What are Swaps?

Advanced Corporate Finance

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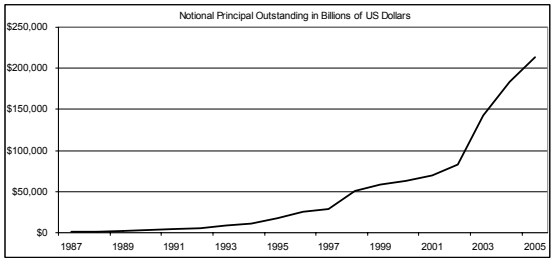
Basic Idea of Swaps

- A "swap" is a mutually beneficial exchange of cash flows associated with a financial asset or liability.
  - Firm A gives Firm B the obligation or rights to something it no longer wants to pay or receive in exchange for something it is more willing to pay or receive.
- A non-finance example … I have signed up for the "Wine of the Month Club" and you have signed up for the "Beer of the Month Club". As hockey season starts, I would like to have beer and you would like to have wine so we "swap". You give me the beer you receive and, in exchange, I give you the wine that I receive.

What are Swaps?

- An agreement between two parties to exchange (or "swap") cash flows in the future.
- Initially based on the idea of "parallel loans":
  - Two parties take out loans. For example, party A borrows at a fixed interest rate and B at a floating rate.
  - A swap occurs if party B makes the fixed payments for A and A the floating for B.
  - Formally: one party agrees to pay the floating interest payment on the "notional principal" and receive the fixed interest payment on the same "notional principal". The other party does the opposite. There is generally no exchange of principal.

Size of Swap Market (billions of USD)



Source: International Swap and Derivatives Association

History of Swaps

- An early form of swaps was developed to circumvent foreign exchange controls during the 1960s and 1970s.
  - For example, there were heavy taxes on the conversion of some currencies so it was very expensive to move currencies across national borders, especially the UK.
  - How could a firm finance operations outside of the UK without converting currencies?
- Consider a UK firm with a US subsidiary. If the US subsidiary needs financing, what were the alternatives?
    - UK parent could borrow in the UK, convert the £'s to US dollars and provide this to its subsidiary. But this conversion was heavily taxed!
    - US subsidiary could borrow directly, but it may have a poor (or no) credit rating in the US. Also costly!
  - Solution?

History of Swaps cont'd

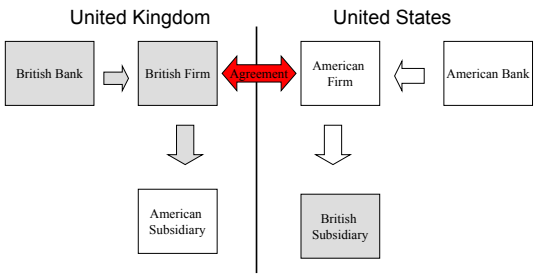
- If a US firm with a UK subsidiary had the same problem, the parent firms could borrow in their own countries and lend to the other firm's subsidiary to avoid conversions.

The cashflows *<u>for the U.S. parent firm</u>* would be:

Year	0	1	2	3	4	5
Get $ loan from US bank	*$2m*	*-$0.2m*	*-$0.2m*	*-$0.2m*	*-$0.2m*	*-$2.2m*
Make $ loan to UK sub	-$2m	$0.2m	$0.2m	$0.2m	$0.2m	$2.2m
Sub gets £ loan from UK firm	£1m	- £0.1m	- £0.1m	- £0.1m	- £0.1m	- £1.1m
Net position	£1m	- £0.1m	- £0.1m	- £0.1m	- £0.1m	- £1.1m

(Note: the US firm now has a loan in British Pounds, as desired, and its payments are based on the UK firm's AAA rating. Similarly, the UK firm has a loan in $'s based on the US firm's AAA rating)

Parallel Loans vs. Currency Swaps



Difficulties of Parallel Loans

- Firms must find a partner where:
  - Relative size of both projects must be similar (e.g. the notional principal must be similar).
  - Two firms in the appropriate countries must have opposite interests.
- Considerable legal detail must be discussed due to the nature of all of the debt contracts and the corresponding payment obligations.
- Effect on financial statements must be “tolerable”.

Types of Swaps

- There are many different types of swaps. In theory, one can swap (or exchange) cashflows generated from ***any*** type of financial asset for those generated from another.
  - Is there a catch?
- Both sides must feel they are benefiting from the trade (i.e., they must be “happy”) since they did not have to do the swap.
- The first swaps were used to circumvent the foreign exchange controls and thus swapped the payments on loans in different currencies.

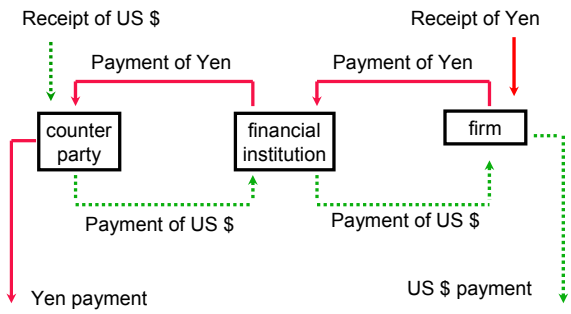
Foreign Currency Swaps

- A contractual agreement between two parties to swap payments of different currencies in the future.
- Each party agrees to exchange a specific amount of one currency for a specific amount of another currency at pre-defined intervals (Note: like a series of forwards).
  - For example, A will pay ¥4.75 billion to B in exchange for £20 million every 6 months for the next 2 years.
- The size of the payments is based on a "notional principal" and agreed upon swap rates (e.g., interest rates).
  - The expected value of each side's payments are equal.
  - Both sides must be "happy" with the terms.

Foreign Currency Swaps

- Foreign Exchange Swap
  - It is similar to one or more forward contracts where the parties are transacting with each other to swap future cashflows in one currency for the reverse at some other point in the future.
- Currency Swap
  - Similar to the original parallel loan agreements. Both parties take out loans in their home country (usually fixed rate), exchange the principal, swap the payments and re-exchange the principal at the end. Increases access to global capital markets.

Foreign Currency Swap



Evolution of Swaps

- As foreign exchange restrictions were relaxed in the mid-1970s, the use of parallel loans (essentially currency swaps) decreased.
- The interest rate swap market really started to develop in the early 1980s because of differences in U.S. dollar interest rates inside and outside of the U.S.
  - The Fed had a tight monetary policy so interest rates in the US were very high, but they were much lower on Eurodollars which were not subject to Fed restrictions.
- Interest rate swaps were a way to decrease borrowing costs.
  - US-based firms would borrow in the Eurocurrency market and swap this for a European bank's US dollar loan in the US.

Eurocurrency Market Review

- Originally centered in London. Now also in Bahamas, Singapore, Hong Kong, US, and Japan
- Started in London with borrowing/lending $US outside the US and British Pounds outside the UK.
  - Now it involves almost all major currencies outside their home country.
- Main advantages: less government regulation, less disclosure, more anonymity and less conditions on borrowing.
- Main disadvantages: less government regulation, less disclosure, more anonymity and less conditions on borrowing.
- Most common quote: LIBOR
  - rate at which London banks will lend to each other

Definition of Interest Rate Swaps

- A contractual agreement between two parties to exchange (or "swap") cash flows according to a pre-determined formula at pre-determined dates in the future.
- The "formula" was initially based on the notion of "parallel loans".

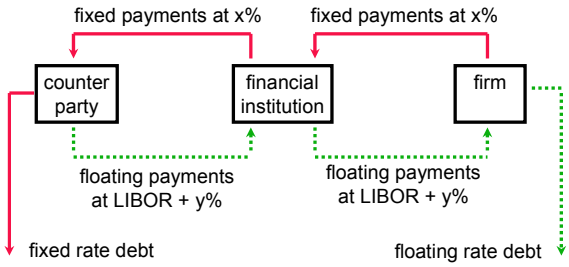
– If party A borrows at a fixed interest rate and party B borrows at a floating rate, a swap occurs if party B makes the fixed payments for A and A the floating for B.

– Formally: one party agrees to pay the floating interest payment on the "notional principal" and receive the fixed interest payment on the same "notional principal". The other party does the opposite. There is generally no exchange of principal.

Interest Rate Swaps

- Each party agrees to make the interest payments on the other's debt. The rates are set so the expected value of each party's future payments are equal (i.e., so both sides are "happy").
- The size of the payments is based on a "notional principal" and agreed upon interest rates.
  - Actual payments are typically "netted".
- Each party remains legally liable for its original debt.

Plain Vanilla Interest Rate Swap



Numerical Example (Plain Vanilla Swap)

Without Swap

	Fixed Rate Financing	Floating Rate Financing	Seeks
Co. A (AAA rated)	12%	Prime + 2.5%	Floating
Co. B (BBB rated)	14%	Prime + 3.5%	Fixed

With Swap

⇐ Fixed Rate Payments at 13.5%

Company A — Company B

Floating Rate Payments at Prime + 3.5% ⇒

⇓ — ⇓

Fixed Rate Financing at 12% — Floating Rate Financing at Prime + 3.5%

- Each company has borrowed at the best rate that they could and they are swapping payments. Are they "happy" with this arrangement?

Swap Example (Plain Vanilla cont'd)

To see that both sides are "happy" consider their payments:

Company A:	Pays its lender	+12% (fixed rate)
	Pays floating to Company B	+(Prime + 3.5%)
	Receives from Company B	-13.5%
	Net being paid by A	Prime + 2% (vs Prime+2.5%)
Company B:	Pays its lender	+Prime + 3.5% (floating)
	Pays fixed to Company A	+13.5%
	Receives from Company B	- (Prime + 3.5%)
	Net being paid by B	13.5% (vs. 14.0%)

- Both are paying less interest than they would have without the swap AND they have the type of interest payments they wanted!

Swap Example (Plain Vanilla cont'd)

- Would A have swapped if it had only been promised 13.25% in return for paying Prime + 3.5%? If it had been promised 13.75%?
  - What about B, how would it feel about these new terms?

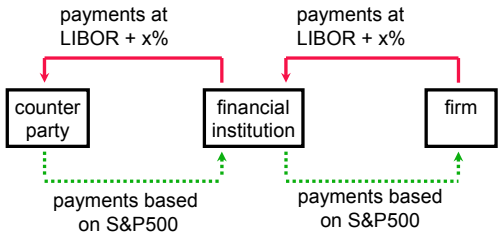
Company A:	Pays its lender	+12% (fixed rate)
	Pays floating to Company B	+(Prime + 3.5%)
	Receives from Company B	-13.25%
	Net being paid by A	Prime + 2.25% (vs Prime+2.5%)
Company B:	Pays its lender	+Prime + 3.5% (floating)
	Pays fixed to Company A	+13.25%
	Receives from Company B	- (Prime + 3.5%)
	Net being paid by B	13.25% (vs. 14.0%)

- How do you think these terms are determined?

Total Return Swap

- A contractual agreement between two parties to receive or pay cashflows to one another from different financial securities at regular intervals.
  - Each party agrees to exchange the cashflows it receives from one financial asset for those received by the other party from a different financial asset.
- The size of the payments is based on a "notional principal" combined with the rate of return on one financial security (e.g. the S&P500) being swapped for the return on another security (e.g. LIBOR).

Total Return Swap



Swap Payments

- Payments are structured such that both sides of the deal are "happy" with the expected values they will pay or receive based on the contract.
- The value of each part should be at least as good if not better than they could have had without the swap.
- We can solve for the fixed interest rate "loan" whose present value is equal to the *expected* present value of the floating interest rate "loan".
  - *Note: as interest rates change, one party will benefit and the other will lose.*
- The expected values are based on the best available information.
  - May be extracted from the yield curve or from the forwards market.

Example 1: Plain Vanilla Swaps

- Have a 3 year $10 million loan at LIBOR plus 1% to be paid every 6 months.
- Investment bank proposed a swap to pay a fixed 9.75% every six months on a "notional principal" of $10 million for three years.

For the floating rate loan the ***forecasted*** interest expenses are:

	LIBOR	Interest Expense	Expected Payment
Today	8.00%	9.00%	$450,000
6 Months	8.50%	9.50%	$475,000
12 Months	9.00%	10.00%	$500,000
18 Months	9.25%	10.25%	$512,500
24 Months	9.40%	10.40%	$520,000
30 Months	8.50%	9.50%	$475,000

For the fixed rate loan the expected costs are:

every 6M		9.75%	$487,500

Example 1 cont'd

	Net Cash flows	Discount Rate	PV of Cashflows
Today	-$37,500	9.75%	-$37,500
6 Months	-$12,500	9.75%	-$11,932
12 Months	$12,500	9.75%	$11,390
18 Months	$25,000	9.75%	$21,744
24 Months	$32,500	9.75%	$26,982
30 Months	-$12,500	9.75%	-$9,906
		Total	**$777.36**

- Why net cashflows?
- Why is the discount rate 9.75%?
- Is this swap fairly priced? Would you enter into it?

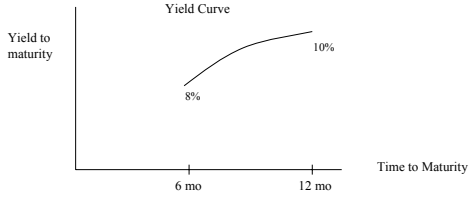
Example 2: Pricing a Swap

Assume:

- Notional principal = $100
- Maturity = 1 year
- Floating rate = LIBOR
- Payments = semi-annual
  - What would be the corresponding fixed rate with the same semi-annual payment arrangement for this swap?

Example 2 cont'd

- How to estimate the floating payments?



- For LIBOR with:
  - 8% annualized rate for 6 month LIBOR
  - 10% annualized rate for 12 month LIBOR

Example 2 cont'd

- First payment is based on 6 month LIBOR:
  100[(0.08/2)] = $4.00
- Second payment?
  - To be indifferent between rolling over after 6 months and investing for 1 year from the outset:

$$(1 + R_{0 \text{ to } 12}) = (1 + \tfrac{1}{2} R_{0 \text{ to } 6}) (1 + \tfrac{1}{2} R_{6 \text{ to } 12})$$

$$(1 + 0.10) = (1 + \tfrac{1}{2}(0.08)) (1 + \tfrac{1}{2} R_{6 \text{ to } 12})$$

$$(1 + \tfrac{1}{2} R_{6 \text{ to } 12}) = (1 + 0.10)/(1 + 0.04)$$

$$R_{6 \text{ to } 12} = 11.5\%$$

  - Second payment is 100 [(0.115/2)] = $5.75

Example 2 cont'd

- What fixed rate is equivalent to this?
  - The discounted value of the floating rate "loan" payments:

[100(0.08/2)] / (1 + 0.08/2) + [100(0.115/2)] / (1 + 0.10) =
$4/(1.04) + $5.75/(1.10) = $9.07

  - If the swap is properly priced, the discounted value of this should be equal to the discounted value of the fixed rate "loan":

$$\$9.07 = 100(x/2)/(1 + x/2) + 100(x/2)/(1 + x)$$

$$x = 9.71\%$$

  - Note: this is the semi-annual rate whereas 10% was for an annual payment.

Example 3: Valuing a Swap

Alternatives:
1) take out a Pound Term loan, or
2) issue a EuroECU bond and swap the Euros to Pounds.

1) The Pound Term Loan:

- the principal was £100M with repayment at the end of 5 years.
- the payments were £3.75M every 6 months for 5 years.

What is the actual, all-in interest rate for this loan?

$$£100M = £3.75M/(1+r) + £3.75M/(1+r)^2 + \ldots + £103.75M/(1+r)^{10}$$

- Using an internal rate of return (IRR) calculation, the semi-annual rate of return for this loan is 3.75%.
  - the corresponding annualized rate is: $(1.0375)^2 = 1.0764$ or 7.64%.

Example 3 cont'd

2) For the five year EuroECU Bond:

- the principal is €160M to be repaid at the end of five years
- the payments are €12.5M every year for 5 years

What is the actual interest rate being paid on this loan?

$€160M = €12.5/(1+r)^1 + \ldots + €12.5/(1+r)^5 + €160/(1+r)^5$

- The IRR or the cost of the €160 M bond is 7.81 % (already an annualized rate of return since the payments are made annually).
- Given these costs, it appears that this company would simply want to take the Pound term loan – the interest rate (IRR) is lower.
  - Is there anything else to consider?

Example 3 cont'd

- To compare "apples to apples", we need to compare loans in the same currency.
- The proposed swap has:
  - A British firm willing to make the €12.5M annual payments and pay €160M in 5 years in exchange for £3.65M every six months and £100M in 5 years.
- The cost of the swapped pound loan would be:

$£100M = £3.65M/(1+r)^1 + \ldots + £3.65M/(1+r)^{10} + £100M/(1+r)^{10}$

- The IRR for this is 3.65% semi-annually or 7.43% annually. This is better than the term loan!
- Why would anyone be willing to take the other side of this swap?

Example 3 cont'd

- If the firm on the other side can borrow pounds at 7.20% and it is receiving £3.65 M every 6 months, this is a good thing for this firm. Why?
- For this firm, the £3.65M payments can finance more than a £100M loan.
  - It could finance about £103.2 M with these payments.
  - The £103.2M is the "notional" principal for the British firm.
  - At the current spot rate of 1.60 ECU/£ this is equivalent to the British firm having received a loan with a "notional principal" of about €165.1M.
  - On this loan it is making annual payments of 12.5M ECU and at the end it has to make a payment of interest and principal of 172.5M ECU:

$€165.1M = €12.5M/(1+r)^1 + \ldots + €12.5M/(1+r)^5 + €160M/(1+r)^5$

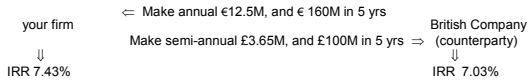
- The British firm has an all-in-cost of about 7.03% per annum.

Example 3 cont'd

Without Swap, your choices are

	Fixed Rate Financing	IRR
Pound Term Loan	Principal £100M, semi-annual £3.75M, repayment 5 yrs	7.64%
Euro Bond	Principal €160M, annual €12.5M, repayment 5 yrs	7.81%

With Swap, your interest rate becomes



- Both are paying less interest than they would have without the swap AND they have the type of interest payments they wanted! But, our firm now has a bond in Euros on its Balance Sheet.

Swap Pro's and Con's

- Advantages:
  - Simplicity
  - Cost-effective
  - Flexibility to change our economic exposure
  - Accounting treatment
- Disadvantages
  - Credit risk (counter-party risk)
  - Timing risk