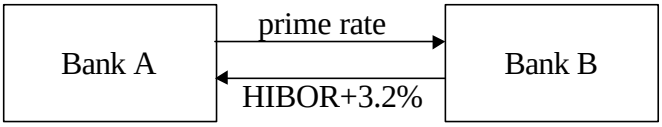
CHAPTER 6

Different Types of Swaps[1]

In the previous chapter, we introduced two simple kinds of generic swaps: interest rate and currency swaps. These are usually known as "plain vanilla" deals because the structures of these swaps are simple and more or less similar, except for the contract details. These constitute a large part of derivatives trading. However, a swap in its most general form is a security that involves the exchange of cash flows according to a formula that depends on the value of one or more underlying variables. There is therefore no limit to the number of different types of swaps that can be invented. In this chapter, we would give you a taste of some "real life" swap structures which you may come across in the future as these become more and more common.

Some Different Kinds of Interest Rate Swaps

In many occasions, an institution enters into a swap transaction with a bank in order to hedge its interest rate exposures. A plain vanilla swap involves the exchange between payments based on a floating rate and a fixed rate. However, depending on the nature of the exposures, an institution may enter into a **basis swap** with a bank, for which the payments are based on two floating rate references. For example, bank A has a mortgage portfolio which receives floating rate payments based on the prime rate, and the portfolio is funded with 3-month deposits, the deposit rate being based on HIBOR. Assume that bank A expects the spread between HIBOR and prime will narrow quite substantially in the future (at present it is, say, 3.5%). In order to lock in this margin, bank A may enter into a swap transaction with bank B, for which



The payments are exchanged every three months, for a term of 5 years. By this deal, even if the spread between HIBOR and prime narrows in the future, bank A is certain to gain 3.2% for each payment received provided that no counterparty defaults.

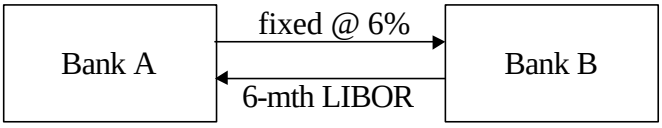
Why should bank A only receive 3.2% instead of 3.5% on top of HIBOR for each payment? In order to price any swap, the important principle is that at the inception of the deal, it should be fair to both parties, otherwise no one would enter into the contract with you. If the future spread between prime and HIBOR is forecast to be reduced, then a fixed margin has to be calculated today based on the present information so that the net present values of all cash flows would be zero at inception.

Basis swaps could involve many different kinds of reference rates for the floating payments, the commonly used references are 3-month LIBOR, 6-month LIBOR, prime rate etc. Another special kind of swap which is worth mentioning is the **Constant Maturity Swap** (CMS) or **Constant Maturity Treasury swap** (CMT swap). These

[1] This chapter was written by Mr. Chau Ka-lok.

swaps, which are very common in the US, typically use a swap rate or T-bill rate as one of the floating references (for example, a swap which exchanges between 5-year swap rate and 6-month LIBOR). Pricing these swaps (i.e. to calculate the fixed margin required) is difficult and advanced techniques are required.

In the cases mentioned above, the notional principal remains constant throughout the life of the swap. However, sometimes the bank may want to use a simple swap to hedge the exposure of a loan with an amortisation schedule. This leads to another important type of swaps known as **amortising swaps**. The principal reduces according to a fixed schedule decided at inception. An example of this is:



Payments are made every 6 months, for a total period of 4 years. The reference principal amounts are:

Year 1	$10 million
Year 2	$ 8 million
Year 3	$ 5 million
Year 4	$ 3 million

The pricing of this swap (i.e. to calculate the required fixed rate using today's market rates) is not difficult. Effectively this is equivalent to a series of swaps added together. The first one is a 4-year swap with notional principal of $10 million. The second one is a 3-year swap starting in one year's time (i.e. a forward starting swap, another common variation of the plain vanilla type), with a notional principal of $2 million in the opposite direction. The third one is a 2-year swap starting in two years' time with a notional principal of $3 million in the opposite direction. The last one is a one year swap starting in three years' time, with a notional principal of $2 million in the opposite direction.

A closely related type is the **index amortising swap** (IAS). Instead of having a fixed amortising schedule as in the above example, the schedule depends on an on-going reference rate (or index), and the manner in which this rate changes in the course of time. For example, the schedule can be:

end of Year 1	If 6-month LIBOR > 7%, principal is reduced by 10%
end of Year 2	If 6-month LIBOR > 7.5%, principal is reduced by 10%
end of Year 3	If 6-month LIBOR > 8%, principal is reduced by 20%

The principal amount at each payment date depends on how the 6-month LIBOR has moved. Assume an initial principal of $10 million, the amount at each payment date for the following two scenarios will be:

a) LIBOR at end of:
Year 1: 6%; Year 2: 8%; Year 3: 8.5%.

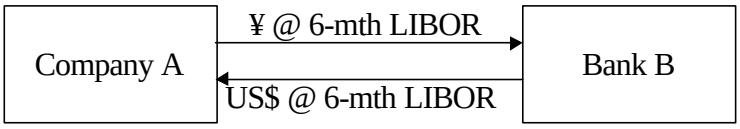
Principal amount at:
Years 1 and 2: $10 million, Year 3: $9 million, Year 4: $7.2 million.

b) LIBOR at end of:
Year 1: 7.5%; Year 2: 8%; Year 3: 7.5%.
Principal amount at:
Year 1: $10 million, Year 2: $9 million, Years 3 and 4: $8.1 million.

Contrary to simple amortising swaps, the pricing of IAS is difficult because a full model of the yield curve has to be used to forecast the behaviour of the reference rate. When this type of swap was introduced in the late eighties, huge margins were charged. Subsequently the margins became tighter as more and more people traded these instruments. However, some people began to realise that the original pricing method was incorrect. Even today we can see many banks use a wrong model in pricing these swaps.

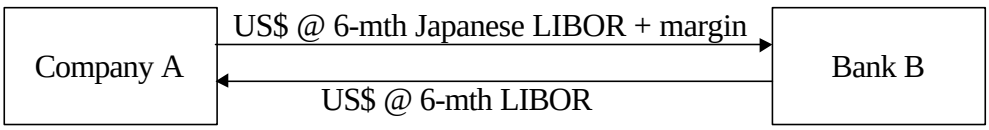
Another variation of the swap family is the differential swap (also commonly known as **diff swap** or quanto swap). This product was first developed in the early nineties in order to suit the needs of customers who had strong views on the spread between interest rates in different countries.

For example, the treasurer of company A, a US based company, gets today's market data for US and Japan's yield curves. He thinks that due to the strong growth in the US economy relative to Japan's, the US interest rates are likely to rise faster than what the market suggests now, i.e. the spread between US interest rates and Japan interest rates would widen even further than today's prediction. A simple strategy is for company A to enter into a cross currency swap with bank B:



With the exchange of principals at the start and end dates, this constitutes a typical cross currency swap (refer to Chapter 5). However, the problem with this kind of swap is that the amount paid in Yen is subject to foreign exchange risk. It is quite likely that even if Japanese rates increase only slightly, Yen could suddenly become much stronger, and the benefit from the increase in US LIBOR would be offset by the appreciation of Yen which makes the payments more valuable from a US company's point of view.

Ever so eager to capture new markets, the "rocket scientists" in investment banks came up with an unnatural product. Instead of paying Japanese LIBOR in Yen, both payments would be made in US dollars, i.e.

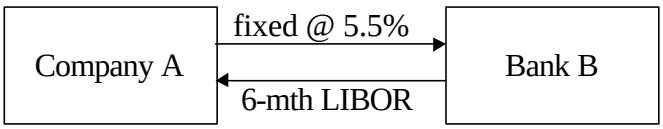


Since all the payments would now be made in US dollars, company A would not be exposed to foreign exchange risk anymore, and the product fully captures its view. In a sense, the Japanese LIBOR only acts as a kind of reference rate. Again, the difficulty for this kind of swap is to calculate the fair value of the fixed margin at the inception of the swap. Fat margins were charged by investment banks initially, with the margins coming down gradually in recent years.

Tailor-Made Structures

So far we have only introduced swaps where coupons are exchanged based on some reference rates. Features of the other big family of derivatives, options, could be added to plain swaps to create some new type of products. The simplest one is the option on a swap, or **swaption**. A typical deal is: in one year's time, the buyer has the right to enter into a plain vanilla 3-year swap, where he pays fixed at 6% and receives floating LIBOR every six months. There is a very active over-the-counter (OTC) market in trading these instruments, with different maturities of the option (one year in the above example) and different maturities of the underlying swaps (3-year above). As with other types of options, a premium has to be paid upfront to purchase the right. This is different from typical swap structures for which no counterparty has to pay any upfront fees because the deal should be fair to both parties at inception.

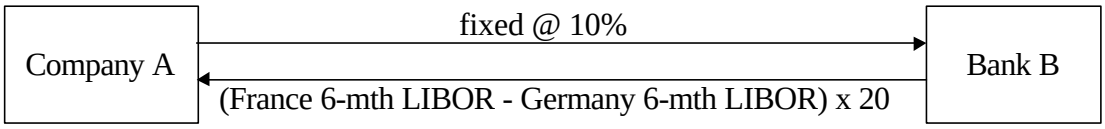
Another common type of OTC swaps with option features is the **extendible and puttable swaps**. These instruments allow one counterparty the right to extend or cancel the swap at the end of a specified period. For example, an extendible swap can be:



in the first 2 years. After 2 years, company A has the right to extend the swap for a further year. If it does not exercise the right, the swap terminates at year 2.

Effectively this is just a 2-year swap plus a 2-year option on a 1-year swap. For this kind of deal, the premium is usually included in the fixed rate. In the example above, the market 2-year swap rate is probably lower than 5.5% (say 5.2%). Company A pays 0.3% above the market rate for the four payments in the first 2 years to compensate for the option premium.

Finally, a swap deal can have a high degree of leverage. Here we use an example similar to the diff swap example above. Germany's and France's interest rates are usually closely linked together, and the spread between the rates are quite constant. However, if customer A thinks that the spread would widen with France's rates higher than that of Germany's. A swap deal which could capture this view is:



This is a highly leveraged deal because the payments are very sensitive to even small movements in the two yield curves. For example, if at the first settlement date, France LIBOR is 4% and Germany LIBOR is 3.5%, then the payments are equal ($(4-3.5)\times 20 = 10\%$). However, if at the next settlement date the LIBORs are 4.2% and 3.3% respectively, company A would receive $(4.2-3.3)\times 20 = 18\%$ while paying 10%, and a net 8% is earned. For a big notional amount (say $20 million) this already represents a profit of $0.8 million (for six months). However, one could as well lose as much. You may think that these deals are just like gambling, but it is not uncommon to find trades like these.

Armed with the different types of swaps and options features introduced above, a bank can tailor-make almost anything according to the customers' needs. In many structured deals, more than two counterparties are involved, which means that two or more simultaneous swaps are entered. Usually the more exotic the instrument becomes, the higher the risk it bears. One of Proctor & Gamble's deals with Bankers Trust, which ended up in a lawsuit, is of the highly leveraged kind. This probably gives the word "derivatives" a bad name.