

PRACTICE FOR MAY 2011 EXAM (TOUGH)

1. SUM OF PARTS VALUATION / BREAK-EVEN APPROACH / SOPV APPROACH TO VALUATION

The “SOPV” approach suggests that the sum of the individual parts of a firm may be worth more than the current value of the whole. The “SOPV” approach involves three steps.

Step 1: Identify the firm’s various business segments and calculate the average capitalization ratios for firms in those industries.

Step 2: Calculate a “theoretical” market value based upon each of the average capitalization ratios.

Step 3: Average the “theoretical” market values to determine the “SOPV” value of the firm.

Practical:

Using the SOPV approach (or Break-up value approach), assign a value for ITC Ltd. Whose stock is currently trading at a total market price of Rs.8 million. For ITC, the accounting data set forth three business segments: Cigarettes, FMCG, and paper. Data for the firm’s three segments are as follows:

Rs. in lakhs

BUSINESS SEGMENT	Segment Sales	Segment Assets	Segment Income
Cigarettes	30	15	2
FMCG	16	14	3
Paper	40	60	12

Industry data for “pure-play” firms have been compiled and are summarized as follows:

BUSINESS SEGMENT	Capitalization/Sales	Capitalization/Assets	Capitalization /OperatingIncome
Cigarettes	1.5	1.2	20
FMCG	2.20	1.8	14
Paper	2	1.2	12

SOLUTION:

ITC – Break-up valuation

BUSINESS SEGMENT	Capitalization/Sales	Segment Sales	Theoretical Values
Cigarettes	1.5	30	45
FMCG	2.20	16	35.2
Paper	2	40	80
Total Value			160.2

BUSINESS SEGMENT	Capital-to- Assets	Segment Assets	Theoretical Values
Cigarettes	1.2	15	18
FMCG	1.8	14	25.2
Paper	1.2	60	72
Total Value			115.2

BUSINESS SEGMENT	Capital-to- Op.Income	Segment Income	Theoretical Values
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Cigarettes	20	2	40
FMCG	14	3	42
Paper	12	12	144
Total Value			226

Average theoretical value = $160.2 + 115.2 + 226 / 3 = \text{Rs. } 350.73$ (approx)

2.

A multinational white goods company based in US has its subsidiaries in UK, France, Japan and Australia. The following are the cash flows occurred during December 2001 among the subsidiaries and the parent company:

From	To	Amount
UK subsidiary	France subsidiary	£ 500,000
France subsidiary	Australia subsidiary	Euro 600,000
Japan subsidiary	France subsidiary	Yen 50 million
Australia subsidiary	US Parent	AUD 750,000
Australia subsidiary	Japan subsidiary	AUD 400,000
Japan subsidiary	UK subsidiary	Yen 10 million
Japan subsidiary	US Parent	Yen 80 million
UK subsidiary	US Parent	£ 650,000
France subsidiary	US Parent	Euro 500,000

The current exchange rates are given below:

\$ / Euro	0.8815
Yen / \$	123.42
\$ / £	1.4226
AUD / \$	1.9153

If the centralized cash management is followed by the company, then you are **required** to arrive at the net cash flows of the subsidiaries and US Parent in US \$ terms.

SOLUTION:

All the subsidiaries and US Parent will convert their receivables and payables in US \$ to determine their net position.

UK subsidiary

Pays	£	500,000	=	\$ 500,000 × 1.4226	=	\$ 711,300 (-)
Receives	Yen	10 million	=	\$ $\frac{10 \text{ million}}{123.42}$	=	\$ 81,024 (+)
Pays	£	650,000	=	\$ 650,000 × 1.4226	=	\$ 924,690 (-)
Net Payment to netting center					=	<u>\$ 1,554,966</u>

France subsidiary

Receives	£	500,000	=	\$ 500,000 × 1.4226	=	\$ 711,300 (+)
Pays	Euro	600,000	=	\$ 600,000 × 0.8815	=	\$ 528,900 (-)
Receives	Yen	50 million	=	\$ $\frac{50 \text{ million}}{123.42}$	=	\$ 405,121 (+)
Pays	Euro	500,000	=	\$ 500,000 × 0.8815	=	\$ 440,750 (-)
Net received from netting center					=	<u>\$ 146,771</u>

Japan subsidiary

Pays	Yen	50 million	=	\$ $\frac{50 \text{ million}}{123.42}$	=	\$ 405,121 (-)
Receives	AUD	400,000	=	\$ $\frac{400,000}{1.9153}$	=	\$ 208,845 (+)
Pays	Yen	10 million	=	\$ $\frac{10 \text{ million}}{123.42}$	=	\$ 81,024 (-)
Pays	Yen	80 million	=	\$ $\frac{80 \text{ million}}{123.42}$	=	\$ 648,193 (-)
Net payment to netting center					=	<u>\$ 925,493</u>

Australia subsidiary

Receives	Euro	600,000	=	\$ 600,000 × 0.8815	=	\$ 528,900 (+)
Pays	AUD	750,000	=	\$ $\frac{750,000}{1.9153}$	=	\$ 391,584 (-)
Pays	AUD	400,000	=	\$ $\frac{400,000}{1.9153}$	=	\$ 208,845 (-)
Net payment to netting center					=	<u>\$ 71,529</u>

US Parent

$$\text{Receives AUD } 750,000 = \$ \frac{750,000}{1.9153} = \$ 391,584 (+)$$

$$\text{Receives Yen } 80 \text{ million} = \$ \frac{80 \text{ million}}{123.42} = \$ 648,193 (+)$$

$$\text{Receives £ } 650,000 = \$ 650,000 \times 1.4226 = \$ 924,690 (+)$$

$$\text{Receives Euro } 500,000 = \$ 500,000 \times 0.8815 = \$ 440,750 (+)$$

$$\text{Net received from netting center} = \$ 2,405,217$$

3. Mr. Mallik, feels that Indian stock markets recently has exhibited weak form of market efficiency. In order to test the validity of his impression, he collected some data relating to movement of sensex for the last 20 trading days which is as follows:

Days	Open	High	Low	Close
1	3470.94	3513.79	3438.03	3453.99
2	3453.63	3478.11	3427.82	3434.83
3	3414.06	3440.29	3397.65	3431.93
4	3434.94	3446.18	3377.58	3383.41
5	3372.92	3380.27	3352.12	3370.93
6	3375.82	3389.49	3331.42	3340.75
7	3340.89	3340.89	3310.95	3330.98
8	3326.84	3340.91	3306.17	3335.08
9	3307.16	3338.22	3296.43	3301.97

10	3298.64	3318.6	3254.28	3259.03
11	3260.04	3278.85	3241.66	3251.53
12	3255.92	3289.46	3249.46	3285.89
13	3288.86	3535.67	3255.98	3329.28
14	3335	3346.21	3276.72	3284.17
15	3293.83	3310.86	3278.54	3298.78
16	3300.02	3337.79	3300.02	3325.38
17	3323.36	3356.34	3322.44	3329.95
18	3322.81	3345.98	3317.44	3319.67
19	3317.51	3321.18	3294.19	3302.32
20	3290.86	3324.96	3279.62	3319.61

Test for efficiency of the market using Auto-Co-relation test.

SOLUTION:

Period I	Sensex closing	Change (X)	Period II	Sensex closing	Change (Y)
1	3453.99	0	11	3251.53	-7.5
2	3434.83	-19.16	12	3285.89	34.36
3	3431.93	-2.9	13	3329.28	43.39
4	3383.41	-48.52	14	3284.17	-45.11
5	3370.93	-12.48	15	3298.78	14.61
6	3340.75	-30.18	16	3325.38	26.6
7	3330.98	-9.77	17	3329.95	4.57
8	3335.08	4.1	18	3319.67	-10.28
9	3301.97	-33.11	19	3302.32	-17.35
10	3259.03	-42.94	20	3319.61	17.29

X	Y	X- Mean X	Y-Mean Y	(X- Mean X) ²	(Y- Mean Y) ²	(X- Mean X)(Y- Mean Y)
(19.16)	34.36	2.50	26.80	6.25	718.24	67.00
(2.90)	43.39	18.76	35.83	351.94	1283.79	672.17
(48.52)	(45.11)	(26.86)	(52.67)	721.46	2774.13	1414.72
(12.48)	14.61	9.18	7.05	84.27	49.70	64.72
(30.18)	26.60	(8.52)	19.04	72.59	362.52	(162.22)
(9.77)	4.57	11.89	(2.99)	141.37	8.94	(35.55)
4.10	(10.28)	25.76	(17.84)	663.58	318.27	(459.56)
(33.11)	(17.35)	(11.45)	(24.91)	131.10	620.51	285.22
(42.94)	17.29	(21.28)	9.73	452.84	94.67	(207.05)
(194.96)	68.08			2625.40	6230.77	1639.44

$$\bar{X} = -21.66$$

$$\bar{Y} = 7.56$$

$$\sigma_x = (2626.40/8)^{1/2} = 18.12$$

$$\sigma_y = (6230.77/8)^{1/2} = 27.91$$

$$\text{Cov}(x,y) = 1639.44/8 = 204.93$$

$$r = 204.93/(18.12 \times 27.91) = 0.405$$

Hence, there is moderate degree of correlation between the returns of two periods and we can conclude the market does not exhibit weak form of efficiency.

4. A speculator is expecting significant depreciation of Yen against dollar over the next six months. The current \$/100¥ spot rate is 0.8805. The following European call options are traded at the market:

Option	Strike price (\$/¥)	Premia (\$/¥)	Maturity
Call	0.0087	0.00015	6m
Call	0.0083	0.00025	6m

The speculator wants to make profit by using above call options.

You are **required** to

- Suggest an appropriate spread strategy explaining the reason for the same.
- Show the pay-off profile and pay-off diagram for the strategy for a range of values between 0.0080 \$/¥ to 0.0090 \$/¥.
- Calculate break-even rate, maximum profit and maximum loss from the strategy.

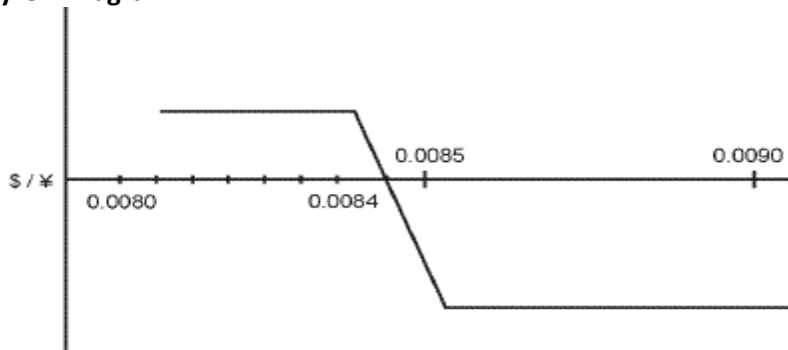
SOLUTION:

a) As the speculator is bearish on yen, so he will go for bearish call spread on Yen options. So he will buy the higher strike call and sell the lower strike call. The spread strategy will give profit if Yen depreciates against dollar.

Pay-off Profile = Buy call at 0.0087 at premium 0.0015 and sell call at 0.0083 at premium 0.0025

Spot (\$/¥)	Gain/loss on C = 0.0087	Gain/loss on C = 0.0083	Net gain/loss
0.0080	-0.00015	0.00025	0.0001
0.0081	-0.00015	0.00025	0.0001
0.0082	-0.00015	0.00025	0.0001
0.0083	-0.00015	0.00025	0.0001
0.0084	-0.00015	0.00015	0
0.0085	-0.00015	0.00005	-0.0001
0.0086	-0.00015	-0.00005	-0.0002
0.0087	-0.00015	-0.00015	-0.0003
0.0088	-0.00005	-0.00025	-0.0003
0.0089	0.00005	-0.00035	-0.0003
0.0090	0.00015	-0.00045	-0.0003

Pay-Off Diagram



Break-even rate = 0.0084 \$/¥

Maximum profit = 0.0001 \$/¥

Maximum loss = -0.0003 \$/¥

5. A trader has gone long on 5 Brent crude futures for December settlement at \$26.32 per barrel. The minimum contract size for Brent futures contract is 100,000 barrel. The initial margin is \$50,000 and the maintenance margin is \$30,000. The futures close at the following prices on the next ten trading days:

Day 1 \$ 26.19

Day 2 \$ 26.30

Day 3 \$ 26.45

Day 4 \$ 26.48

Day 5 \$ 26.34

Day 6 \$ 26.21

Day 7 \$ 25.98

Day 8 \$ 25.87

Day 9 \$ 25.90

Day 10 \$ 25.95

The trader will take out the profit out of the margin account whenever he gets the opportunity to do so.

You are **required** to

a. Prepare the margin account showing all the cash flows.

b. Find the profit/loss for the trader after 10 trading days.

SOLUTION:

Initial margin for 5 contract = 5 x \$50,000 = \$2, 50, 000

Maintenance margin for 5 contracts = 5 x \$30,000 = \$1, 50,000

Day	Futures Price	Daily gain/loss	Balance in Margin A/c.	Profit withdrawn	Margin call
1	26.19	(65,000)	1,85,000	—	—
2	26.30	55,000	2,40,000	—	—
3	26.45	75,000	3,15,000	65,000	—
4	26.48	15,000	2,65,000	15,000	—
5	26.34	(70,000)	1,80,000	—	—
6	26.21	(65,000)	1,15,000	—	1,35,000
7	25.98	(1,15,000)	1,35,000	—	1,15,000
8.	25.87	(55,000)	1,95,000	—	—
9.	25.90	15,000	2,10,000	—	—
10.	25.95	25,000	2,35,000	—	—

Profit/loss = Closing balance in Margin account + Profit withdrawn – [Opening balance in margin account + Margin calls]

= 2,35,000 + (65,000 + 15,000) – [2,50,000 + (1,35,000 + 1,15,000)]

= (\$1,85,000)

6. Three companies X, Y and Z have come together to reduce their interest cost. Following are the requirement of those companies and interest rates offered to them in different markets:

Company	Requirement	Fixed \$	Floating \$	Fixed Euro
X	Fixed \$ funds	5.75%	LIBOR + 0.90%	6.00%
Y	Floating \$ funds	5.25%	LIBOR + 0.75%	6.50%
Z	Fixed Euro Funds	6.00%	LIBOR + 0.60%	6.25%

The amounts required by the companies are equal and are for three years on bullet payment basis. You are **required** to arrange a swap between three parties in such a way so that the benefit of swap is equally divided among the three companies.

SOLUTION:

We can see that, X has absolute advantage for borrowing in Fixed Euro market, Y has absolute advantage in Fixed \$ market and Z has absolute advantage in floating \$ market. So they will borrow in those markets where they have absolute advantage and inter-change the interest payments among them.

Gain due to doing swap

$$= [5.75 + 6.25 + (\text{LIBOR} + 0.75)] - [5.25 + 6.00 + (\text{LIBOR} + 0.60)]$$

$$= 0.90\%$$

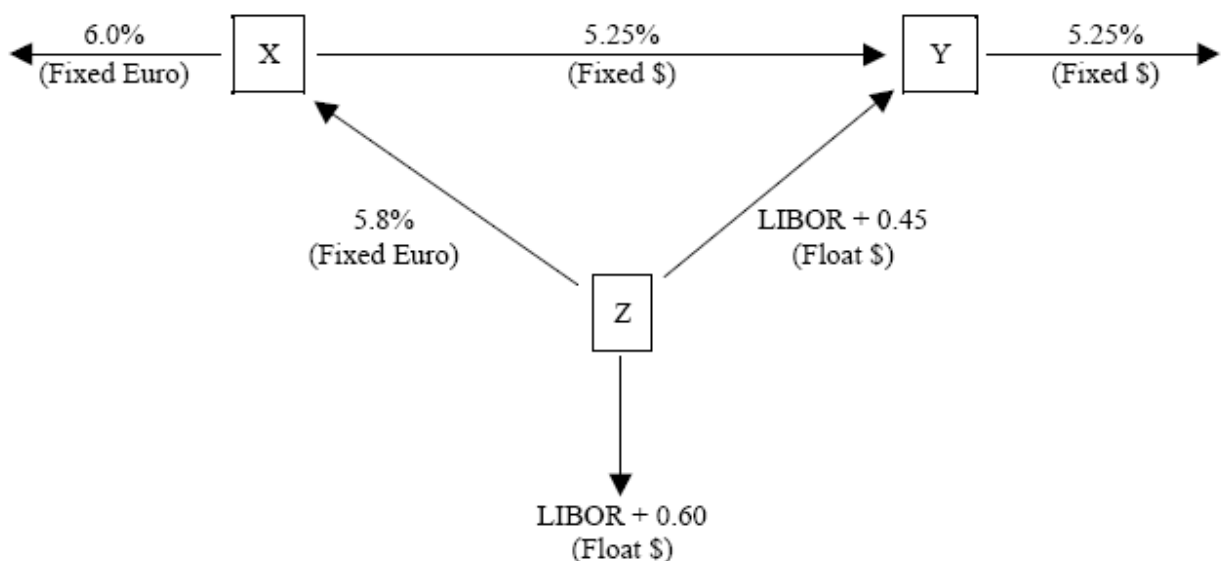
So the total gain of 0.90% will be divided among three parties equally.

Swap arrangement:

X will borrow from the market fixed Euro at 6%, pay Y fixed \$ at 5.25% and receive fixed Euro at 5.8% from Z.

Y will borrow from the market fixed \$ at 5.25%, receive 5.25% fixed \$ from X and pay LIBOR + 0.45%, floating \$ to Z.

Z will borrow from the market floating \$ at LIBOR + 0.60%, receive floating \$ at LIBOR + 0.45% from Y and pay fixed Euro 5.8% to X.



Cost of X = $6 + 5.25 - 5.8 = 5.45$

Cost of Y = $5.25 + (\text{LIBOR} + 0.45) - 5.25 = \text{LIBOR} + 0.45$

Cost of Z = $\text{LIBOR} + 0.6 + 5.8 - (\text{LIBOR} + 0.45) = 5.95$

Gain of X = $5.75 - 5.45 = 0.30\%$

Gain of Y = $\text{LIBOR} + 0.75 - (\text{LIBOR} + 0.45) = 0.30\%$

Gain of Z = $6.25 - 5.95 = 0.30\%$

7.

The following are the details on two potential merger candidates, Blue and Green in 2001:

Particulars	Blue	Green
Revenues	Rs.4,400.00	Rs.3,125.00
Cost of Goods Sold (without Depreciation)	87.50% of Revenue	89.00% of Revenue
Depreciation	Rs.200.00	Rs.74.00
Tax Rate	35.00%	35.00%
Working Capital	10% of Revenue	10% of Revenue
Market Value of Equity	Rs.2,000.00	Rs.1,300.00
Outstanding Debt	Rs.160.00	Rs.250.00

Both firms are in a steady state and are expected to grow at 5% a year in the long-term. Capital spending is expected to be offset by depreciation. The beta for both the firms is 1, and both firms are rated BBB, with an interest rate on their debt of 8.5%. (The Treasury bond rate is 7 % and the risk premium is 5.5 %.)

As a result of the merger, the combined firm is expected to have a cost of goods sold of only 86% of total revenues. The combined firm does not plan to borrow additional debt.

Required:

- Estimate the value of Green, operating independently.
- Estimate the value of Blue, operating independently.
- Estimate the value of the combined firm, with no synergy.
- Estimate the value of the combined firm, with synergy.
- Estimate the worth of the operating synergy

SOLUTION:

	Green	Blue	No. Synergy	With Synergy
Revenues	3,281	4,620	7,901	7,901
– COGS	2,920	4,043	6,963	6,795
– Dep	74	200	274	274
= EBIT	287	378	664	832
EBIT (1 – t)	187	245	432	541
– Change in WC	16	22	38	38
FCFF	171	223	394	503
Cost of Equity	12.50%	12.50%	12.50%	12.50%
Cost of Debt	5.53%	5.53%	5.53%	5.53%
WACC	11.38%	11.98%	11.73%	11.73%
Firm Value	2,681	3,199	5,879	7,479

Synergy Gain = 7479 - 5879 = 1,600

Note: Firm Value = FCFF₁ / (WACC – g)

8. A portfolio manager is considering the following two bonds for inclusion in the portfolio:

a. Bond A is a 25-year maturity bond currently selling at Rs 89.0. It pays an annual coupon @ 8%.

b. Bond B is a 15-year maturity bond selling at Rs. 90.5. It pays an annual coupon @ 7.25%

He predicts an upward sloping yield curve and forecast that after 5 years a 20-year bond will give an YTM of 9% and a 10-year bond will give an YTM of 8%. If investment horizon of the portfolio manager is five years, which bond should he pick? The reinvestment rate is 5%.

SOLUTION:

Bond A

After 5 years the maturity of 25-year bond will be 20 years. The predicted yield of 20-year bond is 9% and its expected price will be

$$8.0 \times PVIFA_{(9,20)} + 100.00 \times PVIF_{(9,20)} = \text{Rs. } 90.832$$

$$\begin{aligned} \text{At the 5\% of reinvestment rate, the five-coupon income will be} &= 8.00 \times FVIFA(5,5) \\ &= \text{Rs. } 44.208 \end{aligned}$$

$$\begin{aligned} \text{Hence total income that may accrue to the bondholders after 5 years} &= 90.832 + 44.208 \\ &= \text{Rs. } 135.04. \end{aligned}$$

$$\begin{aligned} \text{Therefore 5 year return} &= (1+i)^5 = \frac{135.04}{89.0} \\ i &= 8.7\% \end{aligned}$$

Bond B

After 5 years the maturity of 15-year bond will be only 10 years. The predicted yield of 10-year bond is 8% and its expected price will be

$$7.25 \times PVIFA_{(8,10)} + 100.00 \times PVIF_{(8,10)} = \text{Rs. } 94.9475$$

$$\begin{aligned} \text{At the 5\% of reinvestment rate, the five-coupon income will be} &= 7.25 \times FVIFA(5,5) \\ &= \text{Rs. } 40.064 \end{aligned}$$

$$\begin{aligned} \text{Hence total income that may accrue to the bondholders after 5 years} &= 94.9475 + 40.064 \\ &= \text{Rs. } 135.0115 \end{aligned}$$

$$\begin{aligned} \text{Therefore 5 year return} &= (1+i)^5 = \frac{135.0115}{90.5} \\ i &= 8.33\% \end{aligned}$$

As the return from bond A is higher, it should be selected.

9. The Globe Manufacturing Company Ltd. is considering an investment in one of the two mutually exclusive proposals – Projects X and Y, which require cash outlays of Rs. 3,40,000 and Rs. 3,30,000 respectively. The certainty-equivalent (C.E.) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bond is 8% and this be used as the riskless rate. The expected net cash flows and their certainty-equivalents are as follows:

Project X Project Y				
Year-end	Cash flow (X)	C.E.	Cash flow (Y)	C.E.
1	1,80,000	.8	1,80,000	.9
2	2,00,000	.7	1,80,000	.8
3	2,00,000	.5	2,00,000	.7

Present value factors of Re. 1 discounted at 8% at the end of year 1, 2 and 3 are .926, .857 and .794 respectively.

Required: Which project should be accepted?

SOLUTION:

a) Statement showing Net Present Value of Project X

Year-end	Cash flow (a)	C.E. (b)	Adjusted Cash flow (c) = (a) × (b)	Present value factor at 8% (d)	Total present value (e) = (c) × (d)
1	1,80,000	0.8	1,44,000	0.926	1,33,344
2	2,00,000	0.7	1,40,000	0.857	1,19,980
3	2,00,000	0.5	1,00,000	0.794	79,400
					3,32,724
Less: Initial investment					3,40,000
Net present value					(7,276)

Statement showing the Net Present Value of Project Y

Year-end	Cash flow (a)	C.E. (b)	Adjusted Cash flow (c) = (a) × (b)	Present value factor at 8% (d)	Total present value (e) = (c) × (d)
1	1,80,000	0.9	1,62,000	0.926	1,50,012
2	1,80,000	0.8	1,44,000	0.857	1,23,408
3	2,00,000	0.7	1,40,000	0.794	1,11,160
					3,84,580
Less: Initial investment					3,30,000
Net present value					54,580

Decision: Since the net present value of project Y is positive, the project Y should be accepted.

(ii) Since the certainty-equivalent (C.E.) Co-efficient of project X is lower than project Y, the project X is riskier than project Y. Therefore, if risk adjusted discount rate method is used the project X would be analyzed with a higher rate.

10. Consider the following September end option quotations on Nifty

Strike price (E)	Put	Call
4000	80	280
4100	130	140
4400	250	100

Design:-

- Non Volatile Butterfly Spread
- Volatile Butterfly Put Spread

SOLUTION:

(a) Non-Volatile Butterfly Spread (+, 2-, +)

- (1) Put (P^+ , $2P^-$, P^+): P^+ at E = 4000, Premium Outflow = 80
 $2P^-$ at E = 4200, Premium Outflow = $2 \times 130 = 260$
 P^+ at E = 4400, Premium Outflow = 250

Therefore, Net Outflow = $250 + 80 - 260 = 70$

Therefore, Maximum Loss = 70

Maximum Profit = $200 - 70 = 130$

- (2) Call (C^+ , $2C^-$, C^+): C^+ at E = 4000, Premium Outflow = 280
 $2C^-$ at E = 4200, Premium Outflow = $2 \times 140 = 280$
 C^+ at E = 4400, Premium Outflow = 100

Therefore, Net Outflow = $280 + 100 - 280 = 100$

Therefore, Maximum Loss = 100

Maximum Profit = $200 - 100 = 100$

(b) Volatile Butterfly Put Spread (P^- , $2P^+$, P^-)

We have P^- at E = 4000, Premium Outflow = 80

$2P^+$ at E = 4200, Premium Outflow = $2 \times 130 = 260$

P^- at E = 4400, Premium Outflow = 250

Therefore, Net Outflow = $250 + 80 - 260 = 70$

Therefore, Maximum Loss = 70

Maximum Profit = $200 - 70 = 130$

Profile

	(a) (i)	P^+ at	$2P^-$ at	P^- at		
S	4000	4200	4400	Total Pay-off	Initial Inflow	Profit
3800	200	(600)	600	0	70	(70)
4000	0	(400)	400	0	70	(70)
4035	0	(330)	365	35	70	(35)
4070	0	(260)	330	70	70	0
4200	0	0	200	200	70	130
4330	0	0	70	70	70	0
4375	0	0	25	25	70	(45)
4400	0	0	0	0	70	(70)
4500	0	0	0	0	70	(70)

(ii)

(a) C^+ at $2C^-$ at C^+ at

<u>S</u>	<u>4000</u>	<u>4200</u>	<u>4400</u>	<u>Total Pay-off</u>	<u>Initial Inflow</u>	<u>Profit</u>
3800	200	(600)	600	0	70	(70)
4000	0	(400)	400	0	70	(70)
4050	0	(330)	365	35	70	(35)
4100	0	(260)	330	70	70	0
4200	0	0	200	200	70	130
4250	0	0	70	70	70	0
4300	0	0	25	25	70	(45)
4350	0	0	0	0	70	(70)
4400	0	0	0	0	70	(70)
4500	0	0	0	0	70	(70)

11. Brain Ltd. is considering whether to set up a division in order to manufacture a new product, the Agni. The following statement has been prepared, showing the projected “profitability” per unit of the new product:

Selling price		Rs.22
Material(3kg @ Rs.1.5/kg)	Rs. 4.50	
Labor (2 hours @ Rs.2.5/hour)	Rs. 5.00	
Overheads	<u>Rs. 11.50</u>	<u>Rs.21</u>
Profit/unit		Rs.1

A feasibility study, recently undertaken at a cost of Rs.50,000, suggests that a selling price of Rs.22/unit should be set. At this, price it is expected that 10000 units would be sold each year. Demand for the product is expected to cease after 5 years. Direct labor and materials cost would be incurred only for the duration of the product life.

Overheads per unit have been calculated as follows:	Rs.
Variable Overheads	2.50
Rent (see a note below)	0.80
Manager’s Salary(See note b)	0.70
Depreciation (See note c)	5.00
Head Office (See note d)	<u>2.50</u>
	<u>11.50</u>

Notes:

- Agni would be manufactured in a factory rented specially for the purpose. Annual rental be Rs. 8000 payable only for as long as the factory was occupied.
- A manager would be employed to supervise production of Agnis at a salary of rs. 7000 p.a. The manager is at present employed by the company but is due to retire in the near future on an annual pension of Rs. 2000. If he continued to be employed his pension would not be paid during the period of employment. His subsequent pension rights would not be affected.
- Manufacture of the Agni would require a specialized machine costing Rs. 2,50,000. The machine would be capable of producing Agni for an indefinite period, although due to its specialized nature it would not have any resale value or scrap value when the production of Agni ceased. It is the policy of Brain Ltd. to provide depreciation on all fixed assets using the straight line

method. The annual charge of Rs. 50000 for the new machine is based on a life of 5 years, equal to the period during which Agnis are expected to be produced.

- d) Brain Ltd. allocates its head office fixed costs to all products at the rate of Rs. 1.25/direct labour hour. Total head office fixed costs would not be affected by the introduction of the Agni to the company's range of products.

The required return of Brain Ltd. for all new projects is estimated at 5% p.a. in real terms, and you may assume that all costs and prices given above will remain constant in real terms. All cash flows would arise at the end of each year and are certain, with the exception of those relating to product life, annual sales volume and material cost per Agni. Required:

- Prepare NPV calculations, based on the estimates provided, to show whether Brain Ltd. should proceed with manufacture of the Agni?
- Prepare a statement showing how sensitive the NPV of manufacturing Agnis is to errors of estimation in each of the three factors:
Product life, Annual sales volume, and Material cost per Agni?

SOLUTION:

- (a) Selling price = Rs. 22
Variable cost = Rs.12
(Mat, Lab & V.O/H)

∴ Costs/unit = Rs. 10
Annual dd = 10000
Annual contrn = 100,000
Incremental Relevant Fixed Cost = 8000 + 5000
= 13000

Annual C.F = 87000
Life = 5 yrs
Disc. Rate = 5 %
PVIFA (5% ,5) = 4.3295
I.Inv. = 250000
∴ Expected NPV = 87000 * 4.3295 - 250000
= 126664.

- (b) The NPV model is given by -

$$NPV = [(14.5 - M)Q - 13000] PVIFA (5\% , n) - 250000$$

Sensitivity of NPV w.r.t M

∴ Q = 10000 and n = 5 yrs.
∴ NPV = [(14.5) - M)10000-13000] 4.3295-250000 = 0
∴ M = 7.43

as compared to the expected value of 4.50.

$$\text{So, Margin of safety} = \frac{7.43-4.50}{4.50} * 100 = 65.11\%$$

Sensitivity of NPV w.r.t Q

∴ M = 4.50 and n=5 yrs.

$$\therefore NPV = [(14.50 - 4.50) Q - 13000] * 4.3295 - 250000 = 0$$

$$\therefore Q = 7074 \text{ units}$$

as compared to the expected value of 10000 units .

$$\therefore MOS = \frac{10000 - 7074}{10000} * 100 = 29.26\%$$

Sensitivity of NPV w.r.t n

$$\therefore M = 4.50 \text{ and } Q = 5 \text{ } 10000 \text{ units.}$$

$$\therefore NPV = 87000 * PVIFA (5\%, n) - 250000 = 0$$

$$\therefore PVIFA (5\%, n) = 2.8736$$

$$\begin{array}{rcl} \frac{n}{3} & & \frac{PVIFA \text{ (on LHS)}}{2.7232} \\ 4 & & 3.5460 \\ \frac{n-3}{4-3} & = & \frac{2.8736 - 2.7232}{3.5460 - 2.7232} \end{array}$$

$$\therefore n = 3.18 \text{ yrs}$$

as compared to the expected life of 5 yrs.

$$\text{So, MOS} = \frac{5 - 3.18}{5} * 100 = 36.40\%$$

Hence, the sensitivity Analysis Report is shown below :

Factor MOS

Q	29.26%
n	36.40%
M	65.11%

12. Est Corporation is considering a merger with the Reebok Company. Reebok is a publicly traded company, and its current beta is 1.10. Reebok has barely been profitable, so it has paid only 20% in taxes over the last several years. Additionally, Reebok uses little debt, having a market value debt ratio of just 25%. If the acquisition is made, Est plans to operate Reebok as a separate, wholly owned subsidiary. Est would pay taxes on a consolidation basis, and thus the tax rate would increase to 40%. Additionally, Est would increase the debt capitalization in the Reebok subsidiary to a market value of 40% of assets. Est's acquisition department estimates that Reebok, if acquired, would generate the following net flows to Est's shareholders:

Year	Net Cash Flow
1	Rs. 12,00,000
2	Rs. 14,00,000
3	Rs. 16,50,000
4	Rs. 18,00,000
5 and beyond	Constant growth @ 5%

These cash flows include all acquisition effects. The current risk-free rate is 5.6% and the expected return on the market is 12%.

- What rate should be used to discount the given cash flows?
- What is the rupee value of Reebok to Est?
- Reebok has 12,00,000 common share outstanding. What is the maximum price per share the Est should offer to Reebok? If the tender offer is accepted at this price, what would happen to Est's stock price?

SOLUTION:

$$\begin{aligned}
 \text{a. } \beta_L &= 1.10[1 + (1 - 0.4)(0.4 / 0.6)] = 1.54 \\
 K_e &= 5.6\% + 1.54(12\% - 5.6\%) = 15.45\% \\
 TV &= \frac{Rs.18,00,000(1.05)}{0.1545 - 0.05} = Rs. 1,80,86,124 = Rs. 1,98,68,124 \\
 \text{b. } CF_1 &= Rs. 12,00,000 \\
 CF_2 &= Rs. 14,00,000 \\
 CF_3 &= Rs. 16,50,000 \\
 CF_4 &= Rs. 18,00,000 \\
 I &= 15.45\% \\
 PV \text{ of CF} &= 10,39,411 + 10,50,365 + 10,72,265 + 1,11,83,587 \\
 &= Rs. 1,43,45,628 \\
 \text{c. Maximum offering price} & \\
 = & Rs. 1,43,45,628 / 12,00,000 = Rs. 11.95
 \end{aligned}$$

13. NEXT PAGE

You own an unused Gold mine that will cost Rs. 10,00,000 to reopen. If you open the mine, you expect to be able to extract 1,000 ounces of Gold a year for each of three years. After that the deposit will be exhausted. The Gold price is currently Rs. 5,000 an ounce, and each year the price is equally likely to rise or fall by Rs. 500 from its level at the start of year. The extraction cost is Rs.4,600 an ounce and the discount rate is 10 per cent.

Required:

- (a) Should you open the mine now or delay one year in the hope of a rise in the Gold price?
- (b) What difference would it make to your decision if you could costlessly (but irreversibly) shut down the mine at any stage? Show the value of abandonment option. (20 marks)

Answer

- (a) (i) Assume we open the mine now at $t = 0$. Taking into account the distribution of possible future price of gold over the next three years, we have

$$\begin{aligned}
 NPV &= - \text{Rs. } 10,00,000 + \frac{1,000 \times [0.5 \times 5,500 + 0.5 \times 4,500] - 4,600}{1.10} \\
 &\quad + \frac{1,000 \times [(0.5)^2 (6,000 + 5,000 + 5,000 + 4,000) - 4,600]}{(1.10)^2} \\
 &\quad + \frac{1,000 \times [(0.5)^3 (6,500 + 5,500 + 5,500 + 4,500 + 4,500 + 5,500 + 4,500 + 3,500) - 4,600]}{(1.10)^3} \\
 &= - \text{Rs. } 5,260
 \end{aligned}$$

Because the NPV is negative, we should not open the mine at $t = 0$. It does not make sense to open the mine at any price less than or equal to Rs. 5,000 per ounce.

- (ii) Assume that we delay one year until $t = 1$, and open the mine if the price is Rs. 5,500.

At that point :

$$NPV = - \text{Rs. } 10,00,000 + \sum_{t=1}^3 \frac{(1,000) \times (5,500 - 4,600)}{(1.10)^t} = \text{Rs. } 12,38,167$$

If the price at t_1 reaches Rs. 5,500, then expected price for all future periods is Rs. 5,500.

NPV at t_0 = Rs. 12,38,167/1.10 = Rs. 11,25,606

If the price rises to Rs. 5,500 at $t = 1$, we should open the mine at that time.

The expected NPV of this strategy is:

$$(0.50 \times \text{Rs. } 11,25,606) + (0.50 \times 0) = \text{Rs. } 5,62,803$$

As already stated mine should not be opened if the price is less than or equal to Rs. 5,000 per ounce.

If the price at t_1 reaches Rs. 4,500, then expected price for all future periods is Rs. 4,500. In that situation we should not open the mine.

14.

ABC Ltd. Sells computer services to its clients. The company has recently completed a feasibility study and decided to acquire an additional computer, the details of which are as follows:

- (1) The purchase price of the computer is Rs.2,30,000; maintenance, property taxes and insurance will be Rs.20,000 per year. The additional expenses to operate the computer are estimated at Rs.80,000. If the computer is rented from the owner, the annual rent will be Rs.85,000, plus 5% of annual billings. The rent is due on the last day of each year.*
- (2) Due to competitive conditions, the company feels that it will be necessary to replace the computer at the end of three years with a more advanced model. Its resale value is estimated at Rs.1,10,000.*
- (3) The corporate income tax rate is 50% and the straight line method of depreciation is followed.*
- (4) The estimated annual billing for the services of the new computer will be Rs.2,20,000 during the first year, and Rs.2,60,000 during the subsequent two years.*
- (5) If the computer is purchased, the company will borrow to finance the purchase from a bank with interest at 16% per annum. The interest will be paid regularly, and the principal will be returned in one lump sum at the end of the year 3.*

Should the company purchase the computer or lease it? Assume (i) cost of capital as 12%, (ii) straight line method of depreciation, (iii) salvage value of Rs.1,10,000 and evaluate the proposal from the point of view of lessor also.

(20 Marks)

SOLUTION:

Alternative 1

1. Evaluation of ABC Ltd's position under buying option considered.

Cost of Capital 12% as per question.

$$\text{Depreciation p.a.} = \frac{2,30,000 - 1,10,000}{3} = 40,000$$

<i>Particulars</i>	<i>Y</i>	<i>E</i>	<i>A</i>	<i>R</i>
	1	2	3	NPV
Recurrent Cash Flow				
Service Charges Receivable	2,20,000	2,60,000	2,60,000	
Tax, Insurance etc	(-)20,000	(-)20,000	(-)20,000	
Cost of operation	(-)80,000	(-)80,000	(-)80,000	
Depreciation	(-)40,000	(-)40,000	(-)40,000	
Interest on Loan @ 16%	(-)36,800	(-)36,800	(-)36,800	
Incremental PBT	43,200	83,200	83,200	
Corporate tax @ 50%	(-)21,600	(-)41,600	(-)41,600	
Incremental PAT	21,600	41,600	41,600	
Depreciation added back	40,000	40,000	40,000	
Incremental recurrent cash flow	61,600	81,600	81,600	
Terminal Cash Flow				
Repayment of Loan			(-)2,30,000	
Disposal of the computer			1,10,000	
Cash flows of buying option	61,600	81,600	38,400	
Discounting factors @ 12%	*0.893	*0.797	*0.712	
NPV of buying option	55,009	65,035	27,341	92,703

2. Evaluation of ABC Ltd's position under leasing option.

<i>Particulars</i>	<i>Y</i>	<i>E</i>	<i>A</i>	<i>R</i>
	<i>1</i>	<i>2</i>	<i>3</i>	<i>NPV</i>
Service Charges Receivable	2,20,000	2,60,000	2,60,000	
Cost of operation	(-)80,000	(-)80,000	(-)80,000	
Lease Rent	(-)96,000	(-)98,000	(-)98,000	
Incremental PBT	44,000	82,000	82,000	
Corporate tax @ 50%	(-)22,000	(-)41,000	(-)41,000	
	22,000	41,000	41,000	
Discounting factor @ 12%	*0.893	*0.797	*0.712	
NPV of Leasing option	19,646	32,677	29,192	81,515
Higher NPV under buying option				11,188

In view of above buying option is recommended

Note:

1. Maintenance and particularly insurance are to be paid by the owner. So, cash outflow of Rs.10,000 = Rs.20,000* (1 - 0.5) is not considered under leasing option.
2. Cash flows on account of Service Charges Receivable and Cost of Operation of the computer are common to both of the alternatives. These could therefore, have been eliminated. The NPV's of the options will change but the net NPV of Rs.11,188 will be the same. Full credit should be given for such answers also.

Evaluation from the lessor's point of view

The lessor is also supposed to buy the computer under the same terms of financing. His position is analysed below:

	<i>Y</i>	<i>E</i>	<i>A</i>	<i>R</i>
<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>NPV</i>
Lease Rental	96,000	98,000	98,000	
Taxes & Insurance – being the owner, will be borne by the lessor	(-)20,000	(-)20,000	(-)20,000	
Loan Interest	(-)36,800	(-)36,800	(-)36,800	
Depreciation	(-)40,000	(-)40,000	(-)40,000	
Incremental PBT	(-)800	1,200	1,200	
Corporate tax	400	(-)600	(-)600	
(Assuming that the less will get adjusted with other profits for leasing out other assets)	(-)400	600	600	
Depreciation added back	40,000	40,000	40,000	
	39,600	40,600	40,600	
Terminal Disposal			1,10,000	
Repayment of Loan			(-)2,30,000	
Cash Flow	39,600	40,600	79,400	
Discount factor @ 16 (1- 0.5)% = 8%	*0.926	*0.857	*0.794	
NPV of leasing	36,670	36,670	(-)63,044	8,420

The NPV being positive, the proposal would be acceptable to the lessor also.

Alternative answer

	<i>Y</i>	<i>E</i>	<i>A</i>	<i>R</i>
<i>Particulars</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>NPV</i>
Lease Rental	96,000	98,000	98,000	
Taxes & Insurance – being the owner, will be borne by the lessor	(-)20,000	(-)20,000	(-)20,000	
Loan Interest	(-)36,800	(-)36,800	(-)36,800	
Depreciation	(-)40,000	(-)40,000	(-)40,000	
Incremental PBT	(-)800	1,200	1,200	

Corporate Tax @50%		(-) 200	(-) 600	
PAT	(-) 800	1,000	600	
Depreciation added back	40,000	40,000	40,000	
			40,600	
			(-) 1,20,000	
	39,200	41,000	(-) 79,400	
	*0.926	*0.857	*0.794	
	36,299	35,137	(-) 63,044	8,392

In view of the positive NPV , the proposal should be accepted by lessor.

Alternative 2

Evaluation from the point of view of lessee. The lessee has two alternatives: (i) To acquire the computer out of borrowed funds, and (ii) To acquire the computer on lease basis. The financial implications of these two options can be evaluated as follows:

Option I: To acquire computer out of borrowed funds. In this case, the company has to pay interest @ 16% annually and repayment of loan at the end of 3rd year. However, the salvage value of Rs.1,10,000 will be available to it. The information can be presented as follows:

Year	Interest	Depreciation	Expenses	Tax Shield (5)=50% of (2+3+4)	Cash outflows	PVF (8%)	PV (Rs.)
(1)	(2)	(3)	(4)	(5)	6=(2+4-5)		
1.	Rs.36,800	Rs.40,000	Rs.20,000	Rs.48,400	Rs.8,400	.926	7,778
2.	36,800	40,000	20,000	48,400	8,400	.857	7,199
3.	36,800	40,000	20,000	48,400	8,400	.794	6,670
4.	Repayment – Savage (2,30,000 – 1,10,000)				Rs.1,20,000	.794	95,280
	Present Value of Outflows						1,16,927

Option II: To acquire the Computer on lease basis: In this case, the Company will be required to pay an annual lease rent of Rs.85,000 + 5% of annual billing at the end of year. The financial implications can be evaluated as follows:

Year	Rental	5% of Billing	Tax Shield	Cash Outflow	PV (8%)	{PV}
	(1)	(2)	(3)= (50% of 1+2)	(4)= (1+2+3)		
1	Rs.85,000	Rs.11,000	Rs.48,000	Rs.48,000	.926	Rs.44,448
2	85,000	13,000	49,000	49,000	.857	41,993
3	85,000	13,000	49,000	49,000	.794	38,906
	Present Value of Outflows					1,25,347

As the PV of outflows is less in case of buying option, the Company should borrow funds to buyout the computer.

Note: It may be noted that the additional expenses of Rs.80,000 to operate the computer have not been considered in the above calculation. These expenses are required in both the options and are considered to be irrelevant to decide between lease or buy.

Evaluation from the point of view of lessor:

	<i>Year 1</i>	<i>Year 2</i>	<i>Year 3</i>
Lease Rental	85,000	85,000	85,000
5% of Billing	11,000	13,000	13,000
Total Income	96,000	98,000	98,000
Less: Maintenance Expenses	20,000	20,000	20,000
Depreciation	40,000	40,000	40,000
Income before tax	36,000	38,000	38,000
Tax @ 50%	18,000	19,000	19,000
Net Income after Tax	18,000	19,000	19,000
Depreciation added back	40,000	40,000	40,000
Cash Inflow (Annual)	58,000	59,000	59,000
Scrap Value	-	-	1,10,000
	58,000	59,000	1,69,000
PVF (12%)	.893	.797	.712
Present Value	51,794	47,023	1,20,328
Total Present Value			2,19,145
Less: Initial Cost			2,30,000
Net Present Value			<u>-10,855</u>

As the NPV for the lessor is negative, he may not accept the proposal.