

# 4 Derivative markets: swaps

## 4.1 Learning outcomes

After studying this text the learner should / should be able to:

1. Define a swap.
2. Describe the different types of swaps.
3. Elucidate the motivations underlying interest rate swaps.
4. Illustrate how swaps are utilised in risk management.
5. Appreciate the variations on the main themes of swaps.

## 4.2 Introduction

Figure 1 presents the derivatives and their relationship with the spot markets.

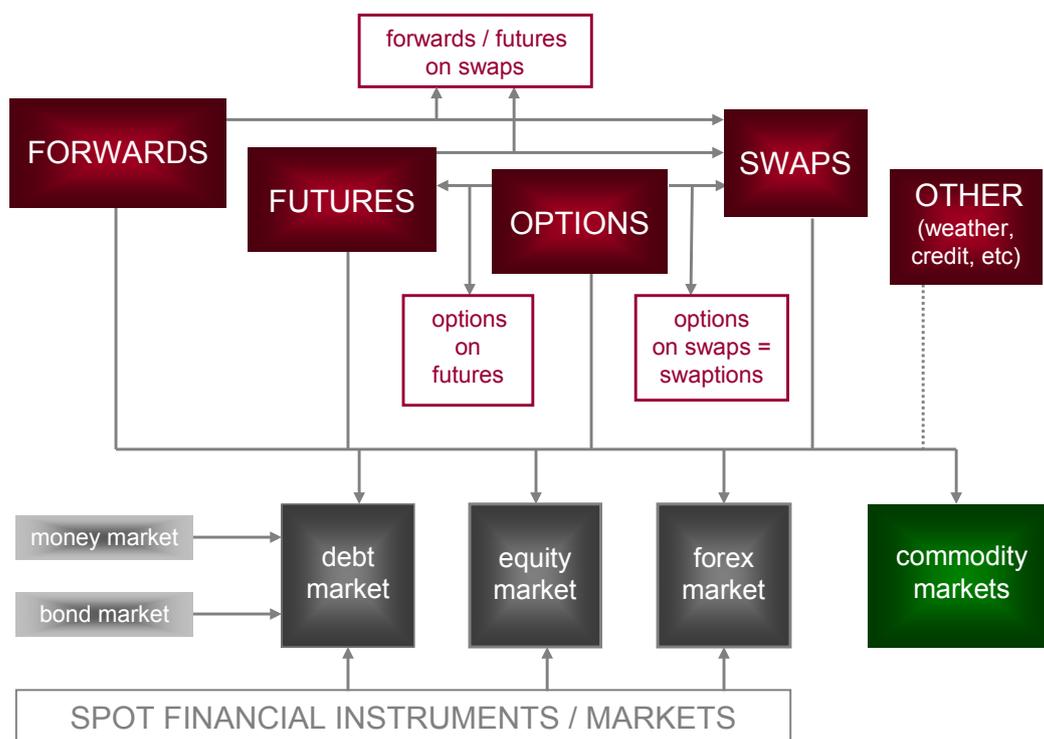


Figure 1: derivatives and relationship with spot markets

Swaps emerged internationally in the early eighties, and the market has grown significantly. An attempt was made in the early eighties in some smaller to kick-start the interest rate swap market, but few money market benchmarks were available at that stage to underpin this new market. It was only in the middle nineties that the swap market emerged in some of these smaller countries, and this was made possible by the creation and development of acceptable benchmark money market rates. The latter are critical for the development of the derivative markets.

We cover swaps before options because of the existence of *options on swaps*. This illustration shows that we find swaps in all the spot financial markets.

A swap may be defined as an agreement between counterparties (usually two but there can be more parties involved in some swaps) to *exchange specific periodic cash flows in the future based on specified prices / interest rates*. The cash flow calculations are made with reference to an agreed notional amount (i.e. an amount that is not exchanged). Swaps allow financial market participants to better manage risk in their relevant preferred habitat markets.



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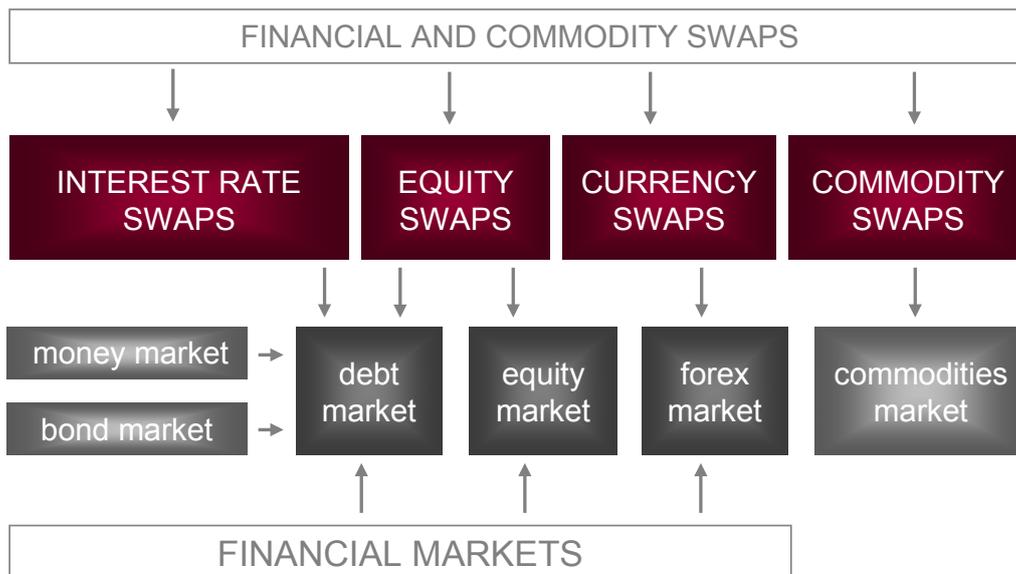
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Swaps are a significant part of the financial markets and, as noted, are found in all the markets. The *interest rate swap* has a leg in the money market and a leg in the bond market. *Equity / share swaps* have a leg in the share market and the other in the bond market (and sometimes the money market). *Currency swaps* (not to be confused with foreign exchange swaps) have two legs in the foreign exchange market, but in different geographic markets. *Commodity swaps* involve the exchange of a fixed price on a commodity for the spot price (usually an average), and sometimes the transaction does not include the same commodity. The swap market may be depicted as in Figure 2.



**Figure 2:** swaps

To this list may be added the *credit risk swap*, but as the compensation for the “protection buyer” is contingent upon a “credit event”, it is more akin to an insurance policy, and will be discussed in the “other derivatives” section.

The various swaps undertaken in the five markets are covered briefly below. Interest rate swaps dominate and are given pole position, and we conclude with brief sections on the listed swaps in South Africa and the organisation of the swap market. The following are the headings:

- Interest rate swaps.
- Currency swaps.
- Equity / share swaps.
- Commodity swaps.
- Listed swaps.
- Organisation of the swap market.

### 4.3 Interest rate swaps

#### 4.3.1 Introduction

An interest rate swap entails the swapping of differing interest obligations between two parties via a facilitator, usually a bank that focuses on this market (and makes a market in this market). It is an agreement between two parties to exchange a series of *fixed rate cash flows* for a series of *floating rate cash flows* in the *same currency*. These interest amounts are calculated with reference to a mutually agreed *notional amount*. The notional amount is not exchanged between the parties.

The party that agrees to make *fixed interest rate* payments is called the *buyer* and the party that undertakes to make *floating rate payments* is called the *seller*. These swaps are also called *coupon swaps*. When two floating rates are exchanged they are called *basis swaps*. In fact, there are a variety of interest rate swaps, and these are mentioned at the close of this section. The following sections are covered here:

- Motivation for interest rate swaps.
- Coupon swap: transforming a liability.
- Coupon swap: transforming an asset.
- Coupon swap: comparative advantage.
- Organisation of the swap market.
- Variations on the theme.

#### 4.3.2 Motivation for interest rate swaps

The circumstances that give rise to interest rate swaps (IRSs) usually involve interest rate risk or comparative advantage. The following main IRSs may be identified:

- Transforming a liability.
- Transforming an asset.
- Comparative advantage.

#### 4.3.3 Coupon swap: transforming a liability

An example of an IRS that transforms a liability is shown in Figure 3.

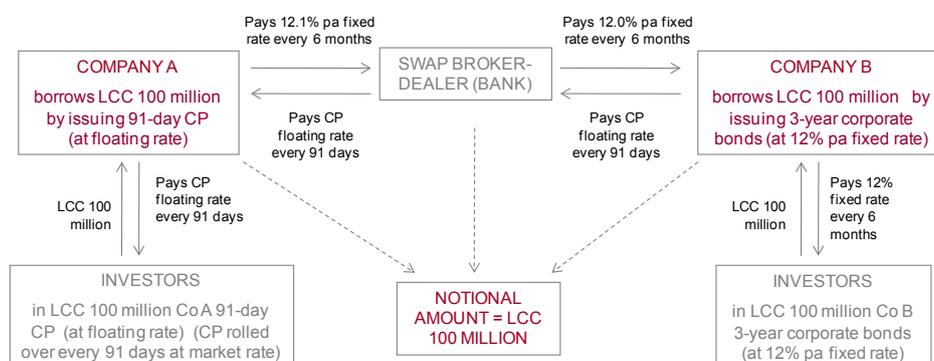


Figure 3: interest rate swap: transforming a liability

In this example Company A has borrowed LCC100 million through the issuing of 91-day commercial paper (which is re-priced every 91 days at the then prevailing rate), while Company B has borrowed LCC100 million by the issuing of corporate bonds at a fixed rate of 12% pa for a 3-year period. These borrowing habitats could reflect the following:

- Company A believes interest rates are going to move down or sideways. It therefore does not want to “lock in” a rate for a long period, and wants to take advantage of rates declining if this does come about.
- Company B is of the view that rates are about to rise and wishes to lock in a rate now for the next three years.

Time passes and the two parties change their views. A sharp banker spots the changed views of the two companies and puts the following deals to them:

### Company A

- Company A and the bank enter into an interest rate swap agreement.
- Company A agrees to pay to the bank a fixed rate of 12.1% for the next three years, interest payable six-monthly.
- The bank agrees to pay Company A the floating commercial paper rate every 91-days.
- The notional amount of the swap is LCC100 million.

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**Company B**

- Company B and the bank enter into an interest rate swap agreement.
- Company B agrees to pay to the bank the commercial paper floating rate every 91 days.
- The bank agrees to pay to Company B paying a fixed rate of 12.0%, interest payable six-monthly.
- The notional amount of the swap is LCC100 million.

Because of their changed views, the deals are accepted by both companies. Company A's obligation to pay the 91-day commercial paper rate to the holders (which may be different in each rollover period) is matched by the bank's payment of the 91-day commercial paper rate to it. It is then left only with the obligation to pay the fixed rate of 12.1% pa to the bank.

Conversely, Company B's obligation to pay the fixed 12% pa to the investors in its paper is matched by the bank's obligation to pay the fixed 12% pa rate to it. Company B is thus left with the obligation to pay the 91-day commercial paper rate to the bank.

The interest obligations of the bank match, with the exception that the bank earns 0.1% on the fixed interest leg of the transaction (LCC100 000 per annum excluding compounding and present value calculations).

The mathematics of this deal is straightforward, and simply amounts to interest payments (i.e. cash flows) over the three-year period. The cash flows are shown in Table 1.

	Company A pays	Company B pays	Floating rate (% pa) assumed
<b>Year 1</b>			
Day 0	-	-	-
Day 91 (91 days)		2 966 849.32	11.9
Day 182 (91 days)	6 050 000	2 991 780.82	12.0
Day 273 (91 days)		3 066 575.34	12.3
Day 365 (92 days)	6 050 000	3 166 301.37	12.7
<b>Year 2</b>			
Day 91 (91 days)		3 241 095.89	13.0
Day 182 (91 days)	6 050 000	3 365 753.43	13.5
Day 273 (91 days)		3 490 410.96	14.0
Day 365 (92 days)	6 050 000	3 427 945.21	13.6
<b>Year 3</b>			
Day 91 (91 days)		3 340 821.92	13.4
Day 182 (91 days)	6 050 000	3 116 438.36	12.5
Day 273 (91 days)		2 991 780.82	12.0
Day 365 (92 days)	6 050 000	2 867 123.29	11.5
<b>Total</b>	<b>36 300 000</b>	<b>38 032 876.73</b>	

**Table 1:** Fixed for floating interest rate swap (fixed rate = 12% pa) (LCC)

Company A's floating rate obligation is cancelled out by the matching payments from the bank, and Company B's fixed rate obligation is cancelled out by the payments from the bank. Company A thus over the period of 3 years paid out a total of LCC36.3 million in interest, compared with Company B's LCC38 032 876.73. Thus, Company A's amended interest rate view was correct, and it saved LCC1.7 million. Company B's treasurer should have stuck to his original view.

**Counterparty risk**

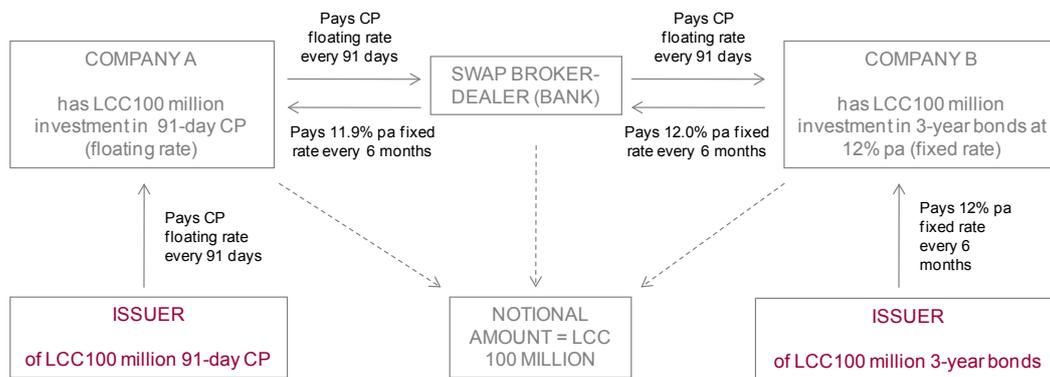
It is rare that counterparties in swap deals are able to find one another and do a deal to their mutual satisfaction. If they do, the *deal rests on the integrity of the two parties*, i.e. they are each exposed to counterparty risk. More generally, it is bankers that seek out these transactions.

The banks then interpose themselves between the clients (principals), and undertake to receive and pay the relevant interest amounts. Clearly, it is only the large banks that are able to do these deals, because the counterparty of each principal is the intermediary bank (sometimes called the *swap agent*).

**Fixed rates and floating rates**

The above was an example of a plain vanilla swap. The floating rate used was the 91-day commercial paper rate. Most swaps in reality involve other well-known benchmark rates, such as the LIBOR in the UK, the Fedfunds rate in the US, the ROD or JIBAR rates in South Africa, and so on. The fixed leg is not benchmarked because it is an agreed number.

**4.3.4 Coupon swap: transforming an asset**



**Figure 4:** interest rate swap: transforming an asset

In the example presented in Figure 4, Company A transforms its investment in 91-day commercial paper, which is repriced every 91-days, into an 11.9% fixed rate investment. Company B does the reverse. In this example the motivation for the deal was a change in interest rate views. It will be noted that there is a mismatch in the timing of the interest payments. This does not have to be the case.

4.3.5 Coupon swap: comparative advantage<sup>41</sup>

Rating	Company	3-year fixed rate (bond market)	Floating rate (money market)
AAA	Company A	11.0%	6-month JIBAR <sup>42</sup> + 0.0%
BBB	Company B	12.0%	6-month JIBAR + 0.5%
Difference (B – A)		+1.0%	+ 0.5%

Table 2: Example of comparative advantage IRS<sup>42</sup>

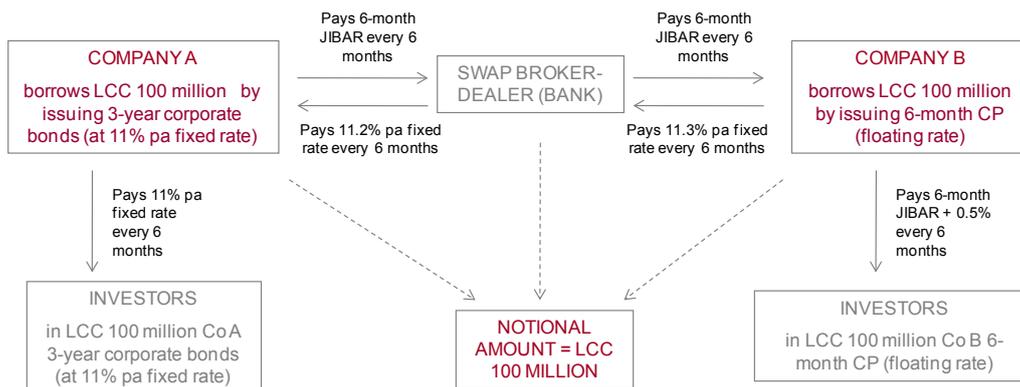


Figure 5: interest rate swap: comparative advantage

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The comparative advantage motivation for a swap deal rests on the existence of a differential in borrowing rates in different markets. An example is presented in Table 2.

Company A has an *absolute advantage* in both markets (as a result of the credit rating difference), i.e. borrows at a lower rate in both markets. However, it will be evident that while Company B pays a higher rate than Company A in both markets, it is “penalised” to a lesser extent in the money market than in the bond market (which could be because of the lower probability of default in the short-term). On the other hand, Company A pays less in the bond market than in the money market when compared with Company B.

Thus, Company A has a *comparative advantage* in the bond market, while Company B has a *comparative advantage* in the money market.

Important assumptions have to be made in this example:

- Company A wants to borrow floating.
- Company B wants to borrow fixed.

An astute banker sees the opportunity and proposes the following deal:

- Company A borrows in the market where it has a comparative advantage in relation to Company B (bond market).
- Company B borrows in the market where it has a comparative advantage in relation to Company A (money market).

The deal is accepted and the IRS then takes place as illustrated in Figure 5.

The details of the transaction supplied in Table 3 should be apparent.

Co	Wanted to borrow	Borrows (paying to investors)	Receives	Paying to bank	Actually paying
A	floating @ 6-m JIBAR	fixed @ 11%	11.2% fixed	6-m JIBAR	6-m JIBAR - 0.2%
B	fixed @ 12%	floating @ 6-m JIBAR + 0.5%	JIBAR	11.3% fixed	11.3% + 0.5%
Bank			0.1% (net)		

**Table 3:** Example of comparative advantage irs: interest payments

Company A borrows out of its preferred habitat (floating rate), but the swap synthesises the preferred habitat, and the company benefits by 0.2%. Company B wants to borrow fixed, but borrows floating every 6 months for 3 years at 6-month JIBAR + 0.5%. It receives 6-month JIBAR, and therefore makes a loss on this leg of 0.5%. It however pays 11.3% fixed to the bank, making its total cost 11.8%, which is 0.2% lower than the fixed rate it would have paid in the bond market for its 3-year paper. The banker pockets 0.1% pa on LCC100 million for 3 years (LCC100 000 per year).

#### 4.3.6 Variations on the theme

There are many variations on the main IRS theme. A few examples are:

- *Basis swap*: A swap where two floating rates are swapped.
- *Amortising swap*: A swap with a notional value that reduces over the life of the swap in a predetermined way.
- *Accreting swap* (also called *step-up swap*): A swap in terms of which the notional amount increases in a predetermined manner during the term of the swap.
- *Roller-coaster swap*: A swap in terms of which the notional amount increases and decreases during the term of the swap.
- *Deferred swap* (also called *forward start swap*): A swap where the counterparties do not start exchanging interest payments until a future date.
- *Extendable swap*: A swap where one party has the option to extend the life of the swap beyond the term of the swap, according to predetermined conditions.
- *Puttable swap*: A swap where one party has the option to terminate the swap prior to maturity date, according to predetermined conditions.
- *Constant maturity swap*: A swap where a floating rate (for example LIBOR) is exchanged for a specific rate (for example the 10-year rate on government bonds).
- *Index amortizing rate swap* (also called *indexed principal swap*): A swap where the notional amount reduces in a way that is dependent on the level of interest rates.
- *Timing-mismatched swap*: A swap with a timing mismatch.

## 4.4 Currency swaps

### 4.4.1 Definition

A currency swap in its simplest form involves the exchange of principal and interest payments in one currency for principal and interest payments in another currency. The amounts involved are usually of equal magnitude and they are exchanged with interest at the beginning and the end of the life of the swap. The following currency swaps are covered here:

- Simple currency swap.
- Comparative advantage currency swap.
- Variations on the theme.

#### 4.4.2 Simple currency swap

Our first example of a swap is a simple one (see Figure 7; assumption: starting exchange rate = GBP / USD 1.5).

The UK financial intermediary company has all its assets in UK pounds, but has GBP 100 million of its liabilities in USD (2-year 10% pa fixed bond issue in USD = USD 150 million). In a similar fashion, a US financial intermediary has all its assets in USD but has USD 150 million of GBP liabilities (2-year 10% pa fixed GBP-denominated bond = GBP 100 million). Interest on both bonds is payable annually.

After a year the UK intermediary becomes concerned that the GBP will *depreciate* in relation to the USD and it will have to service the debt (interest and principal) with more pounds in the future. At the same time the US intermediary becomes concerned that the USD is about to *depreciate* in relation to the GBP, and that it will have to service its UK pound debt (interest and principal) with depreciated dollars.

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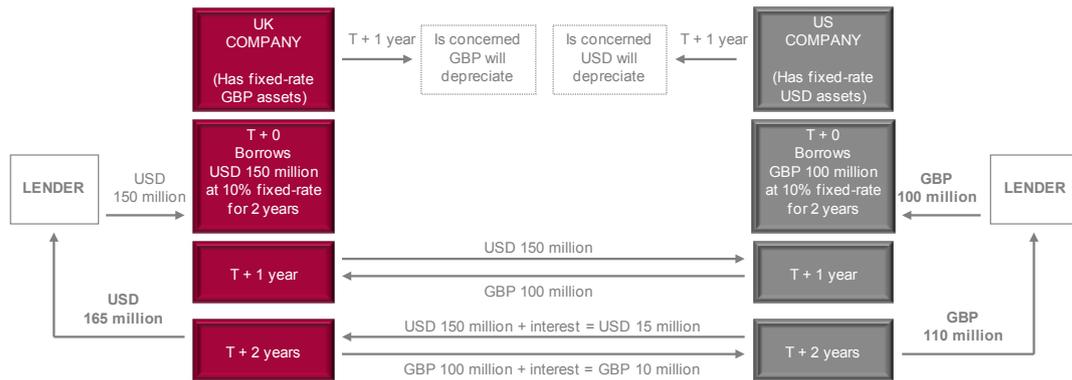


Figure 7: example of currency swap

There is always a smart banker that will spot this “opposing currency risk condition”. He proposes the deal as illustrated in Figure 7, and takes a “small” turn in one of the legs (which we ignore here for the sake of simplicity).

The swap is done for principal and interest and the relevant amounts change hands at T+1year. At T+2 (expiry of the swap and the bonds) the amounts plus interest are exchanged again in order for the debtors to repay the creditors the principal plus interest amounts.

If at T+2 the exchange rate is GBP / USD 1.4, i.e. the GBP has depreciated (less USD per GBP or more GBP per dollar:  $1 / 1.4 = 0.71429$  GBP per USD, compared with  $1 / 1.5 = 0.66667$  GBP per USD), the UK company is better off than it would have been in the absence of the swap, with the position of the US company being the converse. In the absence of the swap the UK company would have had to buy USD 165 million for GBP 117.86 million ( $1 / 1.4 \times \text{USD } 150 \text{ million}$ ), compared with GBP 110 million it paid. The US company would have been better off had the swap not been undertaken: it would have bought GBP 110 for USD 154 million ( $1.4 \times \text{GBP } 110 \text{ million}$ ), compared with USD 165 million it paid.

The above is an example where the currency swap transmutes liabilities from one currency to another, with the purpose of managing currency risk. Another example is where a comparative advantage exists. This follows.

4.4.3 Comparative advantage currency swap<sup>43</sup>

The second example is more realistic and is illustrated in Figure 8.

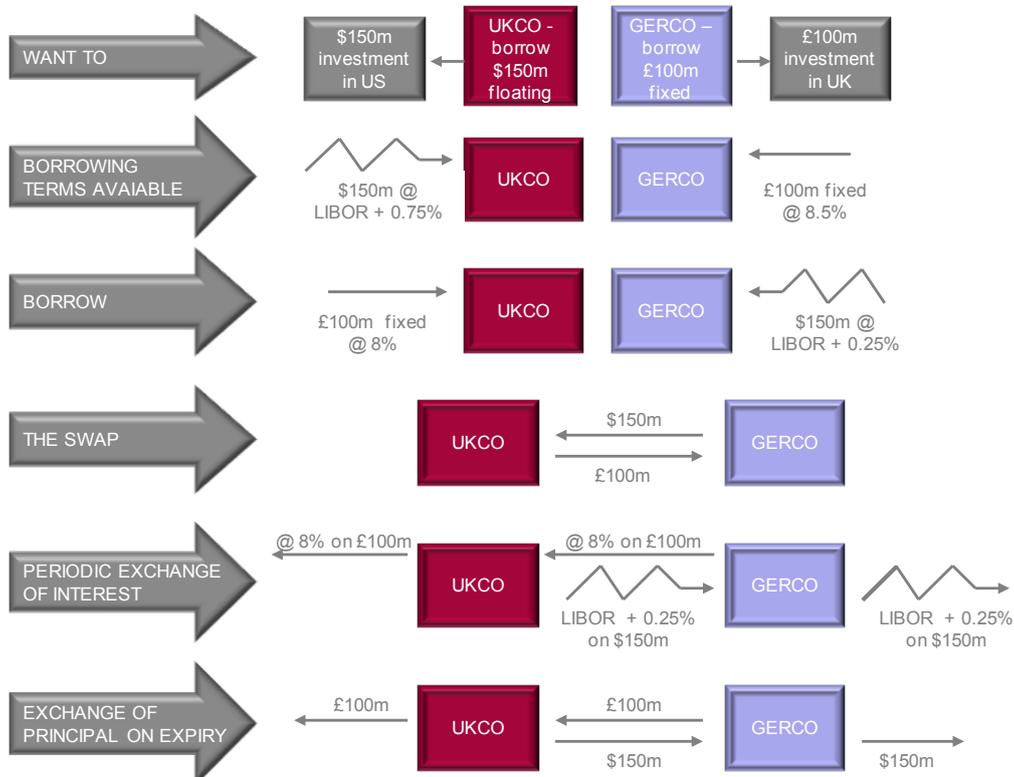


Figure 8: example of currency swap

**Wants / needs:**

A UK company (UKCO) wants to borrow USD 150 million at a floating rate for 10 years in order to make an investment in the US. A German company wants to raise GBP 100 million for 10 years at a fixed rate for investment in the UK. The exchange rate is GBP / USD 1.5.

The following terms are available to them:

- UKCO: USD 150 million at LIBOR + 0.75%
- GERCO: GBP 100 million at 8.5% fixed.

**Prelude to swap:**

Their banker (they happen to have the same bank as their advisor) advises them that they should not borrow on these terms, but rather as follows which they are able to:

- UKCO: borrow GBP 100 million at a fixed rate of 8% for 10 years
- GERCO: borrow USD 150 million at LIBOR + 0.25%

and that they simultaneously undertake to swap the principal and the obligations (interest is payable every six months). It is evident that if they exchange debt obligations, their *wants will be satisfied* and they will be *borrowing at a lower rate*.

A summary of the borrowing terms is given in Table 4.

Co	USD rate	GBP rate	Wants to borrow in:	Actually borrows in:
UKCO	LIBOR + 0.75	Fixed rate 8% pa	USD	GBP
GERCO	LIBOR + 0.25	Fixed rate 8.5% pa	GBP	USD

**Table 4:** Example of comparative advantage currency swap: interest payments

Each party has an advantage in a market compared with the other party: UKCO in the GBP market and GERCO in the USD market.

**Borrowing and the swap:**

UKCO and GERCO see the advantages, accept the terms, borrow as advised, and the swap takes place. Each is able to make their desired investment as follows:

- UKCO: investment of USD 150 million
- GERCO: investment of GBP 100 million.

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**The periodic exchange of interest:**

The following cash flows take place over the period of 10 years (interest is payable every six months):

- UKCO:
  - Pay: 8% fixed rate on GBP 100m (to holders of securities)
  - Receive: 8% fixed rate on GBP 100m (from GERCO)
  - Pay: LIBOR + 0.25% on USD 150m (to GERCO)
- GERCO
  - Pay: LIBOR + 0.25% on USD 150m (to holders of securities)
  - Receive: LIBOR + 0.25% on USD 150m (from UKCO)
  - Pay: 8% fixed rate on GBP 100m (to UKCO).

**Exchange of principal on expiry of contract:**

At expiry of the swap the principal amounts are exchanged as follows:

- UKCO: USD 150 million to GERCO
- GERCO: GBP 100 million to UKCO.

They are able to repay the holders of the securities they issued.

**Net result:**

The net result of the swap is that UKCO *gets to borrow in its preferred habitat*: USD 150 million at LIBOR, but it *borrowed at a cheaper rate* (i.e. LIBOR + 0.25% as opposed to LIBOR + 0.75%). Similarly, GERCO *borrowed where it wanted to* (GBP 100 million in the UK at a fixed rate), but also at a *cheaper rate* (8.0% fixed as opposed to 8.5% fixed).

It is to be noted that the interposition of the bank was left out in the numbers. It will be evident that the savings by each party allow for the banker to take a “healthy” turn. The banker was excluded because of the extra arrows that would have rendered the illustrations untidy.

**4.4.4 Variations on the theme**

There are variations on the main theme of currency swaps, but not as many as in the case of interest rate swaps. One of them is the *cross currency swap* (also called currency coupon swap). It involves the exchange of a floating rate in one currency for a fixed rate in another currency. This is essentially a hybrid of the currency swap and the plain vanilla interest rate swap.

Another is the *differential swap* (also termed the *diff swap*), which involves the exchange of a floating rate in the domestic currency for a floating rate in a foreign currency. Both payments are referenced against a domestic notional amount.

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## 4.5 Equity / share swaps

### 4.5.1 Introduction

An equity / share swap is a *fixed-for-equity swap*. It is similar to the conventional interest rate swap in terms of a term to maturity, notional principal amount, specified payment intervals and dates, fixed rate and floating rate. The difference lies therein that the *floating rate is linked to the return on a specified share index* (usually total return, i.e. capital appreciation and dividend). The following are the sections covered here:

- Example of equity / share swap
- Variations on the theme.

### 4.5.2 Example of equity / share swap

These swaps are a relatively new invention (first emerged in 1989), and are used for temporary desired changes to the income of a portfolio without having to sell the relevant instrument/s. For example (see Figure 9), a portfolio manager may believe that equities are to yield inferior returns for, say, two years, and that over this period bonds should perform well. An equity / share swap is an ideal instrument for this purpose, i.e. the share return is swapped for a fixed rate of return for two years.

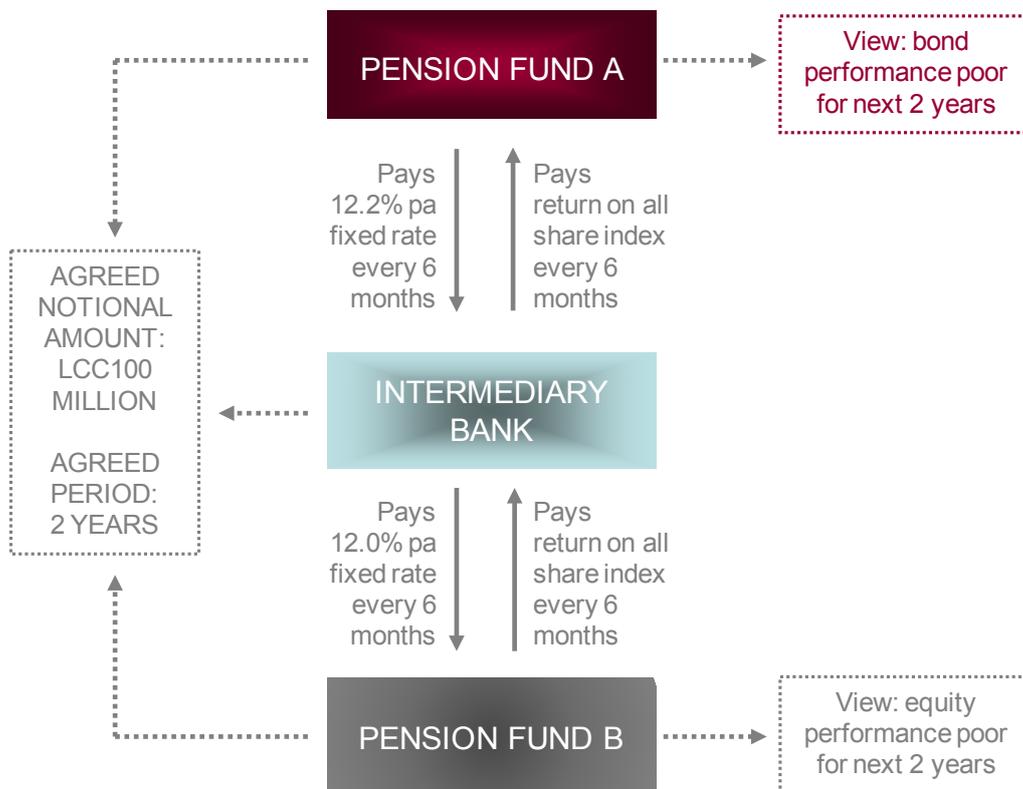


Figure 9: example of an equity swap

It will have been noted that the intermediary bank (who arranged the deal) profits by 0.2% pa on the fixed leg (LCC200 000 pa for 2 years). The two principals (pension funds) are not aware of this because they deal with the bank.

#### 4.5.3 Variations on the theme

There are some variations to this plain vanilla equity / share swap:

- *Floating-for-equity equity swap*: An equity swap with one leg benchmarked against a floating rate of interest and the other leg benchmarked against an equity index.
- *Asset allocation equity swap*: An equity swap where the equity leg is benchmarked against the greater of two equity indices.
- *Quantro equity swap*: An equity swap with two equity legs, the return on one equity index is swapped for the return on another equity index.
- *Blended-index equity swap*: An equity swap where the floating leg is an average (weighted or otherwise) of two or more equity indices.
- *Rainbow-blended-index equity swap*: Same as the previous, but the indices are different foreign indices.

#### 4.6 Commodity swaps

Commodity swaps are where parties *exchange fixed for floating prices on a stipulated quantity of a commodity* (for example a 20 000 ounces of platinum). An example: a South African producer of platinum wishes to fix a price on part of its production (20 000 ounces), because it is of the opinion that the price of platinum is about to fall (wants to *receive fixed*, i.e. a fixed price, and *pay floating*, i.e. the spot rate).

On the other hand, a manufacturer of jewellery in Italy believes that the price of platinum is about to rise sharply (wants to *pay fixed*, i.e. fixed price, and *receive floating*, i.e. spot price).

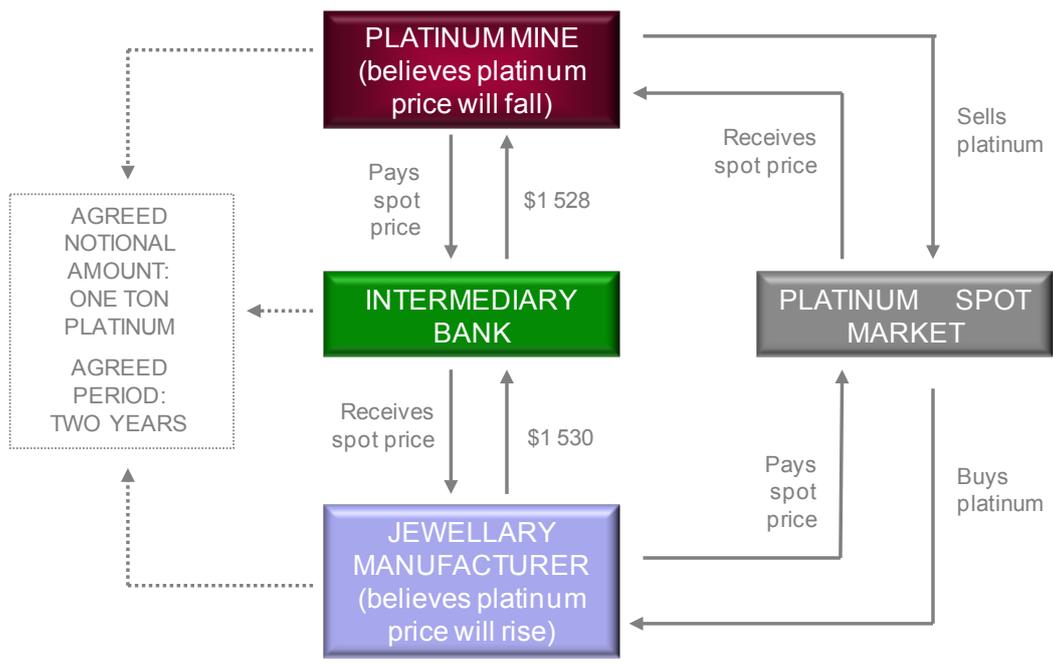


Figure 10: example of a commodity swap

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An on-the-ball intermediary bank spots this difference of opinion and puts together the following deal (spot price at inception of the deal is USD 1 529 per ounce):

- The bank offers the mine a fixed price of USD 1 528 per ounce for the next 2 years, payable monthly, in exchange for monthly payments of the average spot rate for the preceding month.
- The bank offers the jewellery manufacturer monthly payments of the average spot rate for the preceding month, in exchange for a fixed price of USD 1 530 per ounce for the next 2 years, payable monthly.

Both parties cannot believe their good fortune and accept the deal. The banker is also pleased. It will be apparent that if the platinum price falls, the mine will be extremely pleased, because it receives the ever-declining price on the spot market and pays this to the intermediary bank. In exchange the miner receives the fixed price of USD 1 528 per ounce.

The jewellery manufacturer, on the other hand, will be smarting because it is paying floating in the spot market and receiving this same amount, while paying a fixed price that is increasingly higher than the spot price. The opposite case will be obvious. This swap deal is depicted in Figure 10.

#### 4.7 Listed swaps

Generally speaking the swap market is an OTC market “made” by the banks (see next section). However, in certain markets listed swaps are listed on financial exchanges. In some countries the following listed swaps are found:

- Plain vanilla swaps.
- Coupon swaps.
- On-demand swaps.
- Bond look-alike swaps.
- Overnight swaps.

### 4.8 Organisational structure of swap market

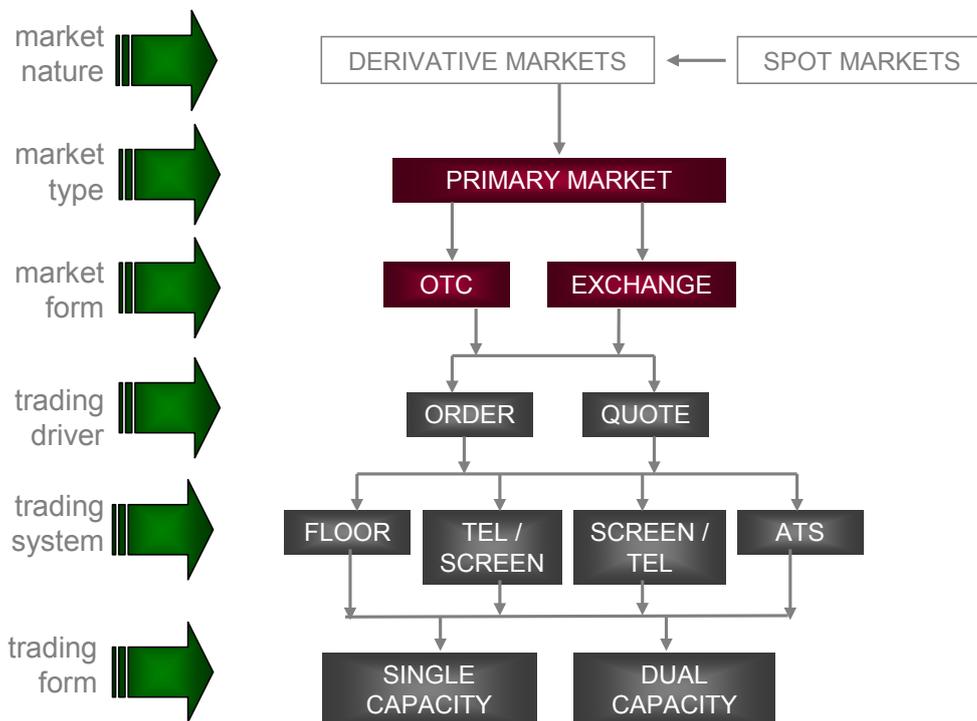


Figure 11: organisation of derivative financial markets

As noted, the swap market is largely an OTC market and it is dominated by the banks. As such, it is largely a primary market. As in the case of OTC forwards, the OTC swaps are difficult to sell and “getting out” of them amounts to finding an equal and opposite OTC deal (which is not always easy to find).

This also applies to the listed swap market, but there is a major difference: the contracts are standardised, and exchange-traded, and trading “out” of them is easier. Another advantage is that the exchange guarantees the swap deals.

In the OTC swap market the trading driver is “quote” (mainly done by the banks) whereas in the exchange-driven market participants place orders with their broker-dealers. The trading system in the OTC market is screen / telephone, i.e. firm prices are quoted on screen and confirmed on the telephone. In the exchange-driven markets it is a combination of ATS and screen-telephone.

### 4.9 Summary

Swaps are obligations to swap cash flows ion future dates. They are used to transform liability and asset portfolios and to take advantages of pricing / credit anomalies in markets. The market is usually OTC but some swap products are traded on exchanges.

## 4.10 Bibliography

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