Please note that these illustrative problems contain some currencies that are out of currency (pun intended) and the exchange rates are also out of sync with current market rates. These problems are for explanation of the principles only.

**Class workout problems in INTEREST RATE AND CURRENCY SWAPS**

**Problem 1**

Two companies A & B have identical dollar borrowing requirements. A prefers floating

rate funding and B fixed rate funding. The interest rates applicable to A & B are as given below.

**Floating Fixed**

A LIBOR + 0.5% 10%

B LIBOR + 1.5% 12%

Explain how they can use an interest rate swap profitably.

**Solution**

A has an absolute advantage of 1% in the floating rate and comparative advantage of 2% in the fixed rate markets.

If A accesses the fixed rate markets and B the floating rate markets, the net advantage for A & B will be 2% - 1%. Let us assume that the benefit of 1% is shared equally between A & B. Then the deal can be structured as explained below.

10.0%

Party

B

Party

A

LIBOR

Libor+1.5%

10%

Effective cost of funding for A = 10.0% + LIBOR - 10.0% = LIBOR

Effective cost of funding for B = (LIBOR+1.5%) – LIBOR + 10% = 11.5%

Note that A has borrowed fixed rate funds but has successfully converted repayment into a floating rate liability. B has done exactly the reverse.

**Problem 2**

In the above problem, assume that an intermediary is needed to structure the deal. The intermediary wants a spread of 0.2%. Explain how the deal can be structured, assuming again that the net benefit is shared equally between A & B.

**Solution**

The deal can be structured as indicated below.

Net cost of funding for A = 10 + LIBOR + 0.5% - 10.4% = LIBOR + 0.1%

Net cost of funding for B = 10.5% + LIBOR + 1.5% - (LIBOR + 0.4%) = 11.6%

Benefit to intermediary = - (LIBOR + 0.4 + 10.4) + (LIBOR + 0.5% + 10.5%)=0.2%

**Problem 3 (Group Project)**

A corporate has a target Debt to Equity ratio (D/E) of 2 : 1. For a new project, the company plans to use Rs 30 lakhs of own funds. Its current Profit after Tax is Rs 18 lakhs and Return on Equity (ROE) 20%. The company would like to maintain its current ROE. The tax rate applicable to the company is 50%. It is expected that the project will generate additional EBIT of Rs 18 lakhs every year. Explain how the company can use an interest 18 lakhs every year. Explain how the company can use an interest rate swap to achieve its target ROE and D/E given the following.

Fixed rate Floating rate

Corporate 10.5% LIBOR + 2%

Bank 8.0% LIBOR + 1%

**Solution**

Let PBT denote Profit before Tax, PAT denote Profit after Tax, D denote Debt, E denote Equity, i denote interest rate

Additional debt which the company can raise is (2) (30) = Rs 60 lakhs (Using Debt Equity ratio)

Current Profit before tax = 18/0.5 = Rs 36 lakhs. (PBT = PAT / (1-Tax rate)

PBT after the loan has been raised = 36 + 18 - 60i (Existing PBT + (New EBIT – New Interest)

Total PAT = Old PAT + New PAT = (54 - 60I) (0.5) (Total PBT)(Tax rate)

ROE = PAT/E (ratio definition)

So before the loan is raised, E = PAT/ROE = 18/0.2 = Rs 90 lakhs.

After the loan is raised, its new Equity will be Rs.90 lakhs + Rs.30 lakhs = Rs.120 lakhs

Since new ROE has to be at least equal to 20%, ie preferably ROE > 20%

Ie., (54 - 60i) (0.5) / (120) > 0.20

So i < 10%.

The company thus has to ensure that its cost of borrowing is less than 10%. As it is likely to prefer fixed rate loan which is available only at 10.5%, the company would have to explore the possibility of a swap.

The bank has an absolute advantage in both markets and relative advantage of of 2.5% in fixed rate markets. Thus, by entering into a swap agreement with the bank which in all probability would be in need of floating rate funds, the cost of borrowing can be reduced. The net advantage if the bank accesses the fixed rate and the corporate the floating rate markets is 2.5% - 1% = 1.5%. Let us assume that the benefit can be shared equally. In that case, the deal can be structured as given below.

8%

Corporate

Bank

LIBOR + 0.25%

LOBOR + 2%

8%

Cost of funds for corporate = LIBOR + 2% - (LIBOR + .25%) + 8% = 9.75%

Cost of funds for Bank = 8% - 8% + LIBOR + 0.25% = LIBOR + 0.25%

**Problem 4 (“Homework”)**

Two companies A & B face the following borrowing rates.

Dollars Sterlings

A 7.0% 10.6%

B 9.0% 11.0%

A wants to borrow in sterlings and B prefers to borrow in $. Assuming the exchange rate is $1.5/£ explain how a currency swap can be structured.

**Solution**

In this case, the absolute advantage rests with A with comparative advantage in Dollar market. A the party with the higher credit rating is in dollar borrowing. If A borrows in $ and B in sterlings, the net total advantage = (9.0% - 7.0%) - (11.0% - 10.6%) = 1.6%. Let us assume that this benefit will be shared equally between A & B. Further, A and B will have to borrow in the ratio of 1.5 :1. That is, if A borrows $ 1.5 million, B will borrow £1 million. At the beginning of the swap, A will give B $ 1.5 million and in turn receive £ 1 million from B.

During the tenure of the loans, A will pay B sterling interest at the rate of 10.6%. It will pay dollar interest at the rate of 7% to its lender. A will also receive dollar interest at the rate of 7.8% from B.

As far as B is concerned, it will pay sterling interest at the rate of 11% to its borrower. It will pay dollar interest at the rate of 7.8% to A. It will receive sterling interest at the rate of 10.6% from A.

By this arrangement, A can access a loan in $ but its interest liability is converted into sterlings. B raises a sterling loan but its interest liability is converted into dollars.

At the end of the swap, A will give B £ 1 million to enable it to repay the sterling loan. B will give A $1.5 million so that A can repay its dollar loan.

The swap can be depicted pictorially as shown below.

GBP, 10.6

Party A

Party B

GBP, 11

$, 7

$, 7.8%

Net interest outflow for A each year

= $ (0.07) (1.5) + £ (0.1060) (1) - $ (0.078) (1.5)

= £. 098 million (by applying the exchange rate of $1.5/£)

Net interest outflow for B each year

= $ (0.078) (1.50) + £ (0.11) (1) - £ (0.106) (1)

= $ .1230 million.

Without the swap arrangement, the costs would have been

A: (0.106) (1) = £ 0.106 million

B: (0.09) (1.5) = $ 0.135 million

Clearly, the swap has benefited both parties.

**Problem 5**

Company A wishes to borrow dollars and B yens. The interest rates applicable to A & B are as follows.

Yens Dollars

A 4.0% 8.5%

B 5.5% 9.0%

Spot rate is Y110/$. Explain how you can structure a currency swap.

**Solution**

Assume A wants to borrow $ 1 million. Then B can borrow approximately Yen 120

million. If A borrows in yens and B in $, both parties can benefit. The comparative advantage in that case = (5.5-4.0) - (9.0-8.5) = 1.0%.

The benefit, say, is shared equally between A & B. Then, the deal can be structured as follows.

$, 8.5%

Party A

Party B

Yen 4.5%

$ , 9%

Yen, 4%

A borrows Yen 120 million and B $ 1 million. They exchange the principal amounts.

A pays interest of Yen (0.040) (120) million to its lender.

A receives interest of Yen (0.045) (120) million from B.

A pays interest of $ (.085) (1) million to B.

Net cost = yen (.04) (120) - Yen (.045) (120) + $ (.085) (1)

= $ .08 million (applying exchange rate of Yen 120/$)

B pays interest of $ (.09) (1) million to its lender.

It receives interest of $ (0.085) (1) million from A.

It pays interest of Yen (0.045) (120) million to A.

Net cost = $ (0.09) (1) - $ (.085) (1) + Yen (.045) (120) = Yen 6 million.

At the end of the swap, A receives Yen 120 million from B and B receives $ 1 million from A. These amounts are used to repay the loans.

Hence, net savings as a result of the swap

for A : (0.085) (1) - 0.08 = $ 0.005 million = $5000.

for B : (.055) (120) - 6 = Yen 0.6 million = Yen 600,000.

**Problem 6 (Group Project)**

Moon Corporation, an US based company wants to raise fixed rate 10 year dollar funds. However, it finds that since its rating is not top quality, the spread that it has to pay over the top rated borrower is less in the continental market than in the U. S. market. It has thus decided to raise a Euro loan at 6.5%.

Sun Corporation, another US company, can raise funds in the US market at 11.5%. It can raise Euro funds in the continental market at 6%.

If Moon corporation raises funds from the US market it has to pay 1% premium over a top rated firm like Sun Corporation.

Now, Sun Corporation wants to swap in order to achieve Euro fixed liability while Moon corporation wants to achieve $ fixed liability.

You are a banker and you are required to structure a swap deal.

**Solution**

Moon Corp. Sun Corp.

Requirement Fixed $ liability Fixed DM liability

Cost of $ funding 12.5% 11.5%

Cost of DM funding 6.5% 6%

Sun Corporation has absolute advantage over Moon Corporation in both the markets and relative advantage over Moon in $ markets. Thus, Moon Corporation can raise fixed rate DM Loan from the continental market and Sun Corporation can raise funds from the US market in fixed rate $. Then they can enter into a Dollar - DM fixed-fixed swap. The swap is pictorially depicted below.

Assume that a swap bank will be needed to structure the deal and that the bank will need a spread of 0.1%.

$ 12.3%

DM 5.8%

Swap Bank

Sun

Moon

$ 11.5%

DM 6.5%

$ ,11.5%

DM 6.5%

As per the conditions of the swap, the relevant cash flows will be as follows:

i) Moon Corporation will pay interest in dollars @ 12.3% to the Swap bank and will receive interest in DM @ 6.5% from the Swap Bank.

ii) Sun Corporation will receive interest in $ @ 11.5% from the Swap Bank and will pay interest in DM @ 5.8% to the Swap Bank.

Cost of funds for Moon Corporation -- $12.3%

Cost of funds for Sun Corporation -- DM5.8%

Without the swap, the costs would have been $ 12.55 and DM 6% respectively.

**Problem 7 (“Practice Problem”)**

Rajesh Ltd is a leading manufacturer of steel in India. It would like to raise 5 year Debt amounting to Rs. 500 million from the capital market on floating rate basis. Rajesh Ltd is also in a position to raise funds at 5% above the 3 year fixed deposit interest of SBI due to its AAA rating. The spread demanded by the market between AAA and BBB rated companies is 2% in the fixed rate segment while it is only 1% in the floating rate segment.

Kavita Ltd is a BBB rated manufacturing firm, which wants to raise rupee funds for 5 years on fixed rate basis to finance its expansion project. It can borrow at a rate of 17%. Both parties have approached a merchant bank for assistance in structuring a suitable swap. The merchant banker, M/S Pankaj Merchant Banking Ltd would like to take a minimum spread of 0.25% in the deal. You are required to structure a suitable swap in which Kavitha Ltd and Rajesh Ltd will share the net benefit in the ratio of 2:1.

**Solution** Rajesh Ltd Kavitha Ltd

Requirement Floating Rate Rs. Fixed Rate Rs.

Cost fixed Rs. 15% 17%

Cost floating Rs. SBI 3 yrs FD rate+5% SBI 3 yrs FD rate + 6%

Rajesh Ltd has an absolute advantage over Kavita Ltd in both the markets and relative advantage in the fixed rate market. Each can achieve cost saving by borrowing in the market where it has a comparative advantage and then doing a fixed to floating interest rate swap.

The terms of the swap arranged by Pankaj Merchant Banking Ltd could be as follows.

1. Rajesh Ltd borrows Rs. 500 million at 15%.
2. Rajesh Ltd pays Pankaj Merchant Banking Ltd (SBI 3 years FD rate + 4.75%). Pankaj MBL passes (SBI 3 years FD rate + 5.25%) to Kavita Ltd.
3. Kavita Ltd borrows Rs. 500 million at (SBI 3 years FD rate + 6%)
4. Kavita Ltd pays the PMBL at 15.75%.

Cost to Rajesh Ltd > [15.00 + SBI + 4.75 - 15 ] = SBI + 4.75%

Cost to Kavita Ltd > [ 15.75 + (SBI + 6) - ( SBI + 5.25) ] = 16.5%

Margin to PMBL = [15.75% + SBI + 4.75 - 15 - SBI - 5.25 ] = 0.25%

15%

Kavita

Rajesh

15.75%

PMBL

SBI+5.25%

SBI+4.75%

SBI + 6%

15%

**Problem 11 (“Practice Problem”)**

An US firm ABC Inc has recently signed a MOU with the Government of India to set up a power project in Hyderabad. The company has estimated the cost of the project to be $100 million. The company has a debt/equity ratio of 1:1. The banker of the US firm has informed that it can finance the project at a spread of 50bp over LIBOR. If the company issues debentures it can raise funds at 30bp over 5 year treasury notes which are currently yielding 8.5%. The company wants to raise funds on fixed rate basis. Meanwhile, another company DEF Inc is planning to raise funds on a floating rate basis to the tune of $ 100 million. Given the current rating of DEF, it can raise funds either at 20bp over LIBOR or at 8.3% in the fixed rate bond market.

Show how a swap can be used to reduce the cost of funds for both companies.

**Solution**

ABC DEF

Requirement Fixed rate of funding Floating rate $ loan

Cost of fixed $ loan 8.8% 8.3%

Cost of floating $ loan LIBOR + 0.50% LIBOR + 0.20%

DEF has relative advantage over ABC in floating rate market and absolute advantage in both the markets. DEF should raise funds in fixed rate market and ABC should raise funds in the floating rate bond market. They can enter into a fixed - floating rate swap structured as indicated below.

Libor +0.5%

ABC

DEF

8.7%

8.3%

Libor + 0.5%

Cost of funds for ABC = (LIBOR + 0.5) + 8.7 - (LIBOR + 0.5)= 8.7%

Cost of funds for DEF = (LIBOR + 0.50 + 8.3) - 8.7= LIBOR + 0.10%

**Problem 12**

“A Bank” has entered into currency swap with “B Govt.” under the following conditions.

(a) The bank will pay 7% per annum in dollars every year.

(b) The bank will receive 4% per annum in yens every year.

(c) The principals involved would be $ 10 million and Yen 1200 million.

(d) The swap will last another 4 years.

If the currency exchange rate is Yen 120 / $, what is the value of the swap to the bank if a discount rate of 3% for Yens and 8% for dollars is considered to be appropriate.

**(Note : This problem could be made more complex with semi-annual payments of interest, instead of annual payments)**

# Solution

Interest payable is first calculated.

$ loan : (0.07) (10) = 0.7 million

Yen loan : (0.04) (1200) = 48 million

Present value of payments associated with the dollar loan =

.7 .7 .7 10.7

----- +------- + ------ + ------ = $9.67 million

1.08 (1.08)2 (1.08)3 (1.08)4

Present value of payments associated with the Yen loan

48 48 48 1200+48

=-------- + ------- + --------- + ------- = = Yen 1245 million

1.03 (1.03)2 (1.03)3 (1.03)4

= $ 1245 / 120 = $ 10.37 million

Present value of the swap to the bank = 10.37 - 9.67 = $ .70 million

**Problem 14 (“Practice Problem”)**

A, a leading bank would like to avail of a floating LIBOR denominated dollar loan. B, a manufacturing company prefers to access fixed rate dollar funds. C, a financial institution based in USA would like to avail of a floating prime rate denominated dollar loan. The cost of accessing funds in each market is indicated below.

--------------------------------------------------------------------------

Fixed Floating LIBOR Floating Prime

--------------------------------------------------------------------------

A 14% LIBOR + 0.5% P + 0.5%

B 13% LIBOR + 0.3% P + 0.75%

C 12% LIBOR + 0.4% P + 1.0%

--------------------------------------------------------------------------

Construct an equal benefit Swap.

**Solution**

Let A access funds in the floating prime market

Let B access funds in the floating LIBOR market

Let C access funds in the fixed rate market

Total cost of funds as a result of swap = P+0.5+LIBOR+0.3+12=P+LIBOR+12.8

Total cost of funds without swap = LIBOR+0.5+13+P+1.0 = LIBOR + p + 14.5

Total benefit = -(P + LIBOR + 12.8) + (LIBOR + P + 14.5) = 1.7%

Benefit to each party = 1.7 / 3 = 0.57%

The swap can be structured as follows :

P + 0.5

A

Libor + 0.3

P + 0.86

C

B

12.43

12

Libpr + .3%

Cost of funds for each party is computed below :

A : (P + 0.5) + (LIBOR + 0.30) - (P + 0.86) = LIBOR - 0.06

B : (LIBOR + 0.3) + (12.43) - (LIBOR + 0.3) = 12.43%

C : (P + 0.86) + (12) - (12.43) = P + 0.43%

**Problem 15 (Group Project)**

Three parties A, B, C need to borrow in different currencies. The cost of accessing funds in various currencies and the borrowing objectives are given below. The funds will be needed for a period of 12 months.

------------------------------------------------------------------------------------

A B C

Objective $ Fixed DM Fixed Yen Fixed

------------------------------------------------------------------------------------

$ Cost(%) 6.5 7.0 6.0

DM Cost(%) 3.0 3.5 4.0

Yen Cost(%) 2.0 1.0 1.5

------------------------------------------------------------------------------------

The spot rates prevailing are DM 1.8/$ and Yen 120/$. Construct an equal benefit triangular swap.

**Solution**

A currency swap involves exchange of both interest and principal. Further, the loan amounts have to synchronise roughly with the exchange rates prevailing.

Suppose A wants to borrow $1 million

B wants to borrow DM 1.8 million

C wants to borrow Yen 120 million

Without a swap, the total cost of funding would be = 6.5 + 3.5 + 1.5 = 11.5%

Suppose A borrows DM, B borrows Yen and C borrows $ based on the competitive

advantage they enjoy in their respective markets. The total cost of funding reduces to 6.0 + 3.0 + 1.0 = 10%

The net benefit as a result of the swap = 11.5 - 10 = 1.5%

This means that each party can benefit by 0.5%

The swap can be structured as follows :

DM, 3

A

DM, 3.5

$, 6.5

C

B

Yen, 1.5

Yen, 1

$, 6

A borrows DM 1.8 million @ 3% from the market and lends to B.

At the end of the swap, A receives DM 1.8 million and interest @3.5% from B.

B borrows Yen 120 million @1% from the market and lends to C.

At the end of the swap B receives Yen 120 million and interest @1.5% from C.

C borrows $1.0 million at 6% from the market and lends to A.

At the end of the swap, C receives $1.0 million and interest @6.5% from A.

We assume that interest is paid at the end of the tenure of the loan and that exchange rates move in line with interest parity. We also assume that the lowest cost of funds closely approximates LIBOR. Using interest parity we can now work out the forward rates.

One year DM/$ forward rate

(1 + 0.03)

= (1.8) ------------- = DM 1.7491 / $

(1 + 0.06)

One year Yen/$ forward rate

(1 + 0.01)

= (120) ------------- = Yen 114.34 / $

(1 + 0.06)

One year Yen/DM forward rate

114.34

= ----------- = Yen 65.37 / DM

1.7491

Cost of funds to each party at the end of the swap can be worked out as follows:

A : DM (1.8) (1.03) - DM (1.8) (1.035) + $ (1) (1.065)

= -DM 0.009 + $ 1.065 = - $ (0.009) / 1.7491 + $ 1.065

= $1.059855 million = $1, 059,855

B : Yen (120) (1.01) - Yen (120) (1.015) + DM (1.8) (1.035)

= - Yen 0.6 + DM 1.863 = - DM 0.6/65.37 + DM 1.863

= DM 1.853822 million = DM 1,853,822

C : $ (1.0) (1.06) - $ 91.0) (1.065) + Yen (120) (1.015)

= - $ 0.005 + Yen 121.8 = - Yen (0.005) (114.34) + Yen 121.8

= Yen 121.2283 million = Yen 121,228,300

The benefits arising from the swap are tabulated below :

------------------------------------------- --------------------------------------------

Outflow without Outflow with Benefit

swap swap

------------------------------------------- --------------------------------------------

A $ 1,065,000 $ 1,059,855 $ 5,145

B DM 1,863,000 DM 1,853,822 DM 9,178

C Yen 121,800,000 Yen 121,228,300 Yen 571,700

------------------------------------------- --------------------------------------------

**Problem 16 (“Practice Problem – after group Project”)**

Three companies A, B, C have the following borrowing objectives.

A : Fixed rate SF B : Fixed rate Yen C : Fixed rate DM

Cost of accessing funds in each market for A, B, C is given below.

A B C

SF 2.00 2.50 3.00

Yen 1.00 1.25 1.50

DM 3.50 4.50 5.50

Explain how a three way currency swap can be structured. Assume that the funds will be used for a year and the spot rates are DM 1.20 / SF and Yen 80 / SF.

**Solution**

In this problem, A has the lowest borrowing cost in all the markets and C the highest borrowing cost in all the currencies. However, a possibility for structuring a swap arises due to comparative advantage rather than an absolute advantage. Quite clearly A has a relative advantage in the DM market (1% vs. 0.5% and 0.25% in the other two markets over B) while it needs funding in a different currency, ie SF.

Similarly B has absolute advantage over C in the SF and Yen market and relative advantage in SF market (0.5% over 0.25%)

Assume the principal amount involved for A is SF 1 million. Then B can borrow approximately Yen 80 million and C DM 1.20 million.

Without swap, the total cost of funding = 2.00 + 1.25 + 5.50 = 8.75

With swap, the total cost of funding = 3.50 + 2.50 + 1.50 = 7.50

So the total benefit due to the swap is 1.25%

Let us assume that A by virtue of its relatively high credit rating wants a share of 0.75% while B and C are each happy with a benefit of 0.25%. The swap can then be structured as indicated below. (You can also assume any such ratios for sharing the benefit – for instance, it could be .6%, .4% and .25%)

To simplify, let us assume that the spot rates remain same after a year.

The swap can be structured as follows :

DM, 3.5

A

SF, 3.0

DM. 5.25

C

B

Yen, 1.5

Yen, 1.5

SF 2.5

A borrows DM 1.20 million @ 3.5% and transfers to C

A receives DM 1.20 million along with interest @ 5.25% from C

B borrows SF 1 million @ 2.5% and transfers to A

B receives SF 1 million along with interest @ 3.0% from A

C borrows Yen 80 million @ 1.50% and transfers to B

C receives Yen 80 million along with interest @ 1.50% from B

Then; net cash flows for A, B, C can be calculated as follows :

A : DM (1.2) (1.035) - DM (1.20) (1.0525) + SF (1) (1.03)

= - DM 0.021 + SF (1.03)

= - SF 0.021 / 1.2 + SF (1.03)

= SF 1.0125 million

B : SF (1.0) (1.025) - SF (1) (1.03) + Yen (80) (1.015)

= - Yen (0.005) (80) + Yen (81.20)

= Yen 80.8 million

C : Yen (80) (1.015) - Yen (80) (1.015) + DM (1.2) (1.0525) = DM 1.263 million

The benefit due to the swap can be tabulated below :

------------------------------------------------------------------------------------

Cash outflow Cash outflow with Net Benefit

without Swap Swap

------------------------------------------------------------------------------------

A SF 1.02 million SF 1.0125 million SF 7,500

B Yen 81 million Yen 80.8 million Yen 200,000

C DM 1.266 million DM 1.263 million DM 3,000

--------------------------------------------------------------------------------------