$(NPV \times P_i)$
Rs (3,500)	0.05	Rs (175)	Rs (2,000)	0.01	Rs (20)	Rs (4,500)	0.03	Rs (135)
(1,000)	0.10	(100)	0	0.04	0	(1,500)	0.07	(105)
0	0.15	0	500	0.15	75	0	0.10	0
2,000	0.20	400	1,500	0.20	300	3,000	0.50	1,500
4,000	0.25	1,000	2,000	0.30	600	4,000	0.25	1,000
6,000	0.15	900	2,500	0.20	500	5,000	0.05	250
11,000	0.08	880	3,000	0.06	180	—	—	—
17,500	0.02	350	3,750	0.04	150	—	—	—
Expected		3,255	Expected		1,785	Expected		2,510

Determination of standard deviation about the expected NPV

Project A

NPV_i		NPV_i –	$(NPV_i –)^2$	P_i	$(NPV_i –)^2 P_i$
Rs (3,500)	Rs 3,255	Rs (6,755)	Rs 4,56,30,025	Rs 0.15	Rs 22,81,501

(1,000)	3,255	(4,255)	1,81,05,025	0.10	1,81,050
0	3,255	(3,255)	1,05,95,025	0.15	15,89,254
2,000	3,255	(1,255)	15,75,025	0.20	3,15,005
4,000	3,255	745	5,55,025	0.25	1,38,756
6,000	3,255	2,745	75,35,025	0.15	11,30,254
11,000	3,255	7,745	59,98,025	0.08	47,98,602
17,500	3,255	14,245	20,29,20,025	0.02	40,58,400
				$\Sigma(NPV_i -)^2P_i$	144,92,823

Project B

NPV_i		$NPV_i -$	$(NPV_i -)^2$	P_i	$(NPV_i -)^2P_i$
Rs (2,000)	Rs 1,785	Rs (3,785)	Rs 1,43,26,225	0.01	Rs 1,43,262
0	1,785	(1,785)	31,86,225	0.04	1,27,449
500	1,785	(1,285)	16,51,225	0.15	2,47,684
1,500	1,785	(285)	81,225	0.20	16,245
2,000	1,785	215	46,225	0.30	13,867
2,500	1,785	715	5,11,225	0.20	1,02.245
3,000	1,785	1,215	14,76,225	0.06	8,85,735
3,750	1,785	1,965	38,61,225	0.04	1,54,449
				$\Sigma(NPV_i -)^2P_i$	16,90,936

Project C

Rs (4,500)	Rs 2,510	Rs (7,010)	Rs 4,91,40,100	0.03	Rs 14,74,203
(1,500)	2,510	(4,010)	1,60,80,100	0.07	11,25,607
0	2,510	(2,510)	63,00,100	0.10	6,30,010
3,000	2,510	490	2,40,100	0.50	1,20,050
4,000	2,510	1,490	22,20,100	0.25	5,55,025
5,000	2,510	2,490	62,00,100	0.05	3,10,005
				$\Sigma(NPV_i -)^2P_i$	42,14,900

= 3,833

= 1,300

= 2,053

Determination of coefficient of variation (V) =

V_A =

V_B =

V_C =

Ranking of projects

Project	*Return*	*Risk*
A	1	3
B	3	1
C	2	2

P.12.13 What would be the risk-adjusted rates of discount for projects, A, B and C in P.12.6 if the company has gathered the following data to determine the risk-return trade-offs:

Coefficient of variation	*Market discount rate*	*Coefficient of variation*	*Market discount rate*
0.0	8.0	1.2	14.0
0.2	9.0	1.4	15.0
0.4	10.0	1.6	16.0
0.6	11.0	1.8	17.0
0.8	12.0	2.0	18.0
1.0	13.0		

Solution

Project	*Coefficient of variation*	*Market discount rate (%)*

A	1.178	14
B	0.730	12
C	0.818	13

Review Questions

12.14 The probability distributions of two projects' NPV are given below:

Project X		*Project Y*	
NPV	*Probability*	*NPV*	*Probability*
Rs 5,000	0.2	0	0.1
7,500	0.7	Rs 7,500	0.7
10,000	0.1	15,000	0.2

Calculate the expected value, the standard deviation, and the coefficient of variation for each project. Which of these mutually exclusive projects do you prefer and why?

12.15 Determine the risk-adjusted net present value of the following projects:

Net cash outlays (Rs)	1,00,000	1,20,000	2,10,000
Project life (years)	5	5	5
Annual cash inflow (Rs)	30,000	42,000	70,000
Coefficient of variation	0.4	0.8	1.2

The company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient of variation	*Risk-adjusted rate of discount*
0.0	0.10
0.4	0.12
0.8	0.14
1.2	0.16
1.6	0.18
2.0	0.22
More than 2.0	0.25

12.16 A company is considering two mutually exclusive projects X and Y. Project X costs Rs 30,000 and Project Y Rs 36,000. You have been given below the net present value probability distribution for each project:

Project X		*Project Y*	
NPV estimate	*Probability*	*NPV estimate*	*Probability*
Rs 3,000	0.1	Rs 3,000	0.2
6,000	0.4	6,000	0.3
12,000	0.4	12,000	0.3
15,000	0.1	15,000	0.2

(a) Compute the expected net present value of projects X and Y.
(b) Compute the risk attached to each project that is, standard deviation of each probability distribution.
(c) Which project do you consider more risky and why?
(d) Compute the profitability index of each project.

Answers

12.14 Expected NPV_x = Rs 7,250; Expected NPV_y = Rs 8,250.
σ_x – 1,346, σ_y = 4,039.
V_x = 0.185, V_y = 0.489.
Therefore, project X is preferable.

12.15 Project A = Rs 8,150; B = Rs 24,186; C = Rs 19,180.

12.16 (a) Expected NPV of X = Rs 9,000; Expected NPV of Y = Rs9,000.
(b) σ_x = 3,795; σ_y = 4,450.

(c) Project Y is riskier (V_x = 0.421; V_y = 0.494).
(d) PI_x = 1.3; PI_y = 1.25.