LECTURE 3

SWAPS

- **Interest Rate Swaps / Foreign Exchange Swaps**
- **Credit Default Swaps (CDS)**

Interest rate Swaps

- It's a derivative in which one party exchange a stream of interest payments for another party's stream of cash flows.
- Interest rate swaps can be used by hedgers to manage their fixed or floating assets and liabilities.
- They could also for speculation – speculators replicate unfunded bond exposures to profit from changes in interest rates.
- Each counterparty agrees to pay either a fixed a floating rate – multiplied by a notional principal amount –

i.e. Party A, who believes that interest rates will rise, via a swap agreement, now pays fixed rate (the swap rate) to Party B, while receiving floating rate (LIBOR + spread). For example A pays 8.65% in exchange for periodic variable interest rate payments of LIBOR + 70bps – there is no exchange of the principal amounts and the interest rates are based on notional amount, so…

Party A pays (LIBOR + 1.50%) + 8.65% - (LIBOR + 0.70%) = 9.45% net

The fixed rate (8.65%) is referred to as the swap rate.

TYPES

- **Fixed for Floating – same currency**
  - For example, if a company has fixed rate USD 10 million loan at 5.3% paid monthly and the floating rate investment of USD 10 million that returns USD $1 LIBOR + 25 bps monthly, it may enter into a fixed-to-floating swap. In this swap, the company would pay a floating rate of USD 1 LIBOR + 25 bps and receive a 5.5% fixed rate, locking in 20 bps profit (5.5 – 5.3%)

   - *The party that pays fixed and receives floating coupon rates is said to be* ***short*** *the interest swap because it is expressed as a bond convention (as price falls, yield rise).*

- **Fixed for Floating – different currency**
   - For example, if a company has fixed rate USD 10 million loan at 5.3% paid monthly and the floating rate investment of JPY 1.2 billion that returns JPY 1 LIBOR + 50 bps monthly, it may enter into a fixed-to-floating swap. In this swap, the company would pay a floating rate of JPY 1 LIBOR + 50 bps and receive a 5.6% fixed rate, locking in 30 bps profit (5.6 – 5.3%) against the interest rate and the fx exposure.

- **Floating for Fixed – same currency**

- **Floating for Fixed – different currency**

- **Fixed for Fixed – different currency**

Valuation and Pricing –

- PV of plain vanilla
- Yield Curve (Forward rates) – used for approximation of floating rate

RISKS

- Interest rate movements
- Credit Risk

Example of Simple Interest Rate Swap:

Suppose that XYZ Corp. has $100 million of floating-rate debt at LIBOR – meaning that every year XYZ pay current six months LIBOR + 3.0% – but would prefer to have fixed-rate debt with 3 years maturity. There are several ways XYZ could effect this change:

1. XYZ could change their interest rate exposure by retiring the floating-rate debt and issuing fixed-rate debt in its place. However, an actual purchase and sale of debt has transaction coats.
2. They could enter into a strip of forward rata agreements (FRAs) in order to guarantee the borrowing rate for remaining life of the debt. Since the FRA for each year will typically carry a different interest rate, the company will lock in a different rate each year and hence, the company's borrowing cost will vary over time, even though it wil be fixed in advance (it could be expensive depending of the steepness of the yield curve).
3. Obtain interest rate exposure equivalent to that of fixed rate debt by entering into a **swap**. XYZ is already paying floating interest rate. They therefore want to enter a swap in which they receive a floating rate and pay the fixed rate – assuming is 5.0%:

$$\text{XYZ net payment} = \underbrace{-\text{LIBOR}}_{\text{Floating Payment}} \underbrace{+\ \text{LIBOR} - 5.0\%}_{\text{Swap Payment}} = -5.0\%$$

- The Notional principal of the swap is $100 million: It is the amount on which the interest payments – and hence, the swap payment – is based. The life of the swap is the **swap term** or **swap tenor.** The annual fixed payment for XYZ is always going to be 5.0% x $100mm = $5 million no matter what happens to LIBOR rates.
- The counterparty (party A) who takes a interest rate risk is betting that the LIBOR rate will not increase over the course of 3 years contract. An assume payment exchange is illustrated below:

Time (six months)	LIBOR Rate	LIBOR SPEAD	Floating Cash Flow Paid by A ($ mm)	Fixed Cash Flow Paid by XYZ ($ mm)	Net Cash Flow for XYZ ($ mm)	Net Cash Flow for A ($ mm)
0	1.00%					
1	1.25%	3.00%	2.00	$ 2.50	$ (2.50)	$ 0.50
2	1.50%	3.00%	2.13	$ 2.50	$ (2.50)	$ 0.38
3	1.75%	3.00%	2.25	$ 2.50	$ (2.50)	$ 0.25
4	2.25%	3.00%	2.38	$ 2.50	$ (2.50)	$ 0.13
5	2.75%	3.00%	2.63	$ 2.50	$ (2.50)	$ (0.13)
6	3.25%	3.00%	2.88	$ 2.50	$ (2.50)	$ (0.38)

Another Simple Interest Rate Swap – Cash Flow Method

Simple Interest Rate Swap - Cash Flow - IRR

Unhedged	0	1	2	3	4	5	6
Outstanding	100.00	100.00	100.00	100.00	100.00	100.00	-
Increase/Decrease in Principal		-	-	-	-	-	100.00
Interest Payment		2.00	2.13	2.25	2.38	2.63	2.88
Total Debt Service	(100.00)	2.00	2.13	2.25	2.38	2.63	102.88
LIBOR Rate forward	1.000%	1.250%	1.500%	1.750%	2.250%	2.750%	
LIBOR Spread		3.000%	3.000%	3.000%	3.000%	3.000%	3.000%
Total Interest Rate		4.000%	4.250%	4.500%	4.750%	5.250%	5.750%

Hedged							
SWAP RATE DEBT							
Outstanding	100.00	100.00	100.00	100.00	100.00	100.00	-
Increase/Decrease in Principal		-	-	-	-	-	100.00
Interest Payment		2.50	2.50	2.50	2.50	2.50	2.50
Total Debt Service	(100.00)	2.50	2.50	2.50	2.50	2.50	102.50
Total Interest Rate		5.000%	5.000%	5.000%	5.000%	5.000%	5.000%

	Effective Cost of Debt	0	1	2	3
Unhedged Cost of Debt	4.7289%	(100.00)	4.13	4.63	105.50
Hedged Cost of Debt	5.0000%	(100.00)	5.00	5.00	105.00
Savings / (Cost) for Hedging			(0.88)	(0.38)	0.50

Comparative Advantage Argument:

Company A offered either a Fixed Rate of 10.0% or Float LIBOR + 30 bps
Company B offered either a Fixed Rate of 11,2% or Float LIBOR + 100 bps

Company A's view: Rates will stay low and is willing to enter into a Floating Rate contract:

Company B's view: Rates will rise and wants to enter into a Fixed Rate contract:

Given the different views, the broker recommends that Company A and Company B get into Swap Agreement with a 9.95% Swap price as follows:

1. Company A picks the Fixed Rate option and pays 10% to the Lender (bank)
2. Company A also pays Company B the LIBOR flat rate.
3. Company A receives 9,95% fixed rate from Company B

1. Company B picks the Floating Rate option and pays LIBOR + 100 bps
2. Company B also pay 9.95% fixed rate to Company A
3. Company B receives LIBOR flat rate.

This swap benefited both parties as follows:

Company A net interest pay: 10% + LIBOR – 9.95% = LIBOR + 5 bps or 25 bps better than the LIBOR + 30 bps original proposal. Even though Company A got into a Fixed Rate contract, the swap agreement "swapped" the fixed into floating with a 25bps benefit.

Company B net interest pay: LIBOR + 100 – LIBOR + 9.95% = 10.95% Fixed Rate or 25 bps better that the 11.05% original proposal. Even though Company B got into a floating Rate contract, the swap agreement "swapped" the floating into fixed with a 25 bps benefit.

SWAP Rate
9.95%

Company A		Company B	
Fixed Rate	10.00%	Fixed Rate	11.20%
Float (L+)	0.30%	Float (L+)	1.00%
IR View:	Low	IR View	High
Choose:	Fixed	Choose:	Float
Cash Flow:		**Cash Flow:**	
Pay	-10.00%	Pay	-(L+1.0%)
Pay	-LIBOR	Pay	-9.95%
Receive	9.95%	Receive	+ L
Net Pay	L + 5 bps	Net Pay	-10.95%
Savings	0.25%	Savings	0.25%

Example of Currency Swap:

Suppose the effective annual euro-denominated interest rate is 6% and dollar-denominated rate is 7.0%. The spot exchange rate is \$1.30 / 1 €. A dollar-based firm has a 3-year 6% euro-denominated bond with a €100 par value and price of €100. The firm wishes to guarantee the dollar value of the payments. Since the firm will make debt payments in euros, it buys the euro forward to eliminate currency exposure. The table below summarizes the transaction and reports the currency forward curve and the unhedged and hedged cash flows. The value of the hedge cash flow is:

COMPANY XYZ

Bond Par Value (€)=	**100 million Euros**
Euro-denominated Rate=	6.00%
Dollar-denomiated Rate =	7.00%
Spot Exchange Rate=	$ 1.30 per €

UNHEDGED

Time	Unhedged Euro Cash Flow (€)	Forward Exchange Rate	Hedges Dollar Cash Flow ($)	Present Value of the unhedged Cash Flows ($)
1	-6.00	1.3200	-7.92	$7.47
2	-6.00	1.3400	-8.04	$7.16
3	-106.00	1.3700	-145.22	$121.93
				$136.56

HEDGED

Time	Cash Flow ($)	Hedges Dollar Cash Flow ($)	Present Value of the hedged Cash Flows ($)
1	-9.10	-9.10	$8.58
2	-9.10	-9.10	$8.10
3	-139.10	-139.10	$116.79
			$133.47

Benefit =	$3.08

The dollar-based firm enters into a swap where it pays dollars (7.0% on $130 bond) and receives euros (7% on a €100 bond). The firm's euro exposure is eliminated. The market-maker receives dollars and pays euros. The position of the market-maker is summarized in table below:

Market Maker (A)

Swap Agreement Payment =	$ 130.00	million bond
Swap Agreement Dollar Rate =	7.00%	
Swap Agreement Receipt =	100	Euro million bond
Swap Agreement Euro Rate =	6.00%	

Time	Forward Exchange Rate ($/€)	Received Dollar Interest ($)	Pay UnHedged Euro Interest (€)	Pay UnHedged Euro Interest ($)	Net Cash Flow ($)	Present Value of the hedged Cash Flows ($)
1	1.3200	9.10	6.00	7.92	1.18	$1.11
2	1.3400	9.10	6.00	8.04	1.06	$0.94
3	1.3700	139.10	106.00	145.22	(6.12)	($5.14)
						($3.08)

Credit Default Swaps (CDS)

- Is a swap contract in which the protection buyer of CDS makes a series of payments to the protection seller and, in exchange, receives a payoff if a credit instrument (typically a loan or a bond) goes into default – like an insurance.- The payments (like premiums) are called "spread" - if the security defaults the seller pays the buyer the par value of the bond or loan in exchange of physical delivery of the bond or loan (though it could be cash too) – CREDIT EVENT

- Naked CDS (not owning the bonds) are done for speculation – side bet – synthetic long and short positions

- CDS can also be used in capital structure arbitrage.

- BDS (basket default swaps)

- Index CDS

- LCDS

History / Background

- Credit-Linked Notes – Bankers Trust / DB / Weinstein
- Probability of Default - $1mm for $10 million Principal
- Secondary market - $2mm if the Event of Default is most likely.
- LTCM 1997 – relatively-value trade - Russian Bond Default
- A big test of CDS market came in 2000, when the California utilities crisis struck and prices soared due to rampant shortages. Suddenly there is a real possibility that a number of large power companies could default. The implosion of Enron in late 2001 was another test of the market which demonstrated that the CDS market could withstand the default of major corporation. – function properly even under stress – skeptics were proven wrong.
- They become more sophisticated – used for arbitrage strategies – inefficiencies in the capital structure – debt and equity – relatively-value arbitrage trade

Example of CDS contract:

Notional Amount = $ 100.00 million

Time (six months)	Lender A that receivesLIBOR SPREAD	Lender A that pays CDS Rate based on Forwards	Cash Flow Received from borrower ($ mm)	CDS cost paid to counterparty ($ mm)	Cash Flow Received ($ mm)
0					
1	3.00%	2.00%	3.00	2.00	1.00
2	3.00%	2.40%	3.00	2.40	0.60
3	3.00%	3.25%	3.00	3.25	(0.25)
4	3.00%	4.00%	3.00	4.00	(1.00)
5	3.00%	4.00%	3.00	4.00	(1.00)

Valuation of Credit Default Swaps

Using John Hall's method given default and recovery rates:

Valuation of Credit Default Swap (CDS) - John Hall's method

Assumptions:

Notional=	$ 1,000
Risk Free Rate=	5%
Prob. Of Default=	2%
Recovery Rate=	40%

PV of Payments = PV of Payoff

Payments by CDS Buyer (Buyer of protection)

PAYMENT

Time	Expected Payments: Discount Factor (comp. e)	Prob of Survival	PV of Exp. Payments	Expected Accrual: Expected Accrual	PV of Exp. Accrual
0.5				1.00%	0.010
1.0	0.951	98.0%	0.932		
1.5				0.98%	0.009
2.0	0.905	96.0%	0.869		
2.5				0.96%	0.008
3.0	0.861	94.1%	0.810		
3.5				0.94%	0.008
4.0	0.819	92.2%	0.755		
4.5				0.92%	0.007
5.0	0.779	90.4%	0.704		
		TOTAL=	4.070	TOTAL=	0.043

Payoffs by CDS seller (protection seller)

EXPECTED PAYOFF

Probability of Default	Discount Factor (comp. e)	% of Notional	PV of:
2.00%	0.975	1.20%	0.012
1.96%	0.928	1.18%	0.011
1.92%	0.882	1.15%	0.010
1.88%	0.839	1.13%	0.009
1.84%	0.799	1.11%	0.009
			0.051

Per $1 Notional

Total Exp. Pmt

Total 4.113

Exp. Payments = 4.113
Exp. Payoff = 0.051
Solve spread (s) (Exp. Pmt x Spread = Exp./ Payoff)= 0.01242488 → 124.25 bps

Insurance Payment