

INTEREST RATE RISK MANAGEMENT

IMPORTANT QUESTIONS

CLASS WORK QUESTIONS

Question 1:

- i. The difference in yield curve may due to the lower credit rating of ABC Ltd. compared to XYZ Ltd.
- ii. DEF Bank will fix interest rate for 2V3 FRA after 2 years as follows:

XYZ Ltd.

$$(1+r) (1+0.0420)^2 = (1+0.0448)^3$$

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$$r = 5.04\%$$

Bank will quote 5.04% for a 2V3 FRA.

ABC Ltd.

$$(1+r) (1+0.0548)^2 = (1+0.0578)^3$$

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$$r = 6.38\%$$

Bank will quote 6.38% for a 2V3 FRA.

- iii. Interest payable by XYZ Ltd. under two scenarios will be computed as follows:

		4.50% - Allow to Lapse	5.50%- Exercise
Interest	₹ 100 crores X 4.50%	₹ 4.50 crores	-
	₹ 100 crores X 5.04%*	-	₹ 5.04 crores
Premium (Cost of Option)	₹ 100 crores X 0.1%	₹ 0.10 crores	₹ 0.10 crores
		<u>4.60 crores</u>	<u>5.14 crores</u>

* Since after 2 years 1 year interest rate turned out to be 5.50%, it will be beneficial for XYZ Ltd. to exercise its option.

Question 2:

- i. TM will make a profit of 25 basis points since a 6X9 FRA is a contract on 3 -month interest rate in 6 months, which turns out to be 5.50% (higher than FRA price).
- ii. The settlement amount shall be calculated by using the following formula:

$$\frac{N(RR - FR)(dtm / 360)}{1 + RR(dt / 360)}$$

- iii. Where N = Notional Principal Amount RR = Reference Rate FR = Agreed upon Forward Rate Dtm = FRA period specified in days.

Accordingly:

$$\frac{100 \text{ crore } (5.50\% - 5.25\%)(92^*/360)}{1 + 0.055(92^*/360)} = \text{Rs. } 6,30,032$$

Hence there is profit of Rs. 6,30,032 to TM Fincorp.

* Alternatively, it can also be taken as 90 days.

Question 3:

a.

i. Since firm is a borrower it will like to off-set interest cost by profit on Future Contract. Accordingly, if interest rate rises it will gain hence it should sell interest rate futures.

$$\begin{aligned} \text{No. of Contracts} &= \frac{\text{Amount of Borrowing}}{\text{Contract Size}} \times \frac{\text{Duration of Loan}}{3 \text{ months}} \\ &= \frac{\text{£ } 25,000,000}{\text{£ } 50,000} \times \frac{6}{3} = 1000 \text{ Contracts} \end{aligned}$$

ii. The final outcome in the given two scenarios shall be as follows:

	If the interest rate turns out to be 4.5%	If the interest rate turns out to be 6.5%
<i>Future Course Action :</i>		
Sell to open	94.15	94.15
Buy to close	95.50 (100 - 4.5)	93.50 (100 - 6.5)
Loss/ (Gain)	1.35%	(0.65%)
Cash Payment (Receipt) for Future Settlement	£ 50,000 × 1000 × 1.35% × 3/12 = £1,68,750	£ 50,000 × 1000 × 0.65% × 3/12 = (£81,250)
Interest for 6 months on £50 million at actual rates	£ 25 million × 4.5% × ½ = £ 5,62,500	£ 25 million × 6.5% × ½ = £ 8,12,500
	£ 7,31,250	£ 7,31,250

Thus, the firm locked itself in interest rate = $\frac{\text{£ } 7,31,250}{\text{£ } 25,000,000} \times 100 \times \frac{12}{6} = 5.85\%$

b. No, the interest cost shall not be less for Espaceplc had it taken the route of FRA, as the 3 x 9 FRA contract are available at 5.64% – 5.94% i.e. borrowing rate of 5.94%. Hence, the interest cost under this option shall be nearby by 5.94% which is more than interest rate under Future contract rate of 5.85%.

Question 6:

i. Semi-annual fixed payment

$$= (N) (AIC) (\text{Period})$$

Where N = Notional Principal amount = ₹5,00,000

AIC = All-in-cost = 8% = 0.08

$$= 5,00,000 \times 0.08 \left(\frac{180}{360} \right)$$

$$= 5,00,000 \times 0.08 (0.5)$$

$$= 5,00,000 \times 0.04 = ₹20,000/-$$

ii. Floating Rate Payment

$$= N (\text{LIBOR}) \left(\frac{dt}{360} \right)$$

$$= 5,00,000 \times 0.06 \times \frac{181}{360}$$

$$= 5,00,000 \times 0.06 (0.503) \text{ or } 5,00,000 \times 0.06 (0.502777)$$

$$= 5,00,000 \times 0.03018 \text{ or } 5,00,000 \times 0.030166 = ₹15,090 \text{ or } 15,083$$

iii. Net Amount

$$= (i) - (ii)$$

$$= ₹20,000 - ₹15,090 = ₹4,910$$

$$\text{or } = ₹20,000 - ₹15,083 = ₹4,917$$

Question 7:

i. The given swap arrangement is Plain Vanilla Overnight Index Swap (OIS).

ii. To compute the Net Settlement amount we shall compute Interest as per floating rate as follows:

Day	Principal (₹)	MIBOR (%)	Interest (₹)
Tuesday	10,00,00,000	8.15	22,329
Wednesday	10,00,22,329	7.98	21,868
Thursday	10,00,44,197	7.95	21,790
Friday	10,00,65,987	8.12	22,261
Saturday & Sunday (*)	10,00,88,248	8.15	44,697
Monday	10,01,32,945	7.75	21,261
Total Interest @ Floating Rate (A)			1,54,206
Total Interest @ Fixed Rate (B)			1,53,425
	$10,00,00,000 \times 8.00\% \times \frac{7}{365}$		
Net Settlement Amount Paid			781

Question 11:

The borrowing situation and comparative benefit is as follows:

Firm	Objective	Available Fixed Interest	Available Floating Interest	Comparative in advantage
APCO	Fixed Rate	9%	LIBOR + 0.75%	Floating Rate
PATCO	Floating Rate	8%	LIBOR + 0.25%	Fixed Rate
Absolute advantage of PATCO		1%	0.5%	

Thus, we can see that while PATCO Ltd. has absolute advantage in both fixed and floating markets, APCO has comparative advantage in the floating market. So, the advantage to both the parties will be 50 bp(0.75% - 0.25%) and that both share the benefit equally, without paying any intermediary commission. Hence APCO will borrow at floating rate and PATCO will borrow at fixed rate.

APCO will borrow fund from floating rate market at LIBOR + 0.75% and will lend that to PATCO at LIBOR. PATCO will borrow fund from the fixed rate market at 8% and will lend that to APCO at same 8%.

The net costs of funds to both the parties will be :

Firm	Paid to counter party	Received from counter party	Paid to the market	Net Cost	Savings
APCO	8%	LIBOR	LIBOR+0.75%	8.75%	9% – 8.75% = 0.25%
PATCO	LIBOR	8%	8%	LIBOR	LIBOR+0.25%– (LIBOR)=0.25%

Question 13:

Principal amount = \$25 million

Interest rate on fixed leg = 8%

Interest rate on floating leg = LIBOR

Present market quote for three year swap = 6% v/s LIBOR

In order to cancel the deal on April 01,2005 (after settling payments), the present value of future cash flows would have to be paid. The discount rate applicable should be the current rate of interest in the market i.e. 6% p.a. or 3% for six months.

Present value of amount to be paid as per the original contract = 1

Value of Fixed leg of interest = \$26.3543 million

Value of Floating leg of interest = \$25 million (as the interest is just paid)

Value of swap to CavinCally = 25 – 26.3543 = -\$1.3543million

This amount is to be paid by the company to the bank.

Question 15:

- i. ABC Bank pays LIBOR + 0.25% p.a. for 5 years. The swap involves payment of 7.5% p.a. and receipt of LIBOR.

In flow	Out flow
LIBOR	LIBOR + 0.25% + 7.5%
Net interest payment	7.75%

Cash flows per six month period

In flow	Out flow
(LIBOR/2) x ₹200 million	(LIBOR/2) x ₹200 million + ₹2,50,000 + ₹ 75,00,000

Therefore All in cost of funds = ₹ 77,50,000.

Alternatively it can also be calculated as follows:

$$₹ 200 \text{ million} \times 7.75\% \times \frac{6}{12} = ₹ 7.75 \text{ million or } ₹ 77,50,000$$

- ii. ABC Bank issues hybrid and enters both the five year and three year swaps.

First three years:

Bank pays on hybrid	7.5% p.a.
Bank pays on five year swap	7.5% p.a.
Bank receives on three year swap	8% p.a.
Bank receives on five year swap	LIBOR
Bank pays on three year swap	LIBOR
Net interest payment	7% p.a.

Final two years:

Bank pays on hybrid	LIBOR – 0.25%
Bank received on five year swap	LIBOR
Bank pays on five year swap	7.5% p.a.
Net interest payment	7.25% p.a.

Therefore the arrangement in (b) compared to (a) saves 0.75 p.a. over the first three years and 0.5% p.a. over final two years.

HOME WORK QUESTION

Question 1:

i. 3 Months Interest rate is 4.50% & 6 Months Interest rate is 5% p.a.

Future Value 6 Months from now is a product of Future Value 3 Months now & 3 Months Future Value from after 3 Months.

$$(1+0.05 \times 6/12) = (1+0.045 \times 3/12) \times (1+i_{3,6} \times 3/12)$$

$$i_{3,6} = [(1+0.05 \times 6/12) / (1+0.045 \times 3/12) - 1] \times 12/3$$

i.e. 5.44% p.a.

ii. 6 Months Interest rate is 5% p.a & 12 Month interest rate is 6.5% p.a.

Future value 12 month from now is a product of Future value 6 Months from now and 6 Months Future value from after 6 Months.

$$(1+0.065) = (1+0.05 \times 6/12) \times (1+i_{6,6} \times 6/12)$$

$$i_{6,6} = [(1+0.065/1.025) - 1] \times 12/6$$

6 Months forward 6 month rate is 7.80% p.a.

The Bank is quoting 6/12 USD FRA at 6.50 – 6.75%

Therefore, there is an arbitrage Opportunity of earning interest @ 7.80% p.a. & Paying @ 6.75%

Borrow for 6 months, buy an FRA & invest for 12 months

To get \$ 1.065 at the end of 12 months for \$ 1 invested today

To pay \$ 1.060[#] at the end of 12 months for every \$ 1 Borrowed today

Net gain \$ 0.005 i.e. risk less profit for every \$ borrowed

$$\#(1+0.05/2) (1+0.0675/2) = (1.05959) \text{ say } 1.060$$

Question 7:

Opportunity gain of A Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to B. Inc in \$ 2,00,000 x 9% = \$18,000 Converted into (\$18,000 x ¥120)		¥21,60,000	
Interest to be received from B. Inc in \$ converted into ¥ (6% x \$2,00,000 x ¥120)	¥14,40,000	-	
Interest payable on ¥ loan	-	¥12,00,000	
	¥14,40,000	¥33,60,000	
Net Payment	¥19,20,000	-	
	¥33,60,000	¥33,60,000	

\$ equivalent paid ¥19,20,000 x(1/¥120)			\$16,000
Interest payable without swap in \$			\$18,000
Opportunity gain in \$			\$ 2,000

Opportunity gain of B Inc under currency swap	Receipt	Payment	Net
Interest to be remitted to A. Inc in (\$ 2,00,000 x 6%)		\$12,000	
Interest to be received from A. Inc in ¥ converted into \$ =¥21,60,000/¥120	\$18,000		
Interest payable on \$ loan@10%	-	\$20,000	
	\$18,000	\$32,000	
Net Payment	\$14,000	-	
	\$32,000	\$32,000	
¥ equivalent paid \$14,000 X ¥120			¥16,80,000
Interest payable without swap in ¥ (\$2,00,000X ¥ 120 X 8%)			¥19,20,000
Opportunity gain in ¥			¥ 2,40,000

Question 8:

Here, White Ltd. has absolute advantage in floating rate market and Black Ltd. has absolute advantage in fixed rate market.

So, White Ltd. will borrow in floating rate market and Black Ltd. will borrow in fixed rate market and then both will swap their borrowing with the help of bank acting as an intermediary.

The total quality spread available

$$= (5\% - 4\%) + [(LIBOR + 0.75\%) - (LIBOR + 0.25\%)]$$

$$= 1\% + 0.50\%$$

$$= 1.50\%$$

Out of this total quality spread 0.20% will be the benefit to the bank. So the remaining quality spread

$$\text{available to both the companies} = (1.50\% - 0.20\%) = 1.30\%$$

$$\text{So, the benefit of swap to White Ltd.} = 1.30\%/2 = 0.65\%$$

$$\text{And the benefit of swap to White Ltd.} = 1.30\%/2 = 0.65\%$$

White Ltd. will borrow fund from floating rate market at LIBOR + 0.25% and will lend that to Bank at LIBOR + 0.25%. It will also borrow funds from bank at the fixed rate of 4.35% p.a. Black will borrow fund from the fixed rate market at 4% and will lend that to Bank at same at 4.25% and borrow funds from bank at the floating rate of LIBOR + 0.35%.

The net costs of funds to both the parties will be :

Firm	Paid to Bank	Received from Bank	Paid to the market	Net Cost	Savings
White Ltd.	4.35%	LIBOR+0.25%	LIBOR+0.25%	4.35%	5%4.35%= 0.65%

Black Ltd.	LIBOR+0.35%	4.25%	4%	LIBOR+0.10%	(LIBOR+ 0.75%)– (LIBOR+ 0.10%)= 0.65%.
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For Bank:

- Received from White Ltd. = 4.35%
- Paid to White Ltd. = LIBOR + 0.25%
- Received from Black Ltd. = LIBOR + 0.35%
- Paid to Black Ltd. = 4.25%.

So, effective rate received

$$= 4.35\% + \text{LIBOR} + 0.35\% - 4.25\% - \text{LIBOR} - 0.25\% = 0.20\%.$$

Question 9:

- i. Let the fixed rate to be received by the bank be 'R', and the notional principal be 'P'.

At the first payment date, the fixed payment is = $P \times R \times (90/360)$

The present value of the fixed leg we can get by multiplying ($P \times R$) by the discounting factor we can get from the LIBOR term structure.

Term	Rate	Discounting factor
90 days	7.00%	$1/(1 + .07(90/360)) = 0.9828$
180 days	7.25%	$1/(1 + .0725(180/360)) = 0.9650$
270 days	7.45%	$1/(1 + .0745(270/360)) = 0.9471$
360 days	7.55%	$1/(1 + .0755(360/360)) = 0.9298$

The present value of fixed leg = $P \times R \times 0.25 (0.9828 + 0.9650 + 0.9471 + 0.9298) = P \times R \times 0.9562$

We know that on the date when interest rate is reset, the bond sells at par value. Hence, at time 0, the present value of floating rate payments is the notional principal, P. But, given that there is no principal payment the present value of principal repayment to be subtracted.

So, present value of floating payments is = $P - P \times 0.9298 = P \times 0.0702$

Now value of the swap at inception should be zero, hence we will equate present value of fixed payments and present value of floating payments.

$$P \times R \times 0.9562 = P \times 0.0702 \quad \text{or, } R = 7.34\%$$

- ii. The first net payment is based on a fixed rate of 7.34 percent and a floating rate of 7 percent:

Fixed payment: $\$10,000,000(.0734)(90/360) = \$183,500$

Floating payment: $\$10,000,000(.07)(90/360) = \$175,000$

The net is that the party paying fixed makes a payment of \$8,500.