How to Design a plain vanilla Interest Rate Swap

An illustration of how to design a plain vanilla interest swap may best be illustrated by working through the following exercise taken from John Hull's book “Futures, Options and Other Derivatives”

Companies A and B each seek a $20M 5-year loan:

A would like to obtain a floating-rate loan because their CFO feels that interest rates are headed downwards and would like to benefit from any fall. They can borrow fixed at 12% and floating at LIBOR plus .1%. B prefers a fixed-rate loan since their CFO feels that they should lock in a fixed rate now since she feels that rates are headed upwards. B can borrow fixed at 13.4% and floating at LIBOR + .6%.

	Fixed	Floating
Company A	12%	LIBOR + 0.1%
Company B	13.4%	LIBOR + 0.6%

Design a swap that will net a bank, acting as intermediary, 0.1% per annum and that will appear equally attractive to both companies.

We can calculate the relative gains between the fixed and floating markets for A vs B and hence we have

$\Delta^{fix} = 13.4-12=1.4 \qquad \Delta^{fl} = (LIBOR + 0.6) – (LIBOR + 0.1)=0.5$

Comparative advantage gain = $\Delta^{fix} - \Delta^{fl} = 1.4 - 0.5=0.9.$

Thus we can see the following :

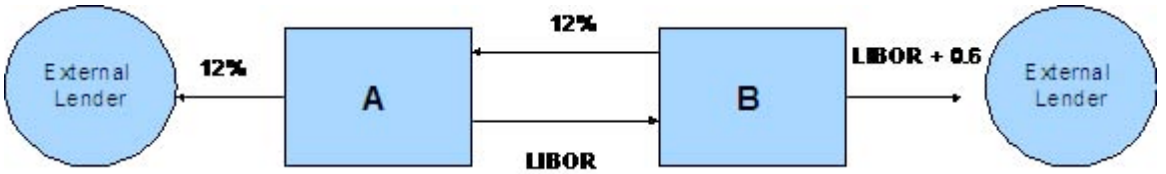
- A has a comparative advantage in both fixed and floating markets.
- A is more creditworthy than B.

We will consider 2 scenarios : i.) Without a financial intermediary ii.) With a financial intermediary Let us first consider the case with no financial intermediary.

In the first case we might construct a swap with payments as below:

Company A
- Pay 12% to outside lender
- Pay LIBOR to B
- Receive 12% from B

Hence net rate of borrowing = (LIBOR + 12) – 12 = LIBOR If A borrowed directly, i.e. w/o the swap, its rate would be LIBOR + 0.1% Hence A is better off by 0.1% for using the swap.



Company B

- Pay LIBOR + 0.6% to outside lender

- Pay 12% to A

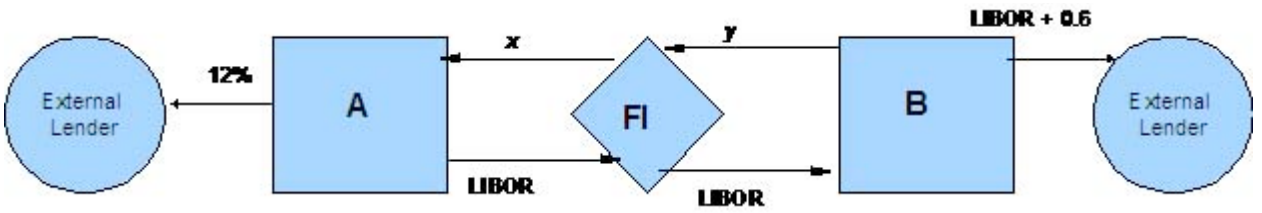
- Receive LIBOR from A

Hence net rate of borrowing = LIBOR + 0.6+12 - LIBOR= 12.6% If B borrowed directly, i.e. w/o the swap, its rate would be 13.4% Hence B is better off by 0.8% (=13.4-12.6) for using the swap. Thus we can see that in the simple case above, net gain = 0.9 as predicted above, but company A would be unhappy since B's gain is much higher.

We now consider the case with a financial intermediary.

In this case the design is not as simple. We have the following constraints:

- Net gain to financial intermediary is 0.1%. (i)
- Net gain to A must equal net gain to B since deal must be equally attractive to both companies.



We can construct a swap that is illustrated above. We need to find the values of *x* and *y* that will satisfy the constraints imposed.

From constraint (i), we have for FI that Cash Inflow – Cash Outflow = 0.1 => *(y+L)-(x+L)=0.1 => y-x=0.1*
(iii)

Gains from using Swap
We determine the net cash outflow, and hence gain from using swap over doing direct Gain (A) = Net cash outflow – Cost of direct floating rate loan for A = *[(L+12)-x] – [L+0.1]=11.9-x*

Gain (B) = Net cash outflow – Cost of direct fixed rate loan for B
= *[y+L+0.6-L]-13.4=y-12.8*

To satisfy (ii), we must have Gain (A) = Gain (B) => *11.9-x = y -12.8 => y+x = 24.7 (iv)*

We can then solve equations iii & iv simultaneously to get : *2x=24.8 => x=12.4 &*

y=12.3 Thus the swap payments will be as follows:

Company A
- Pay 12% to outside lender
- Pay LIBOR to FI
- Receive 12.3% from FI

Hence net rate of borrowing for A: R_A = 12 + LIBOR -12.3=LIBOR-0.3% which is a gain of 0.4% over borrowing directly without the swap.

Company B

- Pay LIBOR+0.6% to outside lender
- Pay 12.4% to FI
- Receive LIBOR from FI

Hence net rate of borrowing for B: R_B = LIBOR + 0.6+12.4-LIBOR = 13% which is a gain of 0.4% over borrowing directly without the swap.

Financial intermediary

- Pay *x=12.3%* to A
- Receive y = 12.4% from B
- Receive LIBOR from A
- Pay LIBOR to B Hence net gain = 12.4-12.3+LIBOR - LIBOR=0.1%