Nature of Swaps

A swap is an agreement to exchange cash flows at specified future times according to certain specified rules.
An Example of a “Plain Vanilla” Interest Rate Swap

- An agreement by Microsoft to receive 6-month LIBOR & pay a fixed rate of 5% per annum every 6 months for 3 years on a notional principal of $100 million
- Next slide illustrates cash flows
## Cash Flows to Microsoft

*(See Table 7.1, page 151)*

<table>
<thead>
<tr>
<th>Date</th>
<th>LIBOR Rate</th>
<th>FLOATING</th>
<th>FIXED</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar. 5, 2004</td>
<td>4.2%</td>
<td>+2.10</td>
<td>-2.50</td>
<td>-0.40</td>
</tr>
<tr>
<td>Sept. 5, 2004</td>
<td>4.8%</td>
<td>+2.10</td>
<td>-2.50</td>
<td>-0.40</td>
</tr>
<tr>
<td>Mar. 5, 2005</td>
<td>5.3%</td>
<td>+2.40</td>
<td>-2.50</td>
<td>-0.10</td>
</tr>
<tr>
<td>Sept. 5, 2005</td>
<td>5.5%</td>
<td>+2.65</td>
<td>-2.50</td>
<td>+0.15</td>
</tr>
<tr>
<td>Mar. 5, 2006</td>
<td>5.6%</td>
<td>+2.75</td>
<td>-2.50</td>
<td>+0.25</td>
</tr>
<tr>
<td>Sept. 5, 2006</td>
<td>5.9%</td>
<td>+2.80</td>
<td>-2.50</td>
<td>+0.30</td>
</tr>
<tr>
<td>Mar. 5, 2007</td>
<td>6.4%</td>
<td>+2.95</td>
<td>-2.50</td>
<td>+0.45</td>
</tr>
</tbody>
</table>
Typical Uses of an Interest Rate Swap

- Converting a liability from
  - fixed rate to floating rate
  - floating rate to fixed rate

- Converting an investment from
  - fixed rate to floating rate
  - floating rate to fixed rate
Intel and Microsoft (MS) Transform a Liability
(Figure 7.2, page 152)

- Intel
- MS
- LIBOR
- LIBOR + 0.1%

5%
5.2%
Financial Institution is Involved

(Figure 7.4, page 153)

5.2% Intel F.I. MS

LIBOR 4.985% 5.015% LIBOR+0.1%

LIBOR
Intel and Microsoft (MS) Transform an Asset
(Figure 7.3, page 153)
Financial Institution is Involved
(See Figure 7.5, page 154)

Intel  \[ \text{LIBOR-0.2\%} \]  4.985\%

F.I.  \[ \text{LIBOR} \]  5.015\%

MS  \[ \text{LIBOR} \]  4.7\%
### The Comparative Advantage Argument (Table 7.4, page 157)

- AAACorp wants to borrow floating
- BBBCorp wants to borrow fixed

<table>
<thead>
<tr>
<th></th>
<th>Fixed</th>
<th>Floating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAACorp</td>
<td>4.0%</td>
<td>6-month LIBOR + 0.30%</td>
</tr>
<tr>
<td>BBBCorp</td>
<td>5.20%</td>
<td>6-month LIBOR + 1.00%</td>
</tr>
</tbody>
</table>
The Swap (Figure 7.6, page 158)

AAACorp 3.95% LIBOR
4%  

BBBCorp LIBOR +1%

LIBOR
The Swap when a Financial Institution is Involved
(Figure 7.7, page 158)
Criticism of the Comparative Advantage Argument

- The 4.0% and 5.2% rates available to AAACorp and BBBCorp in fixed rate markets are 5-year rates.
- The LIBOR+0.3% and LIBOR+1% rates available in the floating rate market are six-month rates.
- BBBCorp’s fixed rate depends on the spread above LIBOR it borrows at in the future (in order to cover the uncertainty in the future, the fixed rate for BBBCorp is more expensive).
The Nature of Swap Rates

- Six-month LIBOR is a short-term AA borrowing rate (because it is the rate that AA-rating bank borrows)
- The 5-year swap rate has a risk corresponding to the situation where 10 six-month loans are made to AA borrowers at LIBOR
- This is because the lender can enter into a swap where income from the LIBOR loans is exchanged for the 5-year swap rate (fixed rate)
# Quotes By a Swap Market Maker

*(Table 7.3, page 155)*

<table>
<thead>
<tr>
<th>Maturity</th>
<th>Bid (%)</th>
<th>Offer (%)</th>
<th>Swap Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years</td>
<td>6.03</td>
<td>6.06</td>
<td>6.045</td>
</tr>
<tr>
<td>3 years</td>
<td>6.21</td>
<td>6.24</td>
<td>6.225</td>
</tr>
<tr>
<td>4 years</td>
<td>6.35</td>
<td>6.39</td>
<td>6.370</td>
</tr>
<tr>
<td>5 years</td>
<td>6.47</td>
<td>6.51</td>
<td>6.490</td>
</tr>
<tr>
<td>7 years</td>
<td>6.65</td>
<td>6.68</td>
<td>6.665</td>
</tr>
<tr>
<td>10 years</td>
<td>6.83</td>
<td>6.87</td>
<td>6.850</td>
</tr>
</tbody>
</table>

- **Bid**: buy a stream of cash flow according to LIBOR
- **Offer**: sell a stream of cash flow according to LIBOR
- **Swap Rate**: the fixed rate let the value of swap to be zero
Using Swap Rates to Bootstrap the LIBOR/Swap Zero Curve (ex. 7.1)

- Consider a new swap where the fixed rate is the swap rate.
- When principals are added to both sides on the final payment date the swap is the exchange of a fixed rate bond for a floating rate bond.
- The floating-rate rate bond is worth par. The swap is worth zero. The fixed-rate bond must therefore also be worth par.
- This shows that swap rates define par yield bonds that can be used to bootstrap the LIBOR (or LIBOR/swap) zero curve.
Valuation of an Interest Rate Swap that is not New

- Interest rate swaps can be valued as the difference between the value of a fixed-rate bond and the value of a floating-rate bond.
- Alternatively, they can be valued as a portfolio of forward rate agreements (FRAs).
Valuation in Terms of Bonds

- The fixed rate bond is valued in the usual way.
- The floating rate bond is valued by noting that it is worth par immediately after the next payment date.

*(example 7.2)*
Valuation in Terms of FRAs

- Each exchange of payments in an interest rate swap is an FRA
- The FRAs can be valued on the assumption that today’s forward rates are realized

*(example 7.2)*
An Example of a Currency Swap

An agreement to pay 11% on a sterling principal of £10,000,000 & receive 8% on a US$ principal of $15,000,000 every year for 5 years
Exchange of Principal

- In an interest rate swap the principal is not exchanged.
- In a currency swap the principal is usually exchanged at the beginning and the end of the swap’s life.
### The Cash Flows (Table 7.7, page 166)

<table>
<thead>
<tr>
<th>Year</th>
<th>Dollars</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>$</td>
<td>£</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>−15.00</td>
<td>+10.00</td>
</tr>
<tr>
<td>2005</td>
<td>+0.60</td>
<td>−0.70</td>
</tr>
<tr>
<td>2006</td>
<td>+0.60</td>
<td>−0.70</td>
</tr>
<tr>
<td>2007</td>
<td>+0.60</td>
<td>−0.70</td>
</tr>
<tr>
<td>2008</td>
<td>+0.60</td>
<td>−0.70</td>
</tr>
<tr>
<td>2009</td>
<td>+15.60</td>
<td>−10.70</td>
</tr>
</tbody>
</table>
Typical Uses of a Currency Swap

- Conversion from a liability in one currency to a liability in another currency
- Conversion from an investment in one currency to an investment in another currency
Comparative Advantage Arguments for Currency Swaps (Table 7.8, page 167)

General Motors wants to borrow AUD
Qantas wants to borrow USD

<table>
<thead>
<tr>
<th></th>
<th>USD</th>
<th>AUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Motors</td>
<td>5.0%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Qantas</td>
<td>7.0%</td>
<td>13.0%</td>
</tr>
</tbody>
</table>

* Figure 7.10, 7.11, and 7.12
Valuation of Currency Swaps

- Like interest rate swaps, currency swaps can be valued either as the difference between 2 bonds or as a portfolio of forward contracts

*Table 7.9: difference between 2 bonds
*Table 7.10: a portfolio of forward contracts
Swaps & Forwards

- A swap can be regarded as a convenient way of packaging forward contracts
- The “plain vanilla” interest rate swap in our example (slide 7.4) consisted of 6 FRAs
- The “fixed for fixed” currency swap in our example (slide 7.22) consisted of a cash transaction & 5 forward contracts
Swaps & Forwards
(continued)

- The value of the swap is the sum of the values of the forward contracts underlying the swap
- Swaps are normally “at the money” initially
  - This means that it costs nothing to enter into a swap
  - It does not mean that each forward contract underlying a swap is “at the money” initially
Credit Risk

- A swap is worth zero to a company initially
- At a future time its value is liable to be either positive or negative
- The company has credit risk exposure only when its value is positive
Other Types of Swaps

Floating-for-floating interest rate swaps, amortizing swaps, step up swaps, forward swaps, constant maturity swaps, compounding swaps, LIBOR-in-arrears swaps, accrual swaps, diff swaps, cross currency interest rate swaps, equity swaps, extendable swaps, puttable swaps, swaptions, commodity swaps, volatility swaps……....