CHAPTER – 12

ADVANCED CAPITAL BUDGETING

PART 1: INFLATION IN CAPITAL BUDGETING

Question – 01

A firm has projected the following cash flows from a project under evaluation:

Year	₹ lakhs
0	(70)
1	30
2	40
3	30

The above cash flows have been made at expected prices after recognizing inflation. The firm's cost of capital is 10%. The expected annual rate of inflation is 5%.

Show how the viability of the project is to be evaluated.

(SM TYK – 17)

Solution:

Nominal Cash Flows & Nominal Discounting Rate

NDR = $[(1.10 \times 1.05) - 1] \times 100$

= 15.5%

$$NPV = \frac{30}{(1.155)^1} + \frac{40}{(1.155)^2} + \frac{30}{(1.155)^3} - 70$$

= 5.429 lakh

Since NPV is positive hence project is viable.

Question – 02

KLM Ltd. requires ₹ 15,00,000 for a new project.

Useful life of project is 3 years.

Salvage value - NIL. Depreciation is ₹ 5,00,000 p.a.

Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000
Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume nominal cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years = 0.877, 0.769 and 0.675

Show amount to the nearest rupee in calculations.

You are required to calculate net present value of the project.

(SM TYK – 19)

Solution:

अगर Revenue & Cost का Inflation rate अलग अलग है तो NCF & NDR ही हमें लेना होगा।

Nominal CF

	1	2	3
Revenue	10,00,000 (1.09) =10,90,000	13,00,000 (1.09) (1.08) = 15,30,360	14,00,000 (1.09) (1.08) (1.06) = 17,46,965
(-) Cost	5,00,000 (1.10) 5,50,000	6,00,000 (1.10) (1.09) 7,19,400	6,50,000 (1.10) (1.09) (1.07) 8,33,905
CFBT – (i)	5,40,000	8,10,960	9,13,060
(-) Depreciation	5,00,000	5,00,000	5,00,000
PBT	40,000	3,10,960	4,13,060
Tax @ 35% – (ii)	14,000	1,08,836	1,44,571

CFAT (i – ii)	5,26,000	7,02,124	7,68,489
(x) PVF (14%)	0.877	0.769	0.675

PVCI = ₹ 15,19,965

(-) PVCO = ₹ 15,00,000

NPV = ₹ 19,965

Since NPV is positive hence project should be accepted.

Question – 03

Determine NPV of the project with the following information:

Initial Outlay of project	₹ 40,000
Annual revenues (Without inflation)	₹ 30,000
Annual costs excluding depreciation (Without inflation)	₹ 10,000
Useful life	4 years
Salvage value	Nil
Tax Rate	50%
Cost of Capital (Including inflation premium of 10%)	12%

Solution:

Alternative 1: RCF & RDR

CFAT

Sales = 30,000

(-) cost = 10,000

CFBT (i) = 20,000

(-) Dep. $\left(\frac{40,000}{4}\right)$ = 10,000

PBT = 10,000

Tax @ 50% (ii) = 5,000

CFAT (i – ii) = 15,000

RDR $= \left[\frac{1.12}{1.10} - 1\right] \times 100 = 1.82\%$

NPV = (15000 × 3.824) = 40,000

= 17,360

Alternative 2: NCF & NDR

Since inflation rate is 10% a year, real cash flows may be stated in nominal cash flows as follows:

Nominal Cash Flow = (1 + Inflation Rate) Real Cash Flows

Year	Real Cash Flows	Nominal Cash Flows
1	15,000	15,000 × 1.10 = 16,500
2	15,000	15,000 × $(1.10)^2$ = 18,150
3	15,000	15,000 × $(1.10)^3$ = 19,965
4	15,000	15,000 × $(1.10)^4$ = 21,962

NPV using nominal discounting rate 12%

$$\frac{16,500}{(1.12)^1} + \frac{18,150}{(1.12)^2} + \frac{19,965}{(1.12)^3} + \frac{21,962}{(1.12)^4} - 40,000$$

= ₹ 14,732 + ₹ 14,469 + ₹ 14,211 + ₹ 13,957 – ₹40,000

= ₹ 17,369 (Approx)

PART 2: RISK IN CAPITAL BUDGETING

(I) STATISTICAL TECHNIQUES

Question – 04

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs ₹ 36,000 and project B ₹ 30,000. You have been given below the net present value probability distribution for each project.

Project A		Project B	
NPV Estimates (₹)	Probability	NPV Estimates (₹)	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4

6,000 3,000	0.3 0.2	6,000 3,000	0.4 0.1

(i) Compute the expected net present values of projects A and B.

(ii) Compute the risk attached to each project i.e. standard deviation of each probability distribution.

(iii) Compute the profitability index of each project.

(iv) Which project do you recommend? State with reasons.

(SM TYK – 06)

Solution:

(i) Expected NPV

Project A

= (15,000 × 0.2) + (12,000 × 0.3) + (6,000 × 0.3) + (3,000 × 0.2)

= 9,000

Project B

= (15,000 × 0.1) + (12,000 × 0.4) + (6,000 × 0.4) + (3,000 × 0.1)

= 9,000

(ii) Standard Deviation

Project A

$$\sigma_x = \sqrt{(15,000 - 9,000)^2\ 0.2 + (12,000 - 9,000)^2\ 0.3 + (6,000 - 9,000)^2\ 0.3 + (3,000 - 9,000)^2\ 0.2}$$

= 4,450

Project B

$$\sigma_B = \sqrt{(15,000 - 9,000)^2\ 0.1 + (12,000 - 9,000)^2\ 0.4 + (6,000 - 9,000)^2\ 0.4 + (3,000 - 9,000)^2\ 0.1}$$

σ_B = 3,795

	A	B
NPV	9,000	9,000
S.D.	4,450	3,795

(iii) Profitability Index

$$PI = \frac{PVCI}{PVCO}$$

$$A = \frac{36,000 + 9,000}{36,000} = 1.25$$

$$B = \frac{30,000 + 9,000}{30,000} = 1.30$$

(iv) Coefficient of Variation = $\frac{\sigma}{\bar{x}}$

$$A = \frac{4,450}{9,000} = 0.49$$

$$B = \frac{3,795}{9,000} = 0.42$$

Project B should be accepted due to lower risk (C.V.)

Question – 05

KLM Ltd., is considering taking up one of the two projects-Project-K and Project-So Both the projects having same life require equal investment of ₹ 80 lakhs each. Both are estimated to have almost the same yield. As the company is new to this type of business, the cash flow arising from the projects cannot be estimated with certainty. An attempt was therefore, made to use probability to analyze the pattern of cash flow from other projects during the first year of operations. This pattern is likely to continue during the life of these projects. The results of the analysis are as follows:

Project K		Project S	
Cash Flow (in ₹)	Probability	Cash Flow (in ₹)	Probability
11	0.10	09	0.10
13	0.20	13	0.25

15 17 19	0.40 0.20 0.10	17 21 25	0.30 0.25 0.10

Required:

(i) Calculate variance, standard deviation and co-efficient of variance for both the projects.

(ii) Which of the two projects is riskier?

(SM TYK – 04)

Solution:

Calculation of Variance & SD, EV.

Project K

Expected Cash Flows

$= (11 \times 0.10) + (13 \times 0.20) + (15 \times 0.40) + (17 \times 0.20) + (19 \times 0.10)$

$= 15$

$\sigma^2 = (11-15)^2\ 0.10 + (13-15)^2\ 0.20 + (15-15)^2\ 0.4 + (17-15)^2\ 0.20 + (19-15)^2\ 0.10$

$= 4.8$

$\sigma = \sqrt{4.8} = 2.19.$

$C.V. = \frac{\sigma}{\bar{x}} = \frac{2.19}{15} = 0.146$

Project S

Expected Cash Flows

$= (9 \times 0.10) + (13 \times 0.25) + (17 \times 0.30) + (21 \times 0.25) + (25 \times 0.10)$

$= 17$

$\sigma^2 = (9-17)^2 0.10 + (13-17)^2 0.25 + (17-17)^2 0.3 + (21-17)^2 0.25 + (25-17)^2\ 0.10$

$= 20.8$

$\sigma = \sqrt{20.8} = 4.56$

$C.V. = \frac{\sigma}{\bar{x}} = \frac{4.56}{17} = 0.268$

Project S is riskier as it has higher Coefficient of Variation.

Question – 06

A company is considering Projects X and Y with following information:

Project	Expected NPV (₹)	Standard Deviation
X	1,22,000	90,000
Y	2,25,000	1,20,000

(i) Which project will you recommend based on the above data?

(ii) Explain whether your opinion will change, if you use coefficient of variation as a measure of risk.

(iii) Which measure is more appropriate in this situation and why?

(SM TYK – 03)

Solution:

(i) On the basis of NFV project Y is better due to higher NPV.

On the basis of standard deviation, project x is better due to lower standard deviation.

(ii) Coefficient of Variation = $\frac{\sigma}{x}$

$X = \frac{90,000}{1,22,000} = 0.738$

$Y = \frac{1,20,000}{2,25,000} = 0.533$

Project Y is better due to lower (C.V.)

(iii) However, the NPV method in such conflicting situation is best because the NPV method is in compatibility of the objective of wealth maximization in terms of time value.

(II) CONVENTIONAL TECHNIQUES

(i) Risk Adjusted Discounting Rate

Question – 07

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

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

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

Coefficient of Variation	Risk-Adjusted Rate of Return	P.V. Factor 1 to 5 years At risk adjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

(SM TYK – 15)

Solution:

Risk adjusting NPV

Project X

RADR = 16%

RANPV = (70,000 × 3.274) – 2,10,000

= 19,180

Project Y

RADR = 14%

= (42,000 × 3.433) – 1,20,000

= 24,186

Project Z

RADR = (30,000 × 3.605) – 1,00,000

= 8,150

Question – 08

New Projects Ltd. is evaluating 3 projects, P-I, P-II, P-III. Following information is available in respect of these projects:

	P-I	P-II	P-III
Cost	₹ 15,00,000	₹ 11,00,000	₹ 19,00,000
Inflow-Year 1	6,00,000	6,00,000	4,00,000
Year 2	6,00,000	4,00,000	6,00,000
Year 3	6,00,000	5,00,000	8,00,000
Year 4	6,00,000	2,00,000	12,00,000
Risk Index	1.80	1.00	0.60

Minimum required rate of return of the firm is 15% and applicable tax rate is 40%. The risk free interest rate is 10%.

Required:

(i) Find out the risk-adjusted discount rate (RADR) for these projects.

(ii) Which project is the best?

(SM TYK – 16)

Solution:

(i) The risk free rate of interest and risk factor for each of the projects are given. The risk adjusted discount rate (RADR) for different projects can be found on the basis of CAPM as follows:

Required Rate of Return = I_{Rf} + (K_0 – I_{RF}) Risk Factor

For P-I : RADR = 0.10 + (0.15 – 0.10) 1.80 = 19%

For P-II : RADR = 0.10 + (0.15 – 0.10) 1.00 = 15 %

For P-III : RADR = 0.10 + (0.15 – 0.10) 0.60 = 13 %