WORLD 3 / CHAPTER 4

FINANCIAL SWAPS

FINANCIAL SWAPS

Since the early 80s, the term "swap" is used not only for a special type of forward exchange deal (see chapter 3) but also for a series of other financial instruments: the financial swaps. In the meantime, financial swaps (often simply referred to as "swaps") have become one of the most important financial instruments in the financial market.

We differentiate between the following types of financial swaps:

- interest rate swaps
- currency swaps, cross currency swaps
- credit swaps and swaps of the second and third generation (which will not be discussed here)

The possible roles of banks in the swap business are explained in the following:

Public agent

The bank bokers a swap deal between two potential parties and supports them with its know-how during the negotiations of the contract. Legally, the bank is not involved in the contract and therefore does not take on any risk.

Anonymous agent

The bank takes the role of an intermediary between two parties ("A" and "C"). With both parties, the bank concludes a contract separately. Parties "A" and "C" do not enter a legal agreement. In this case, the risks of creditworthiness are taken over by the bank.

Active party

The swap is taken as an active position by the bank on its own risk, i.e. the bank takes on the credit risk as well as the market risk.

Counterparties

The two parties to a swap deal.

Fixed-rate payer

The fixed-rate payer of a swap is the party that pays a fix interest-rate. The fixed-rate payer is also called swap "buyer". The recipient of the fixed-rate interest is called fixed-rate receiver or swap "seller".

Floating-rate payer

The floating-rate payer of a swap is the party that pays a floating interest rate.

Principal

The principal is the amount of capital that is the basis for the calculation of the interest payments in a swap (usual principals lie between 10 and 100 Mio per deal; other amounts are possible, too).

Trading date

On the trading date, the two parties agree to make a swap deal.

Settlement date / effective date

On settlement date, the calculation of interest payments from the swap starts. Regarding the settlement date one differentiates between two types of swaps:

- **Spot swaps**: settlement date is usually two days after the trading date (exception is e.g. GBP: same-day settling)
- **Forward swaps**: settlement date is on a different date than the two days after trading date (exceptions: see above).

Maturity date

Maturity of a swap is the last day of its term.

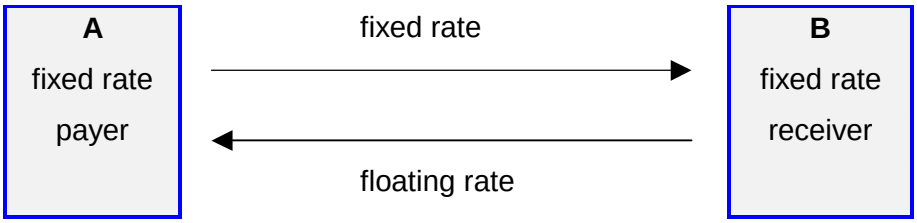
1. Interest rate swap (IRS)

An interest rate swap is a contract between two parties ("A" and "B") to exchange different, specified interest payments in the same currency during a term that is stated in the contract. The amount of the interest payment is calculated on the underlying principal and the interest rate of the respective interest period. The principal is not exchanged under an interest rate swap.

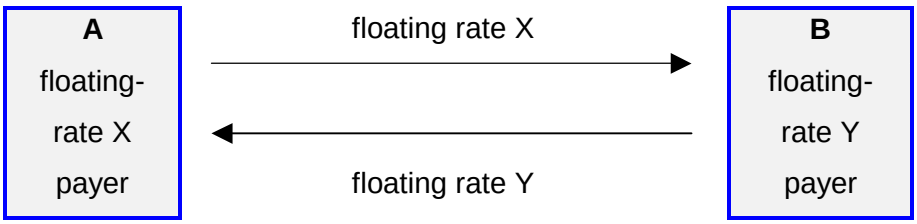
1.1. Terminology

Swaps can be differentiated with regard the types of interest payment

- **Coupon swap** (also called fixed-rate interest swap)
  Exchange of a fixed against a floating interest rate

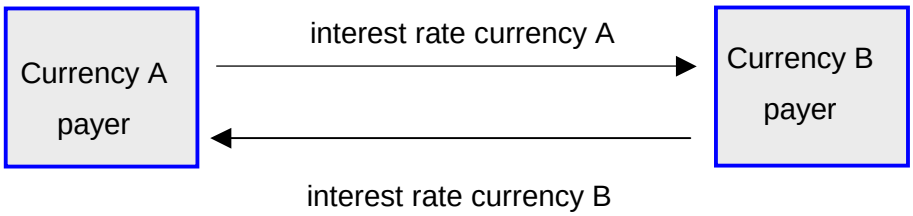


- **Basis swap**
  Exchange of two different, floating interest rates in the same currency.



- **Cross Currency Interest Rate Swap**

  Exchange of two interest rates in different currencies



Coupon swap

A coupon swap (also called fixed-rate interest swap, par swap, or plain vanilla swap) is a contract between two parties ("A" and "B") to exchange a fixed-rate interest payment for a floating-rate interest payment. It is calculated on the basis of a fixed principal for an agreed period of time.

Conventions

Example

We want to demonstrate the chronological steps of a spot swap with an example: A CHF fixed-rate interest swap with a term of 5 years and annual fixed-rate interest payments against 6-month CHF LIBOR.

Trading date: September 1st, 1997
Principal: CHF 100,000,000
Deal: 5 years fixed, 5.20 % annually
First LIBOR, fixed: 3.50 %

LIBOR	*Beginning of the*	*End of the*	*Interest payments*	
fixing of interest	interest period	interest period	floating	fixed
September 1st, 1997	September 3rd, 1997	March 3rd, 1998	3.50%	
February 27th, 1998	March 3rd, 1998	September 3rd, 1998	LIBOR	5.20 %
September 1st, 1998	September 3rd, 1998	March 3rd, 1999	LIBOR	-
March 1st, 1999	March 3rd, 1999	September 3rd, 1999	LIBOR	5.20 %
September 1st, 1999	September 3rd, 1999	March 3rd, 2000	LIBOR	-
March 1st, 2000	March 3rd, 2000	September 4th, 2000	LIBOR	5.20 %
August 31st, 2000	September 4th, 2000	March 5th, 2001	LIBOR	-
March 1st, 2001	March 5th, 2001	September 3rd, 2001	LIBOR	5.20 %
August 30th, 2001	September 3rd, 2001	March 4th, 2002	LIBOR	-
February 28th, 2002	March 4th, 2002	September 3rd, 2002	LIBOR	5.20 %

Quotation

Fixed-rate interest swaps are usually quoted as a fixed interest rate for the term on the basis of the reference rate (e.g. LIBOR) without spread, i.e. flat.
In the example above, the quotation of the 5-year CHF swap aginst the 6-month CHF LIBOR would be 5.20 %.

The quotation on the fixed-rate side can be done by a quotation of the interest rate (e.g. 5.20 %) or by a quotation of the spread to the current yield of (usually) government bonds (usually for USD).

Example

A market maker's quotation for a 5-year USD fixed-rate swap against 3-month USD LIBOR would be:

5.00 % – 5.05 %

The market maker is willing to pay a fixed interest rate of 5.00 % for the swap. As fixed-rate receiver, he demands 5.05 % from the counterparty. The market maker's quotation could also be the following:

5-years T bond + 20 / 25

In this case, the current yield of 5-year T-bonds had to be fixed first and then the quoted spread of 20 and 25 basis points is added. If we assume a current 5-year yield of 4.80 % the following rates would be effective

5.00 %	–	5.05 %
(4.80 % + 20 bp)		(4.80 % + 25 bp)

I. Floating-rate interest payments

Floating index

Usually the money market reference rate (LIBOR, EURIBOR, TIBOR), often a 3-month or 6-month index, but also individual solutions for each swap, i.e. 1-month, 12-month or other indices are also possible.

Reset date / fixing date

On fixing date, the interest rate is adjusted, i.e. the interest rate for the following interest period is fixed. Usually, the fixing of swap rates takes place 2 working days before the interest period starts (exceptions: GBP same-day fixing); but it is also possible to fix the swap rate during the term which is then valid for the running term (in arrears).

Interest period

The length of an interest period normally equals the floating rate index, i.e. with a swap against a 3-month LIBOR the floating interest period is 3 months (but also concerning the structuring of interest periods, swaps are usually quite flexible).

Frequency of payments

Usually, payments are due at the end of each interest period. (Exception: EONIA Swap).

Calculation of interest payments

Usually, the interest payments are calculated according to the currencies' money market conventions.

II. Fixed-rate interest payments

Fixed interest rate

The interest rate, agreed on the trading date, holds for the whole term of the swap.

Adjustment of interest rate

The interest rate is not adjusted.

Frequency of payments

The frequency of interest payments can be freely arranged(monthly, quarterly, six-monthly, annually, etc.). With EUR and CHF, annual payments are usual, with USD/GBP/JPY semi-annual payments are quite common.

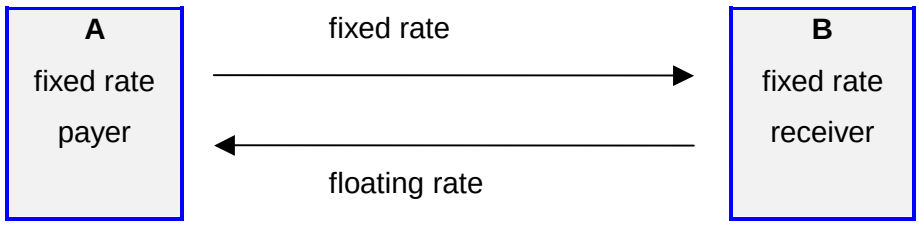
Calculation of interest payments

The calculation of interest payments is analogously to the practice on the respective capital markets.

Netting

If, in a swap, interest payments between the counterparties flow on the same dates, only the difference between the interest payments, i.e. the net amount, is exchanged.

Example



Trading date:	September 1st, 1997
Principal:	USD 100,000,000
Deal:	5 years fixed, 5.20 % annually
First LIBOR, fixed:	3.50 %

LIBOR	*beginning of the*	*end of the*	*interest payments*	
fixing of interest	Interest period	Interest period	floating	fixed
September 1st, 1997	September 3rd, 1997	March 3rd, 1998	3.50%	
February 27th, 1998	March 3rd, 1998	September 3rd, 1998	LIBOR	5.20 %
September 1st, 1998	September 3rd, 1998	March 3rd, 1999	LIBOR	-
•	•	•	•	•
•	•	•	•	•
•	•	•	•	•
February 28th, 2002	March 4th, 2002	September 3rd, 2002	LIBOR	5.20 %

on March 3rd, 1998 I) B pays A 3.5 % for the first 6 months

on September 3rd, 1998 I) B pays A LIBOR for the second 6 months
on September 3rd, 1998 II) A pays B 5.2 % for the first year

Cash flow on September, 3rd 1998: I) – II) = net cash flow
if I) < II) A pays the difference to B
if I) > II) B pays the difference to A

"Asset swap" and "liability swap"

The terms "asset swap" and "liability swap" are used according to the side of the balance sheet that is changed by the swap transaction:

From the investor's point of view, an **asset swap** is the swapping of a

- fixed interest rate investment into a floating rate investment(= fixed-rate payer swap)
- floating interest rate into a fixed rate investment (= fixed-rate receiver swap).

A liability swap works deals with the re-financing side of the balance. It is a swap that turns a

- fixed into a floating refinancing (= fixed-rate receiver swap)
- floating into a fixed refinancing (= fixed-rate payer swap).

1.2. Examples

a) Swap from floating into fixed refinancing

Example

Bank X has a floating refinancing in the market with the following conditions:

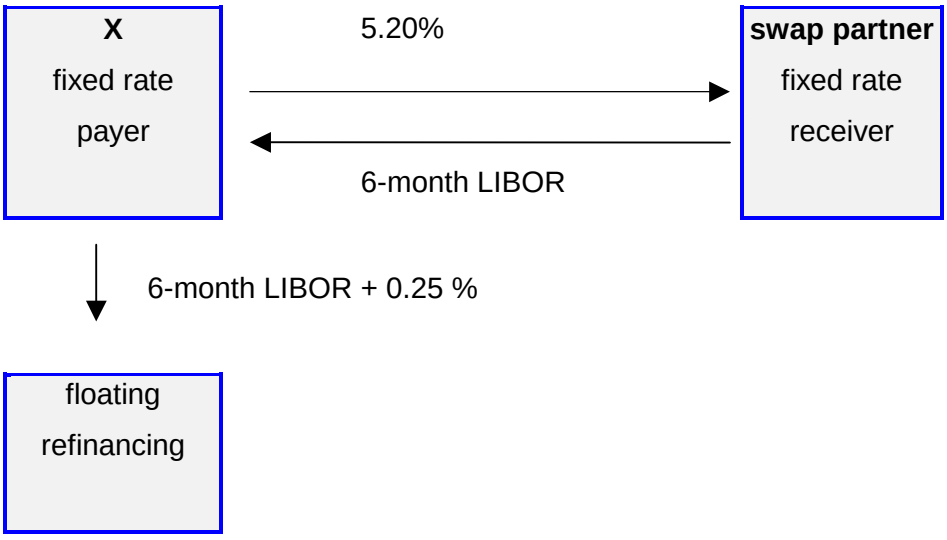
- term of 7 years at 6-months LIBOR + 0.25 %

The bank expects interest rates to rise in 2 years. It decides to swaps the floating rate into a fixed rate. This can be done by re-paying the current liabilities and simultaneously borrowing money at a fixed interest rate. An pre-mature repayment is not possible or would be unprofitable for the bank because of the high additional costs for the contract termination.

Therefore, X completes a fixed-rate interest swap for the rest of the term (5 years) at market conditions:

- 5-year term at 5.20 % for the 6-month LIBOR

(From X's point of view, this deal is a liability swap.)



Under the interest rate swap, the 6-month LIBOR is just like a running position:

- X pays 6-month LIBOR + 0.25 % for the floating refinancing.
- X receives 6-month LIBOR from the interest rate swap.

For X, the net interest payment from the two floating interest rates (0.25 %) remains. The fixed interest rate from the swap has to be added.

Ignoring the effects of compound interest (annual fixed interest rate in contrast to a 6-month LIBOR) and the different basis of interest (30 / 360 compared to ACT / 360), the effective costs are:

X pays 0.25 %
X pays 5.20 %
X pays 5.45 %

b) Swap from fixed to floating refinancing

Example

Bank X issued a fixed-rate interest bond 2 years ago:
fixed interest rate is 4.75 %, total term 7 years

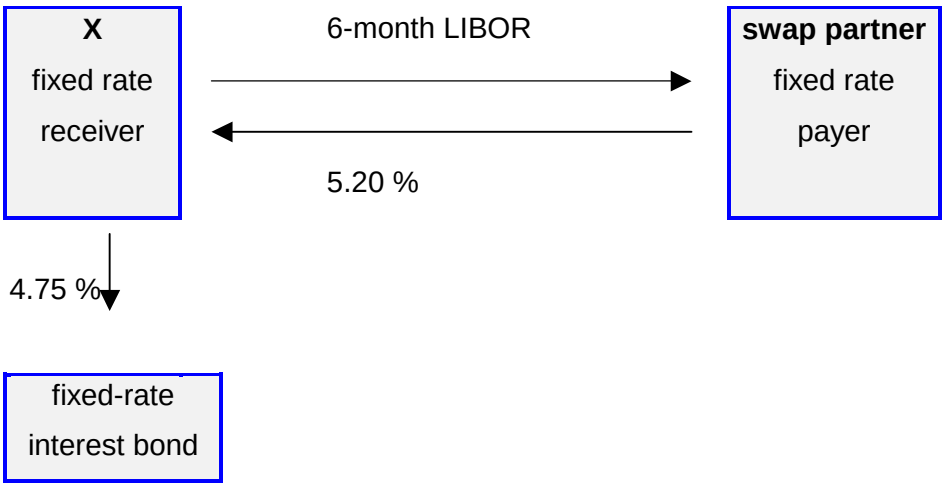
The bank decides to change the fixed-rate interest payment into a floating one, according to its expectations on the further development of interest rates.

This could be done by an additional floating refinancing and a fixed-rate interest investment. But this would lead to an unwanted extension of the balance sheet. Also, the costs of the spread between investment and refinancing must be taken into account. Because X wants to avoid these effects, the bank will use an interest rate swap (fixed-rate receiver swap).

Market conditions:

- 5-year term at 5.20 % for a 6-months LIBOR

(From X's point of view, this is a liability swap, because the swap will leads to a change on the liability side of the balance.)



X could turn the fixed interest payments into floating ones by completing the swap.

The following are the effective interest costs for X:

X pays	4.75 % for the fixed-rate interest bond
X receives	5.20 % from the interest rate swap
X receives	0.45 %

- X pays 6-month LIBOR for the interest rate swap.

Often, the difference between the interest rates (here: 0.45 %) is defined as the LIBOR spread. Ignoring compound interest and different basis of interest rates, X pays:

- 6-month LIBOR – 0.45 %

In this example, the change in the market interest rates leads to 6-month LIBOR – 0.45 %. In other cases, the cost of refinancing ("LIBOR – x") can be achieved by exploiting the of advantages of capital markets through swaps (see point 5).

c) Swap from floating into fixed investment (loan)

Example

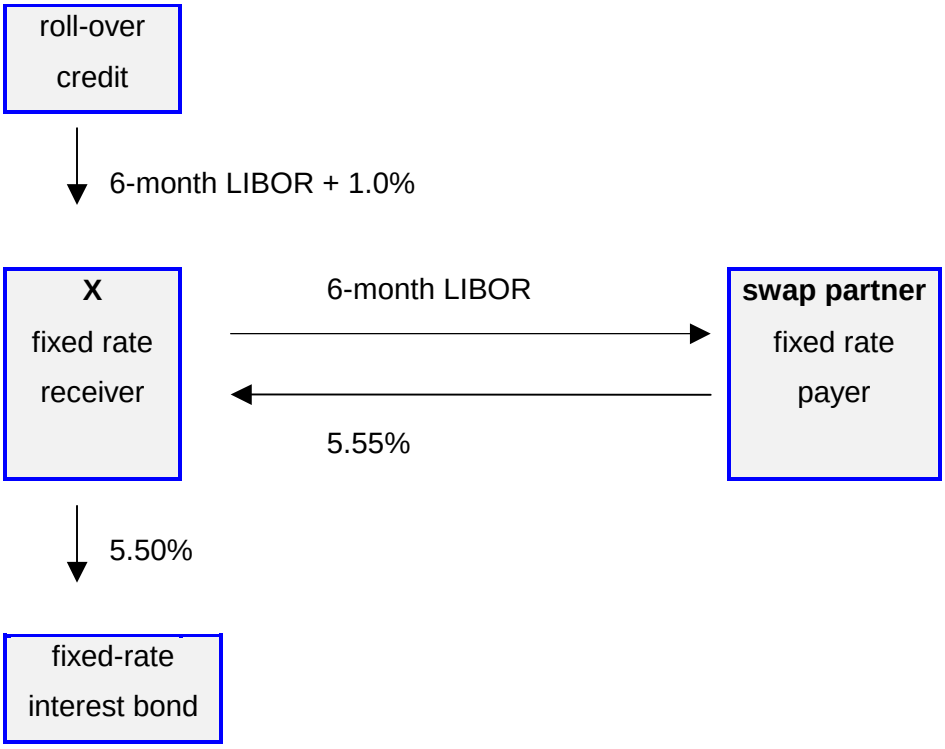
Bank X gives a roll-over credit (6-month LIBOR + 1 %, 7-year term) to a company. At the same time, the bank has the possibility to issue a fixed-rate interest bond at 5.50 % and a term of 7 years.

X wants to use the issue's liquidity for the credit but does not want to take on any interest rate risks. This cannot be achieved with the classic instruments of the balance sheet. By completing a fixed-rate receiver swap, X can use the issue's liquidity for the credit while simultaneously eliminating the interest rate risk.

In this case, a clear line between an asset swap and a liability swap cannot be drawn. In combination with the roll-over credit the deal is an asset swap while in conjunction with the issue the same swap is a liability swap.

X completes an interest rate swap:

- 5.55 % for 6-month LIBOR, 7-year term



Because X pays and receives interest payments on both the floating and fixed side, it has virtually eliminated the interest rate risk.
The net interest income of the whole deal is:

+ (6-month LIBOR + 1 %) – (6-month LIBOR)	= 1.00 %
– (5.50 %) + (5.55 %)	= 0.05 %
	= 1.05 %

(Ignoring arrangements for payments of fixed and floating rates of interest.)

d) Swap from fixed into floating investment

Example

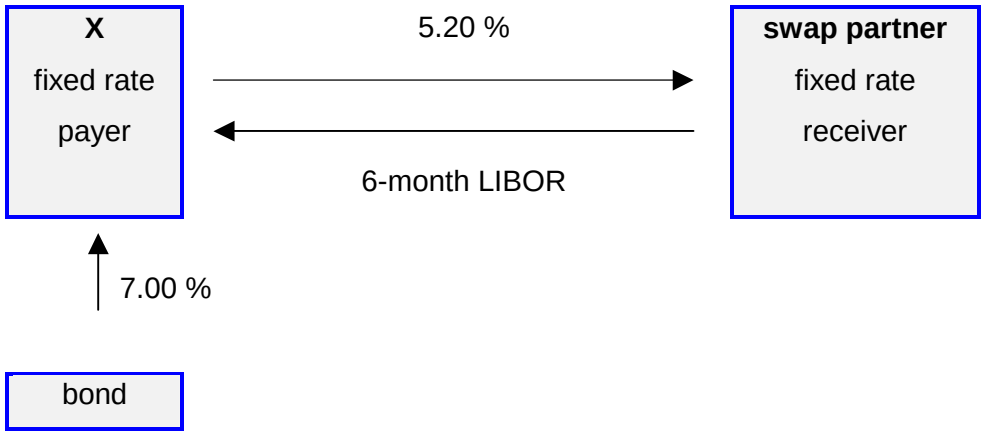
In times of high interest rates, X had completed a fixed-rate interest bond: 7.0 % fixed-rate interest bond, time to maturity: 5 years.

The bank assumes that the interest rates have already passed the trough and are going to rise again. The sale of the bond may not be possible for several reasons:

- The bond is part of the fixed assets and therefore cannot be sold.
- The market for this bond is not very liquid and the selling price is not attractive.
- The liquidity that results from the sale of the bond must be invested, and possible spreads and / or equity costs may occur.

X decides to go in for an asset swap: in this case a fixed-rate payer swap

- 5.20 % for 6-month LIBOR, 5-year term



By completing the swap, X can realise a net interest income of 1.80 % until maturity (assuming that the bank refinances at LIBOR + / – 0.0 %, i.e. LIBOR flat, for the whole term of the swap).

Note: The term "coupon" swap for a fixed-rate interest swap may result from the above application: The earnings of the coupons go(partly) into the interest rate swap.

e) Arbitrage on credits with interest rate swaps

Interest rate swaps are often used to exploit the so-called comparative advantage. This term was coined by David Ricardo, who in the 19th century, developed the theory of comparative advantage for the international exchange of goods. Applied to the financial market, the theory says that the exchange of different interest rates can be profitable for both parties if they encounter different conditions on the different markets. This is even true, if one of the parties has better conditions on both markets, i.e. has a lower fixed and floating interest rate.

Example

Assume, that company X has an AAA rating company Y has an A-rating. Company X needs a variable refinancing for 5 years and company Y needs a fixed refinancing for 5 years.

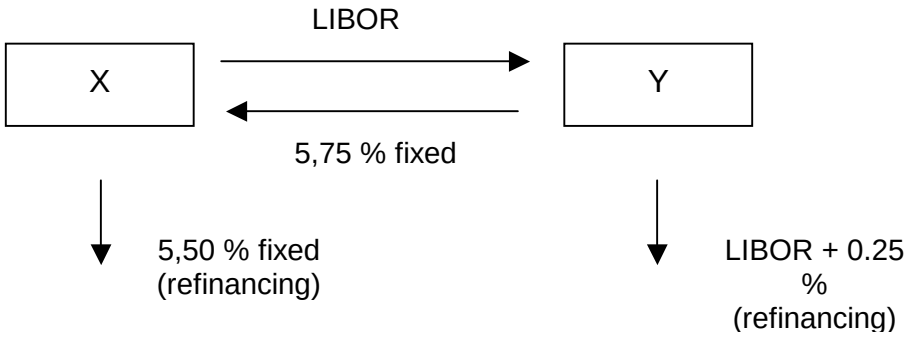
	company X	***company Y***
fixed interest rate	5.50 %	6.25 %
floating interest rate	LIBOR	LIBOR + 25 bp

If both companies refinance themselves according to their demand, the costs would be for:

Company X floating at LIBOR and for
Company Y fixed at 6.25 %.

Alternatively, both companies may choose the opposite refinancing; i.e. company X refinances itself at a fixed rate of 5.50 % while company Y chooses a floating rate of LIBOR + 25 bp. Simultaneously, they arrange an interest rate swap by which company X gets a fixed rate and pays LIBOR (vice versa for company Y).

Assuming a fixed interest rate of 5.75 %, the deal can be shown as this:



Results

From X's point of view:

X pays a fixed rate of 5.50 % for its refinancing and receives a fixed rate of 5.75 % from the swap: the profit on the fixed rate side is 0.25 %. Since X has to pay LIBOR, the total cost is LIBOR – 25 bp. This calculation takes the profit from the fixed side into account.

From Y's point of view:

Y pays a floating rate of LIBOR + 25 bp for its refinancing and receives a floating rate of LIBOR from the swap: the loss on the floating side 25 bp. Since Y faces a fixed interest rate payment of 5.75 %, it has locked in a fixed rate of 6.00 % (5.75% from the swap + 25 bp loss on the floating interest rate). Company Y could also reduce its refinancing costs by 25 bp (6.25 % to 6.00 %).

The total benefit from the interest rate swap is 0.50 % and is a result of the different market conditions for the companies in the markets. In the market for floating rates, the difference between the conditions is 0.25 % (X: LIBOR; Y: LIBOR + 0.25 %), in the market for fixed rates the difference is 0.75 % (X: 5.50 %; Y: 6.25 %). The total difference of 0.50 % (0.75 % – 0.25 %) is the comparative advantage that is realized in the swap deal.

Note: In order to speak of a real arbitrage, one had to compare interest rates in the capital market, i.e. the conditions for both contractors over the whole term, for fixed- and floating-rates. In practice, the possible interbank refinancing in the money market is often used as the basis for the floating interest rates.

In the situation above, this would mean from Y's point of view that the company has access to an interbank refinancing at LIBOR + 25 bp for the whole term. If the spread changes during the term, the basis for the calculation also changes.

1.3. EONIA swap

Like the classic swaps in the capital market, the EONIA swap (Euro Overnight Index Average Swap) was developed in Germany (as FIONA SWAP) to serve as part of the risk management in the money market.

Similar swaps already exist in other countries, USA (Fed funds swap). Especially for short-term interest rates, there was still a derivative missing with which interest rate risks could be reduced and the flexibility increased. This swap helps to vary the locked-in of interest rates on a short-term basis and to reduce the risk of varying overnight rates.

Principle

Just as with swaps in the capital market, a fixed interest rate is swapped against a floating interest rate; where one of the rates is paid and the other one is received. At the trading date, the fixed interest rate, the principal, and the length of the term are determined. The floating interest rate is calculated on the basis of the overnight rates that are determined by the EURIBOR fixing during the EONIA term. On the maturity date, a settlement payment is due, which is calculated by comparing the floating rate to the fixed rate in relation to the term and principal. However, the calculation of the floating interest rate of EONIA swaps is more complicated in comparison to the calculation in the capital market. It is not simply calculated as an average of the overnight rates but also takes into account the effects of compound interest. This effect is demonstrated in the following example:

Formula to calculate the floating rate

$$r = \left\{ \left[\prod_{i=d_1}^{d_e - 1} \left(1 + \frac{r_i \cdot D_i}{360} \right) \right] - 1 \right\} \cdot \frac{360}{D}$$

r = floating rate including effects of compound interest
d_1 = start date of the EONIA swap
d_e = maturity date
r_i = rate of overnight fixing (in per cent, divided by 100)
D_i = number of days for which r_i is valid (usually 1 day, weekends: 3 days)
D = days of EONIA swap's term

Example

Two parties (A and B) complete a swap with an underlying of EUR 250 Mio: "A" is receiver of the fixed-rate of 3.20 % for a term of 7 days (April 7th - 14th, 1999)

Assume the following overnight rates:

April 7th	3.125 %	(1 day)
April 8th	3.100 %	(1 day)
April 9th	3.150 %	(1 day)
April 10th	3.150 %	(1 day)
April 11th	3.125 %	(3 days)

Using the formula, we get

$$\left\{ \left[\left(1 + \frac{0{,}03125}{360} \right) \cdot \left(1 + \frac{0{,}031}{360} \right) \cdot \left(1 + \frac{0{,}0315}{360} \right) \cdot \left(1 + \frac{0{,}0315}{360} \right) \cdot \left(1 + \frac{0{,}03125 \cdot 3}{360} \right) \right] - 1 \right\} \cdot \frac{360}{7}$$

= 3.12911 %

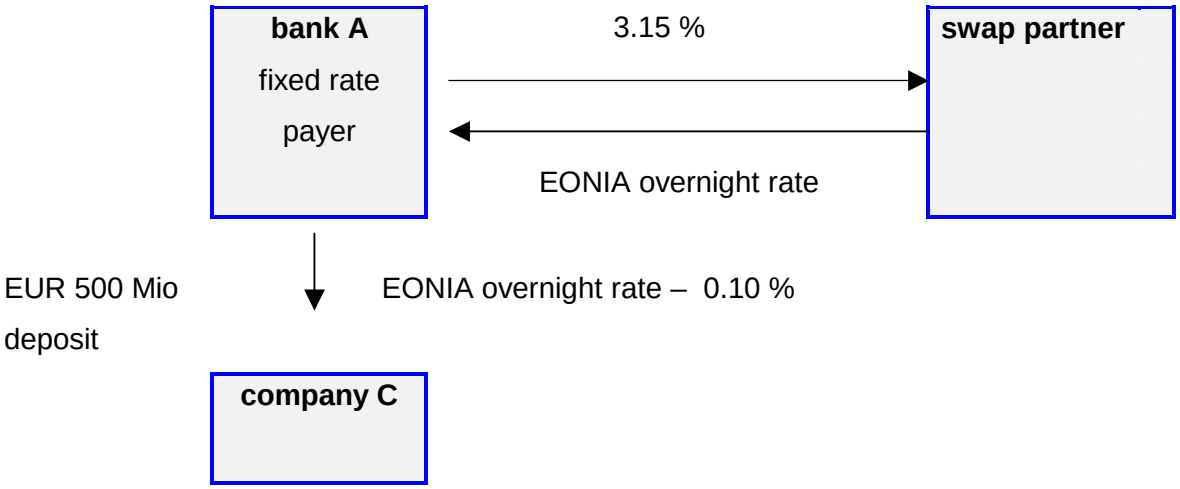
(Comparison: the arithmetic average = 3.12857)

Party A gets 3.20 % for 7 days on EUR 250 Mio, i.e. EUR 155,555.56. At the same time, A pays 3.12911 % for the same principal and the same term, i.e. EUR 152,108.51.
This means, A receives a settlement payment of EUR 3,446.05 from B, because only the difference between the two payments is exchanged (netting).

Example

Example

Company C has an overnight deposit at bank A of EUR 500 Mio at an interest rate that is pegged to the overnight rate(fixing rate is 0.10 %). The customer deposit will last for one week. The bank,, expecting rising overnight rates, enters a EONIA swap of EUR 500 Mio in which it pays 3.15 % for a week and receives the average overnight rate.



With the swap, bank A has hedged itself against paying higher overnight rates for the customer's deposit in the future. Now it has the deposit in its trading book at 3.05 %.
Since the bank receives the average overnight rate and pays 10 basis points below EONIA overnight rate, the interest rate is lower than the swap.

Furthermore, bank A must decide what to do with the money. The alternatives are: a loan in the overnight market at the expected higher interest rates or a loan for a week.

Specifications of the contract

- Money market swap with free setting of terms (2 days to 12 months)
- Start date usually two working days after trade date
- Date of payment is at maturity, but only the settlement payment is exchanged
- Overnight rate is determined by the EURIBOR fixing (telerate 22000), compound interest is included and the euromethod (ACT / 360) is used.
- Documentation is done according to ISDA treaty or German framework treaty.

1.4. Pricing and mark to market evaluation of interest rate swaps

As shown in the example of comparative advantage, a swap deal can be of advantage for both counterparties. You assume that the price was "fair" when the deal was settled.

But when can one speak of a "fair" price?

Assumption:
The market quote for a 5-year swap against 6-month LIBOR is

- 5.18 – 5.22 % p.a.

Therefore a swap settled at 5.20 % is fair. Neither party A nor B is in a better situation than its partner at the trading date. This means, that the present value of the swap is 0.

If the market price for a 5-year swap changes during the day due to changes in supply and demand, to 5.23 – 5.27 % p.a., the present value of a settled swap also changes.

One way to evaluate swaps at market interest rates(a "mark to market" evaluation), is to compare the variable cash-flows (floating rate payments) with fixed – rate payments.

To calculate any floating forward interest rates, the implied forward rates is used, i.e. FRAs that are calculated from the yield curve. In order to make cash flows of different times comparable, the present values of the cash flows are calculated. In contrast to bonds, the zero rate curve is used in the case of swaps.

evaluation of a newly entered interest rate swap
Specifications:

Type: fixed-rate interest payer swap
Principal: 100,000,000.00
Term: 5 years
Fixed interest rate:5.20 % (30E / 360)
floating index: 6-month LIBOR (ACT / 360), first rate is fixed at 3.125%

Assumptions for the calculation

- For all interest periods of floating interest rates, the implied FRA rate is calculated from the current yield curve (see 6)
- Each time interest is paid, only the net cash-flow is exchanged, i.e. the difference between the assumed floating interest rate and the fixed interest rate (see 8)
- In order to compare these net cash-flows one has to use the same basis: that is, the present-value (see 9)
- The present value (see evaluation) of the interest rate swap equals the sum of its cash-flows (see NPV); if the market value of the swap is 0 at the trading date, the price is called "fair", because the interest that has to be paid equals the interest that will be received.

DEM - IRS

HANDELSTAG	01.09.97	BANK	PAYER	STARTBETRAG	100.000.000,00			
BEWERTUNG	0,00	START	03.09.97	ERSTES FIXING	3,125	ACT / 360	6-MTS-DEM-LIBOR	
		ENDFÄLLIG	03.09.02	FESTZINS	-5,2	30 E / 360	p.a.	

	1 a)	1 b)	2)		3)	4)	5)	6)	7)	8)	9)
	DATE	DAY COUNT FLOAT	DAY COUNT FIX	RATE ACT / 360	RATE 30/360	df	IMPLIED FRA	NOTIONAL AMOUNT	FLOATING CASHFLOW	FIX CASHFLOW	NET CASHFLOW	DISCOUNTED NET CASHFLOW
t_0	03.09.97	s.a.	p.a.			1						
$t_{0,5}$	03.03.98	0,502777778		3,125	-	0,9845312	3,125	100.000.000,00	1.571.180,56	0,00	1.571.180,56	1.546.876,34
t_1	03.09.98	0,511111111	1	3,25479	3,3	0,9680542	3,33	100.000.000,00	1.702.076,75	-5.200.000,00	-3.497.923,25	-3.386.179,34
$t_{1,5}$	03.03.99	0,502777778				0,9472629	4,37	100.000.000,00	2.194.885,34	0,00	2.194.885,34	2.079.133,40
t_2	03.09.99	0,511111111	1	3,84658	3,9	0,9261269	4,47	100.000.000,00	2.282.186,27	-5.200.000,00	-2.917.813,73	-2.702.265,89
$t_{2,5}$	03.03.00	0,505555556				0,9009041	5,54	100.000.000,00	2.799.725,38	0,00	2.799.725,38	2.522.284,06
t_3	04.09.00	0,513888889	1,003	4,43437	4,5	0,8752655	5,70	100.000.000,00	2.929.237,12	-5.214.444,44	-2.285.207,33	-2.000.163,12
$t_{3,5}$	05.03.01	0,505555556				0,8495918	5,98	100.000.000,00	3.021.883,87	0,00	3.021.883,87	2.567.367,80
t_4	03.09.01	0,505555556	0,997	4,82957	4,9	0,8239181	6,16	100.000.000,00	3.116.047,20	-5.185.555,56	-2.069.508,36	-1.705.105,47
$t_{4,5}$	04.03.02	0,505555556				0,7985011	6,30	100.000.000,00	3.183.087,63	0,00	3.183.087,63	2.541.699,12
t_5	03.09.02	0,508333333	1	5,12596	5,2	0,7729445	6,50	100.000.000,00	3.306.401,04	-5.200.000,00	-1.893.598,96	-1.463.646,90
											NPV	0,00

1 a)	Tageberechnung: d_n	$(t_n - t_{n-0,5}) / 360$	Basis Act / 360
1 b)	Tageberechnung: d_n	$(t_n - t_{n-1}) / 360$	Basis 30 / 360
2)	Marktzinssatz		
3)	Diskont-/ Barwertfaktor df_n	s. Exkurs Zerokupon und Diskontfaktoren	(lineare Interpolation der "df" zwischen zwei Punkten der Zinskurve)
4)	FRA :	$(df_{n-0,5} / df_n - 1) / d_n * 100$	
5)	Nominalbetrag		
6)	= 4) * 1a) * 5)		
7)	= Festzins * 1b) * 5)		
8)	= 6) + 7)		
9)	= 8) * 3)		

Example

Evaluation of an interest rate swap after a change in interest rates
On trading day and after the swap deal is settled at 5.20 %, the swap rates for 5-year fixed against 6-month LIBOR rise by 0.05 % for interest rates of 1 year up to 5 years, LIBOR for the first floating rate payment stays unchanged.

Because of the changed yield curve, the factors for discounting and the implied FRAs have changed. When evaluating the interest rate swap, one gets a market value of 218,018.64.

DEM - IRS				BANK	PAYER		STARTBETRAG	100.000.000,00			
HANDELSTAG	01.09.97			START	03.09.97		ERSTES FIXING	3,125		ACT / 360	6-MTS-DEM-LIBOR
BEWERTUNG	218.018,64			ENDFÄLLIG	03.09.02		FESTZINS	-5,2		30 E / 360	p.a.
	1 a)	1 b)	2)		3)	4)	5)	6)	7)	8)	9)
	DATE	DAY COUNT FLOAT	DAY COUNT FIX	RATE ACT / 360	RATE 30/360	df	IMPLIED FRA	NOTIONAL AMOUNT	FLOATING CASHFLOW	FIX CASHFLOW	NET CASHFLOW	DISCOUNTED NET CASHFLOW
t_0	03.09.97	s.a.	p.a.			1						
$t_{0,5}$	03.03.98	0,502777778		3,125	-	0,9845312	3,125	100.000.000,00	1.571.180,56	0,00	1.571.180,56	1.546.876,34
t_1	03.09.98	0,511111111	1	3,30411	3,35	0,9675859	3,43	100.000.000,00	1.751.303,31	-5.200.000,00	-3.448.696,69	-3.336.910,20
$t_{1,5}$	03.03.99	0,502777778		0		0,9465838	4,41	100.000.000,00	2.218.722,89	0,00	2.218.722,89	2.100.207,15
t_2	03.09.99	0,511111111	1	3,89589	3,95	0,9252336	4,51	100.000.000,00	2.307.543,89	-5.200.000,00	-2.892.456,11	-2.676.197,66
$t_{2,5}$	03.03.00	0,505555556		0		0,8998259	5,59	100.000.000,00	2.823.631,83	0,00	2.823.631,83	2.540.776,94
t_3	04.09.00	0,513888889	1,003	4,483637	4,55	0,8739993	5,75	100.000.000,00	2.954.988,56	-5.214.444,44	-2.259.455,89	-1.974.762,82
$t_{3,5}$	05.03.01	0,505555556		0		0,8481647	6,02	100.000.000,00	3.045.944,67	0,00	3.045.944,67	2.583.462,62
t_4	03.09.01	0,505555556	0,997	4,87885	4,95	0,82233	6,21	100.000.000,00	3.141.637,21	-5.185.555,56	-2.043.918,35	-1.680.775,44
$t_{4,5}$	04.03.02	0,505555556				0,7967754	6,34	100.000.000,00	3.207.251,85	0,00	3.207.251,85	2.555.459,49
t_5	03.09.02	0,508333333	1	5,175246	5,25	0,7710804	6,56	100.000.000,00	3.332.337,81	-5.200.000,00	-1.867.662,19	-1.440.117,76
											NPV	218.018,64

Example

Pricing of an interest rate swap

Using the same method as in the two examples above, one can also calculate the "fair" market price of more complex interest rate swaps.

In this example, we calculate the fixed interest rate for a forward swap with increasing and decreasing principal.

You have to look for the fixed interest rate and the swap structure, where the market value is 0 (= the "fair" price at trade date).

DEM - IRS				BANK	PAYER		STARTBETRAG	100.000.000,00			
HANDELSTAG	01.09.97			START	03.09.98		ERSTES FIXING	3,125	ACT / 360	6-MTS-DEM-LIBOR	
BEWERTUNG	0,00			ENDFÄLLIG	03.09.02		FESTZINS	-5,708016038	30 E / 360	p.a.	
	1 a)	1 b)	2)		3)	4)	5)	6)	7)	8)	9)
	DATE	DAY COUNT FLOAT	DAY COUNT FIX	RATE ACT / 360	RATE 30/360	df	IMPLIED FRA	NOTIONAL AMOUNT	FLOATING CASHFLOW	FIX CASHFLOW	NET CASHFLOW	DISCOUNTED NET CASHFLOW
t_0	03.09.97	s.a.	p.a.			1						
$t_{0,5}$	03.03.98	0,502777778		3,125	-	0,9845312		0,00		0,00	0,00	0,00
t_1	03.09.98	0,511111111	1	3,254795	3,3	0,9680542	3,33	0,00	0,00	0,00	0,00	0,00
$t_{1,5}$	03.03.99	0,502777778		0		0,9472629	4,37	50.000.000,00	1.097.442,67	0,00	1.097.442,67	1.039.566,70
t_2	03.09.99	0,511111111	1	3,846575	3,9	0,9261269	4,47	50.000.000,00	1.141.093,13	-2.854.008,02	-1.712.914,89	-1.586.376,61
$t_{2,5}$	03.03.00	0,505555556		0		0,9009069	5,54	100.000.000,00	2.799.410,78	0,00	2.799.410,78	2.522.008,35
t_3	04.09.00	0,513888889	1,003	4,434366	4,5	0,8752711	5,70	100.000.000,00	2.928.898,33	-5.723.871,64	-2.794.973,31	-2.446.359,23
$t_{3,5}$	05.03.01	0,505555556		0		0,8495945	5,98	75.000.000,00	2.266.662,72	0,00	2.266.662,72	1.925.744,10
t_4	03.09.01	0,505555556	0,997	4,829569	4,9	0,8239179	6,16	75.000.000,00	2.337.301,03	-4.269.120,33	-1.931.819,30	-1.591.660,46
$t_{4,5}$	04.03.02	0,505555556		0		0,7985009	6,30	20.000.000,00	636.617,76	0,00	636.617,76	508.339,85
t_5	03.09.02	0,508333333	1	5,125958	5,2	0,7729442	6,50	20.000.000,00	661.280,46	-1.141.603,21	-480.322,74	-371.262,70
											NPV	0,00

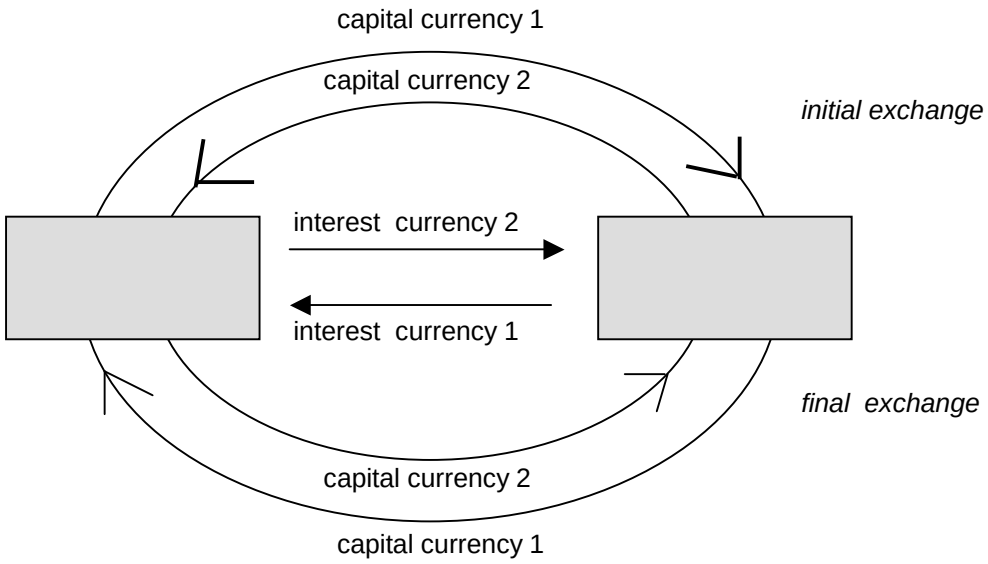
2. Cross-currency swap

2.1. Terminology

A currency swap (or cross-currency swap) is a contract between two parties (A and B) to exchange two different, specific interest payments in different currencies (1 and 2) during a term that is fixed in the contract. The interest payments are calculated on the basis of the principals of the two currencies and the interest rate for the respective term of interest.

Under a currency swap, the principal is usually exchanged. For all the transactions An exchange rate is fixed for all transactions when the swap is entered
Basically, one can divide a currency swap into three different transactions.

- Initial transaction: Exchange of the principal in different currencies (1 and 2) - **initial exchange**
- Interest payment transaction: Exchange of interest payments in different currencies during the swap term
- Final transaction: Re-exchange of the principal in 1 and 2 - **final exchange**



Currency swaps are closely related to FX swaps that have already been discussed in chapter 3, where only the principals are exchanged and no interest payments are made in the two currencies.
The term of a currency swap is usually longer than 1 year.

Depending on the stipulated rate for the final exchange, one differentiates between "forward outright" and "par value" swap:

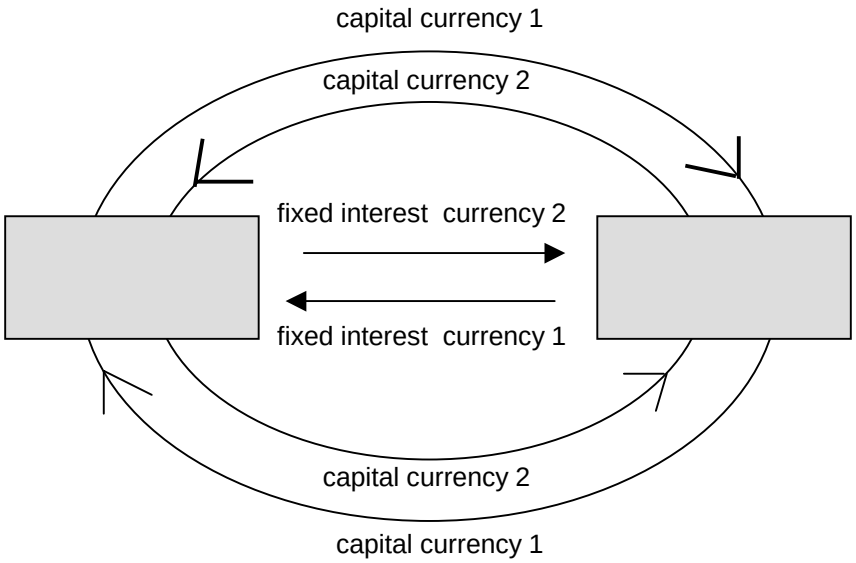
Forward outright: At a forward outright cross currency swap, a forward exchange rate, prevailing at the trading date, for the final exchange is fixed

Par value: At a par value cross currency swap, the exchange rate for the initial exchange is the same as the exchange rate for the final exchange (one usually fixes the par value rate at the mid spot rate)

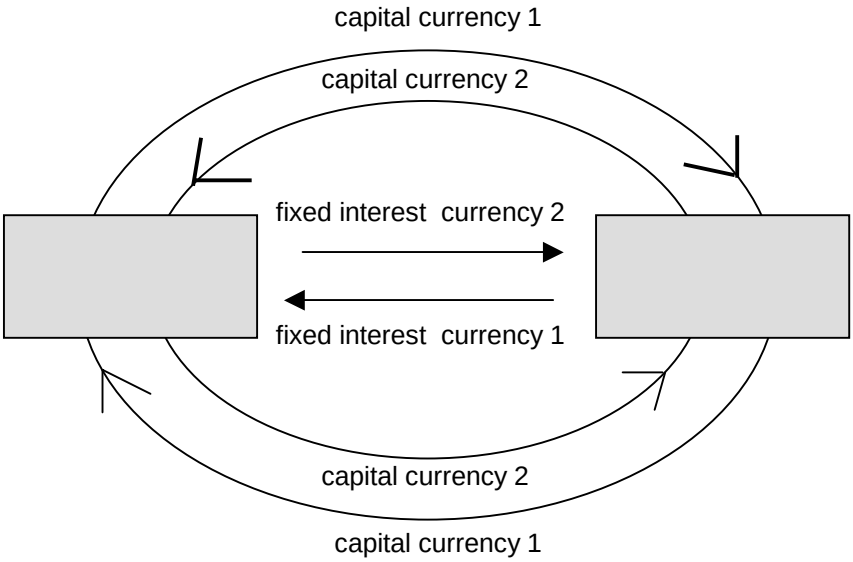
Note: As an exceptional case, the initial or final exchange (or both) may not take place at all.

For cross currency swaps, like for interest rate swaps, exist several combinations concerning the exchange of interest payments.

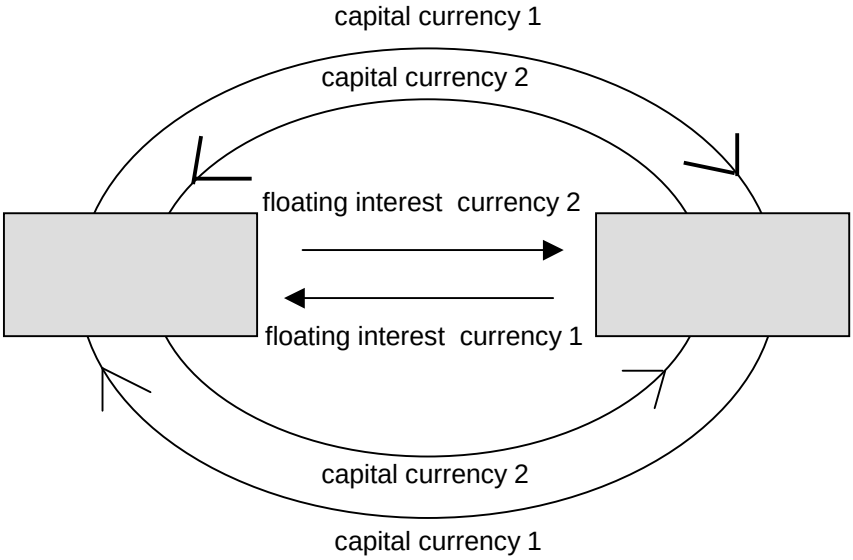
fixed against fixed



fixed against floating



floating against floating



Cross currency swaps are used

- to hedge against interest rate risk and currency risk
- to exploit cost advantages resulting due to different spreads in the two capital markets involved(see example below).

2.2. Example of a currency swap

Example

A Swiss bank X, with an A rating, needs USD 100 Mio for 5 years at a fixed rate and could refinance itself at 6.50 % in USD; the current yield in the capital market is 6.25 % (5 years).

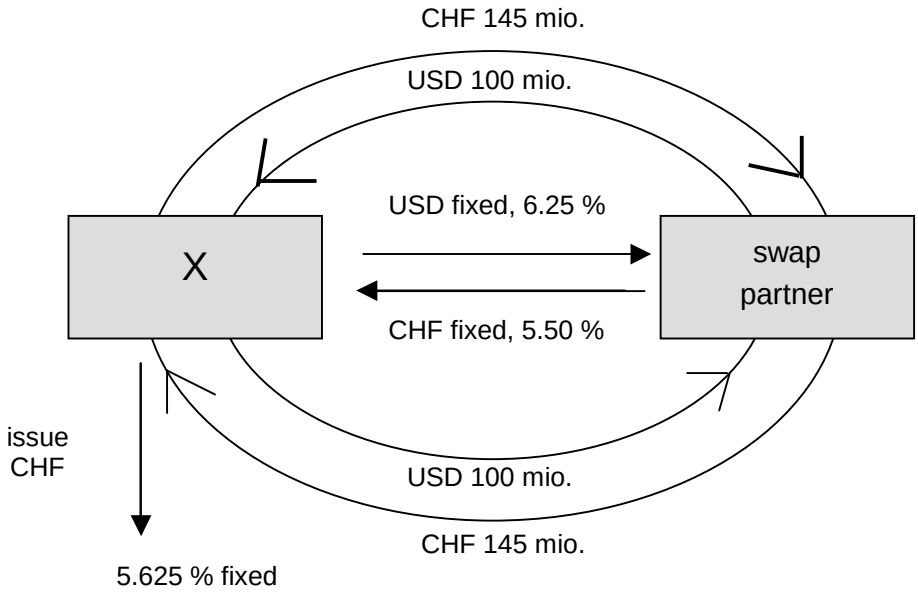
X has the possibility to issue a 5-year bond in Swiss francs with an interest rate of 5.625 %. The current rate in the capital market is CHF 5.50 %.

The treasurer of bank X enters into a par value currency swap with an exchange of fixed interest rates:

6.25 % in USD
5.50 % in CHF

For both the initial and final exchange a USD/CHF rate of 1.4500 is fixed.

From X's point of view the situation looks like this:



With the CHF-issue and the simultaneous currency swap, X could secure the needed USD 100 Mio. On the CHF side, a loss of 0.125 % will be incurred(5.625 % expenditure for the issue – 5.50 % interest return on the swap). As for the USD, there is just an expenditure of 6.25 % from the currency swap.

Theoretically, the total expenditure of the deal is:

6.250 % in USD
0.125 % in CHF

6.325 %

We do not go into the so-called conversion factors that are needed to transfer spreads from one currency to another. In this example we assume that $^1/_8$ % in CHF equals $^1/_8$ % in USD.

Under the currency swap, X was able to raise the USD $^1/_8$ % cheaper than in a possible USD issue (6.50 %).

Note: You have still to compare the advantages from the swap with the disadvantages, e.g. the required equity costs and the required limits.

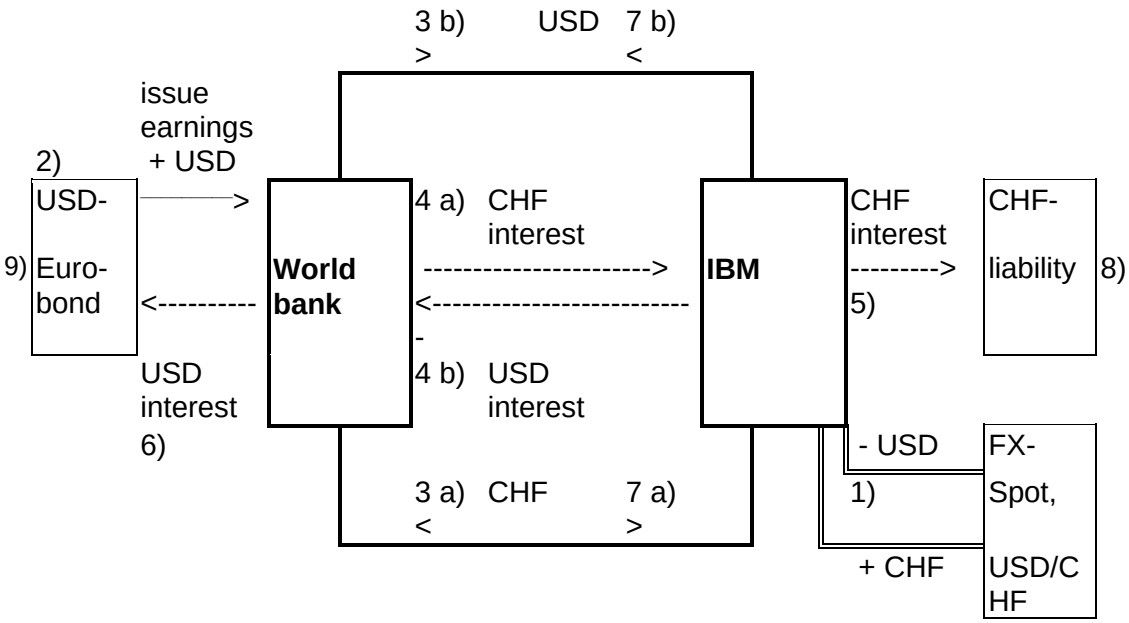
3. Development of financial swaps

One of the first publicly known financial swaps was undertaken by the World Bank and IBM in August 1981. This deal demonstrates the background and the development of the swap market very well and is quoted often as the classic example.

In 1981, the USD rose against European currencies. Therefore, in order to take advantage of the favorable exchange rates, IBM was looking for the possibility to pay back pre-maturely its CHF and DEM liabilities (dating back to 1979) which it entered in order to finance USD investments on the US capital. However, a termination of these liabilities was not possible.

At the same time, the World Bank was wanted to enter into liabilities in currencies that had low interest rates. Because of its earlier use of the CHF capital market, no first class conditions were available - contrary to the situation in the USD capital market.

The matching needs of IBM and World Bank made it possible to arrange a swap deal from which both parties gained.



1) IBM buys CHF equal to the CHF liability against USD (the CHF from the original liability were exchanged into USD in 1979 just after the purchase)
2) The World Bank issues a USD eurobond (conditions as arranged with IBM: principal and term correspond to the liability (see 1) - the spot deal USD/CHF)
   IBM and the World Bank enter a cross currency swap with the following arrangements:
3) 3 a) IBM gives CHF from the FX deal to the World Bank and
   3 b) receives an amount that comes from the World Bank's eurobond. This amount is given in USD; the exchange rate is determined by the swap's conditions.
4) During the currency swap's term,
   4 a) IBM receives CHF interest from the World Bank and 5) services its CHF liability with it
   4 b) the World Bank receives USD interest from IBM and 6) services its USD eurobond with it
   At the end of the swap term, in addition to the interest payments 4a), 4b), 5), and 6), other payments are made:
7) 7 a) the World Bank pays back the CHF 3a) it received as initial transaction from IBM
   7 b) IBM pays back the USD 3b) it received as initial transaction from the World Bank
8) IBM uses the CHF from 7a) to pay off its own CHF liability
9) The World Bank pays off the eurobond with the USD payment 7b)
   In the same way, the World Bank and IBM treated the DEM liabilities with a USD/DEM currency swap.

In this way, IBM eliminated the economic risk of having CHF and DEM in its balance sheet without any offsetting positions and realized a currency profit.

The World Bank took advantage of its advantage regarding costs in the Euro-USD market and ”transferred” this advantage into CHF and DEM. Thereby it got better interest conditions than if it had directly operated in the Swiss or German capital markets.

Ever since, currency swaps have developed into one of the most important instruments in the financial market.

4. Closing of an open swap position

There are three different ways of closing an open swap position:

a) reversal
b) closing-out
c) assignment

4.1. Reversal

A reversal is the most common way to close an interest rate swap. In this case, the bank enters a second, opposite interest rate swap (usually with a third party) over the same principal and the same term as the original swap. Thereby, both interest rate swaps lead to fixed profits and losses in the future. Nevertheless, they are still in the balance sheet and must be taken into account when determining the respective limits and the equity cover.

4.2. Closing-out

A closing-out is an early termination of the swap deal. Both parties agree to eliminate the interest rate swap from their books. The outstanding cash flows are marked –to- market. Usually, one of the counterparties has to make a settlement payment. Since in a closing-out the swap is eliminated from the books, no receivables or liabilities have to be considered when the partner limits or the equity cover are determined.

4.3. Assignment

A swap deal can also be closed by transferring the swap to a third party. This new party must agree to accept the original swap on all the original conditions and must accept the swap's counterparty. Furthermore, the original counterparty must give his consent to the new partner.

With an assignment, usually an up-front payment has to be made if the current market rates differ from the original rates of the interest rate swap.