

What are Swaps?

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"I'll trade you two of my chocolate bars for five of your cigarettes."

Basic Idea of Swaps



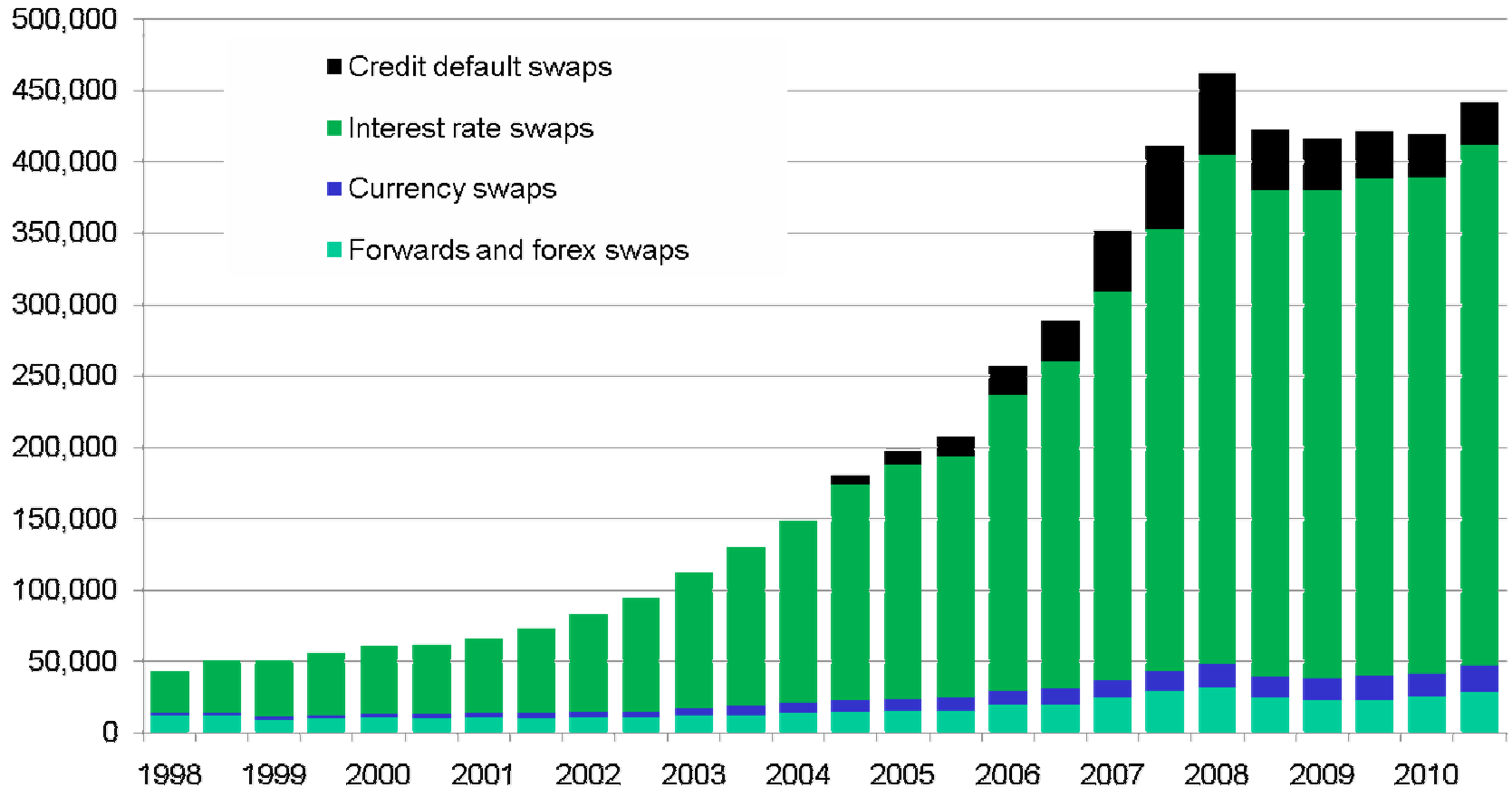
- A non-finance example ... I have signed up for the “Wine of the Month Club” and you have signed up for the “Beer of the Month Club”. As the hockey season approaches, I would like to have beer and as winter approaches you would like to have wine so we “swap”. You give me the beer you receive and, in exchange, I give you the wine that I receive.
- Here 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.

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 party A makes the floating payments 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

(notional amounts, billions of USD)



Source: International Swap and Derivatives Association

Hutchison Whampoa Limited

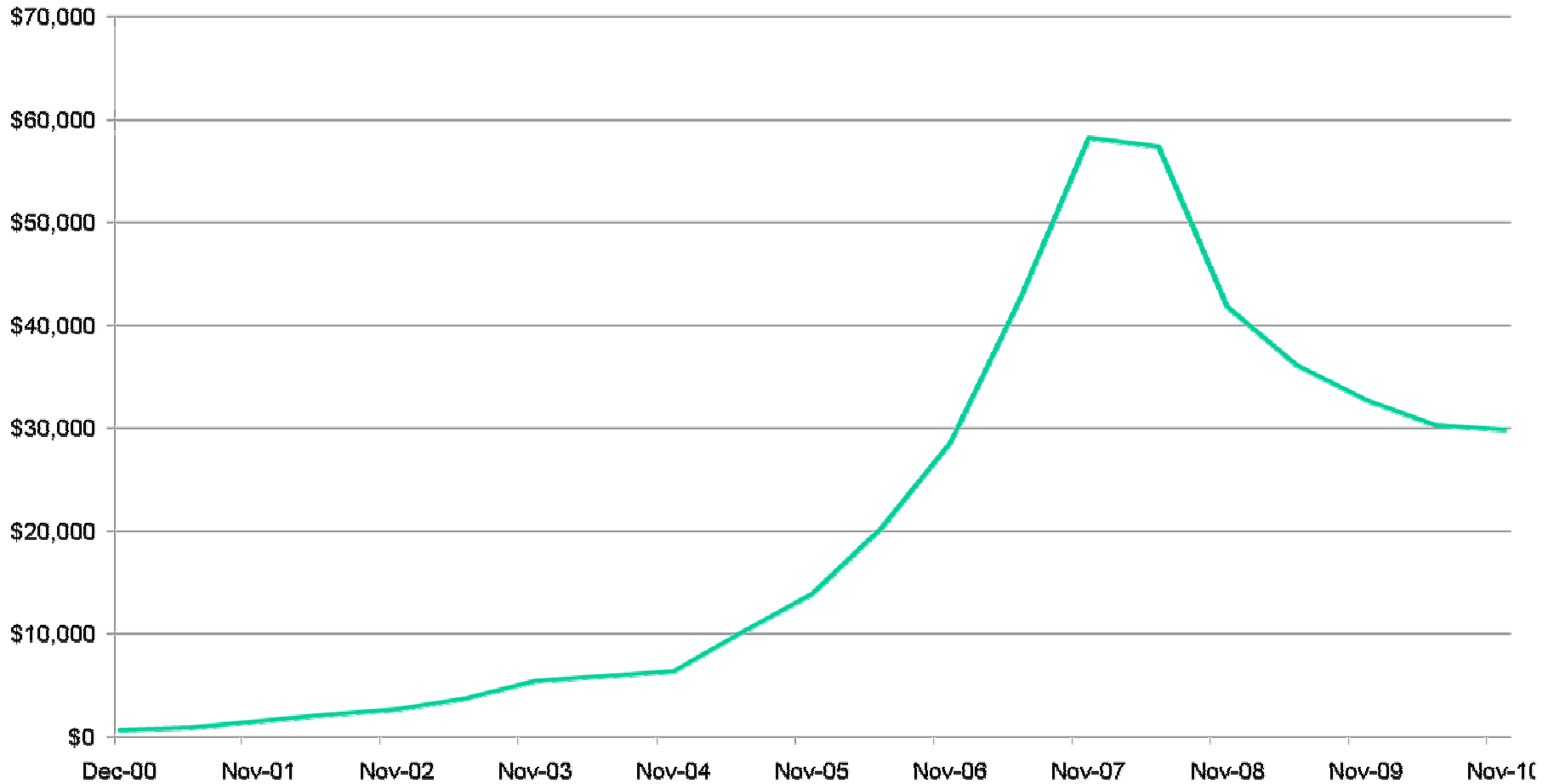
2010 Annual Report (Capital Resources and Liquidity section)

Interest Rate Exposure

The Group manages its interest rate exposure with *a focus on reducing the Group's overall cost of debt and exposure to changes in interest rates*. When considered appropriate, the Group uses derivatives such as interest rate swaps and forward rate agreements to manage its interest rate exposure. The Group's main interest rate exposure relates to US dollar, British Pound, Euro and HK dollar borrowings.

At 31 December 2010, approximately *40% of the Group's total principal amount of bank and other debts were at floating rates and the remaining 60% were at fixed rates*. The Group has entered into various interest rate agreements with major financial institution counterparties to swap approximately HK\$71,300 million principal amount of fixed interest rate borrowings to effectively become floating interest rate borrowings. In addition, HK\$4,270 million principal amount of floating interest rate borrowings were swapped to fixed interest rate borrowings. *After taking into consideration these interest rate swaps, approximately 67% of the Group's total principal amount of bank and other debts were at floating rates and the remaining 33% were at fixed rates at 31 December 2010.*

Credit Default Swap (CDS) Market (notional amounts, 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.
 - There were heavy taxes on the conversion of some currencies so it was very expensive to move currencies across national borders. This was the case in 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 these to its subsidiary. But this conversion was heavily taxed!
 - US subsidiary could borrow itself in the US directly, but it may have a poor (or no) credit rating in the US. Also costly!
- Solution?

History of Swaps cont'd

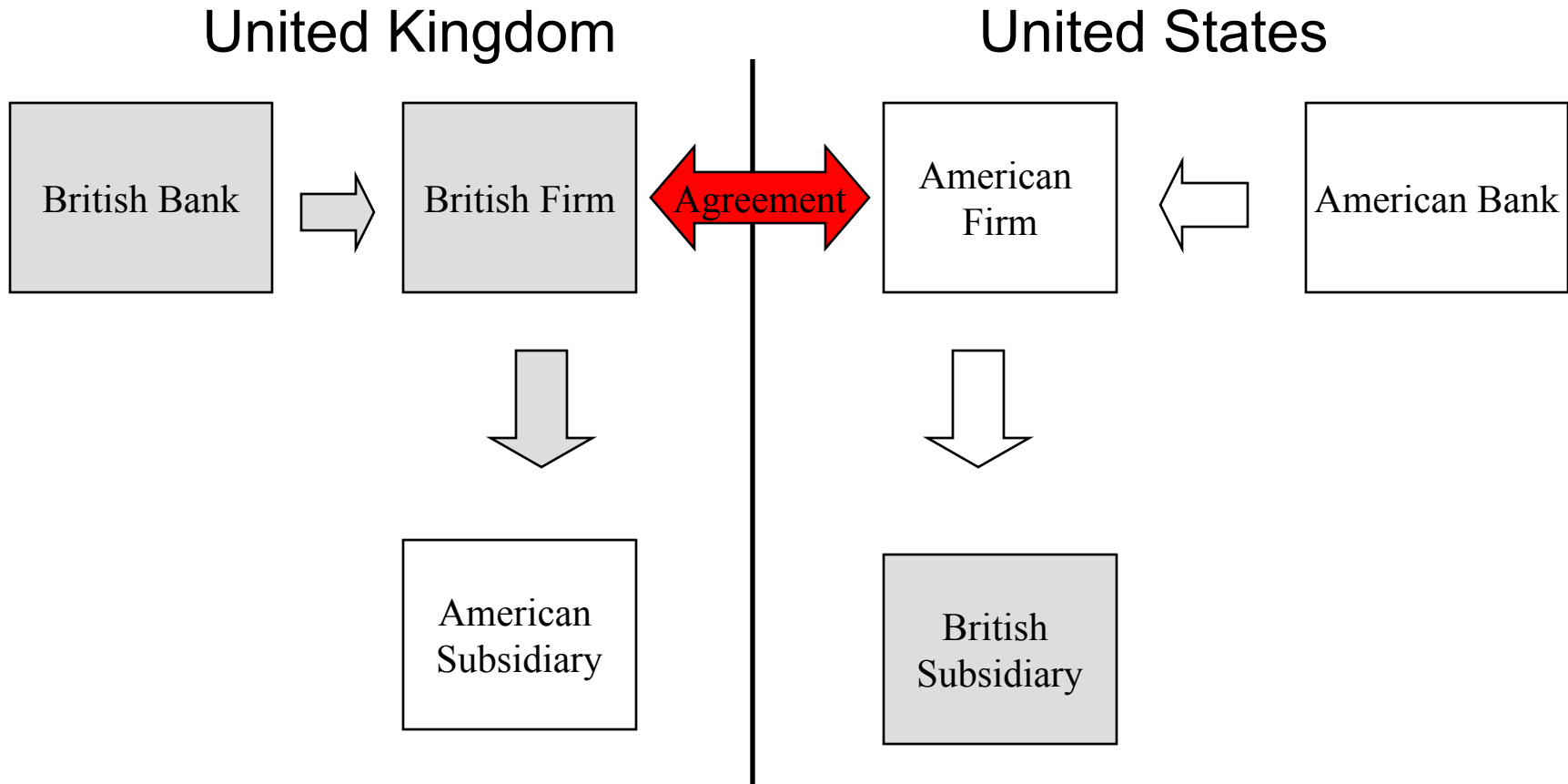
- If a US firm with a UK subsidiary had the same problem, the parent firms could borrow in their own countries and lend to the other firm's subsidiary to avoid conversions.

The cashflows for the U.S. parent firm 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



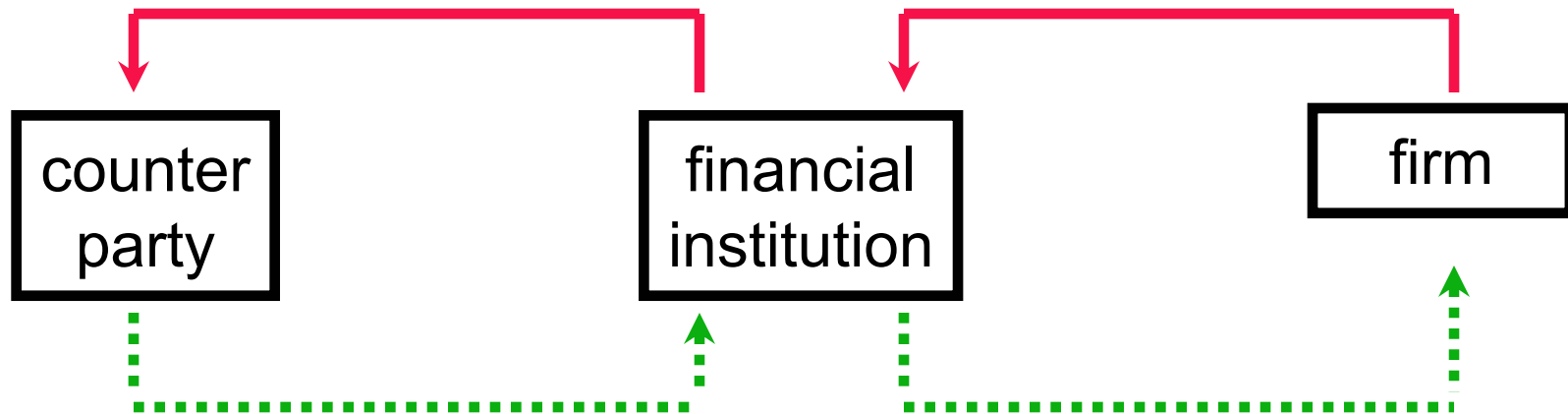
Difficulties with Parallel Loans

- Firms must find a partner where:
 - The firms must be in the appropriate countries and have almost perfectly opposite interests.
 - For example, the relative size of both projects (i.e. the notional principals) and the maturities must be similar.
- Considerable legal detail must be worked out – there are a large number of debt contracts and 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 any other.
 - 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 → they swapped the payments on loans in different currencies.

General Outline of a Swap



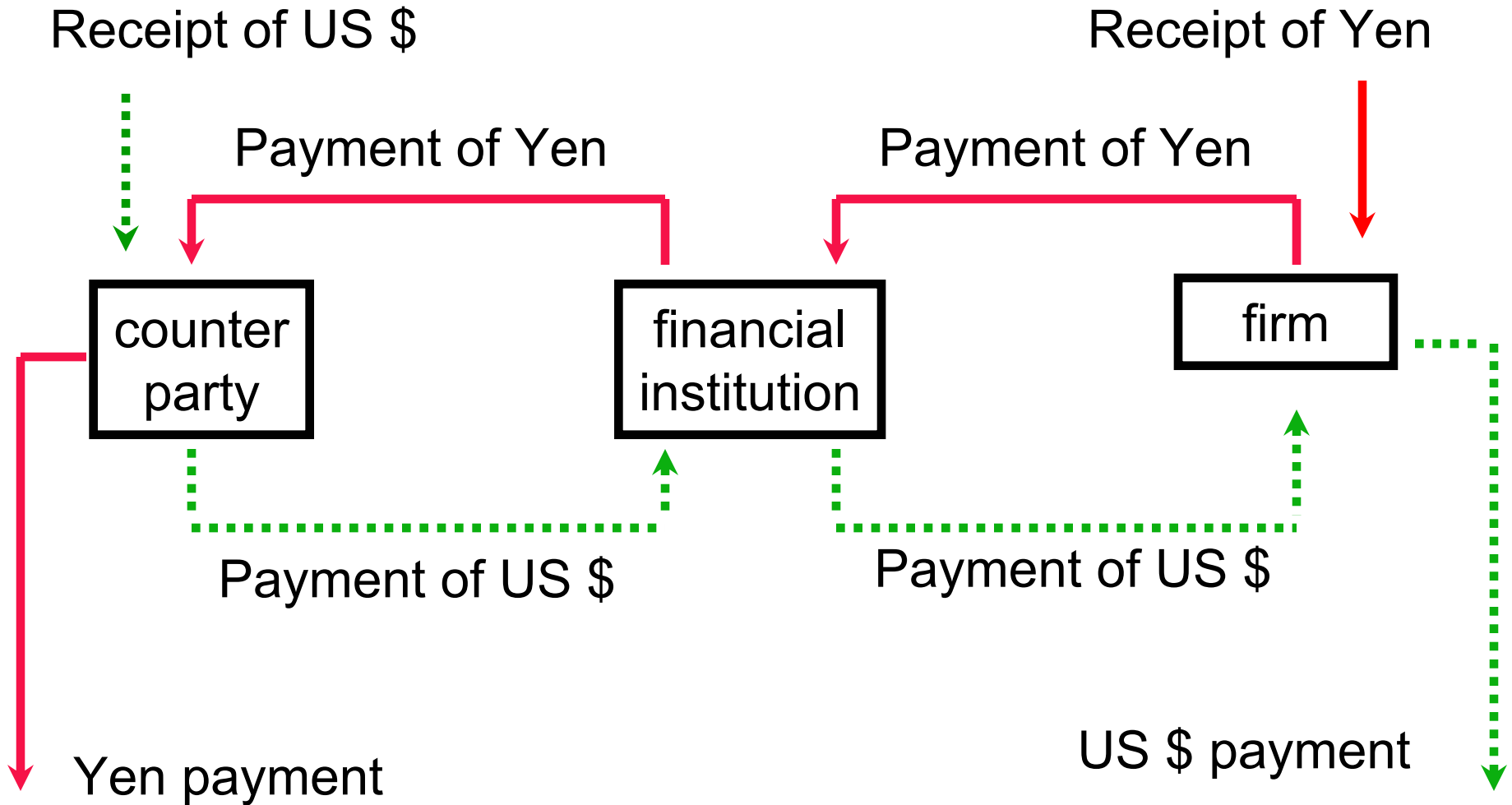
Foreign Currency Swaps

- 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 or future exchange 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 swap market started to develop in the early 1980s because of differences in US dollar interest rates inside and outside of the US.
 - The Fed had a tight monetary policy so short-term 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, for example, in the Bahamas, Singapore, Hong Kong, US, and Japan
- Started in London with borrowing/lending US\$ outside the US and for 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

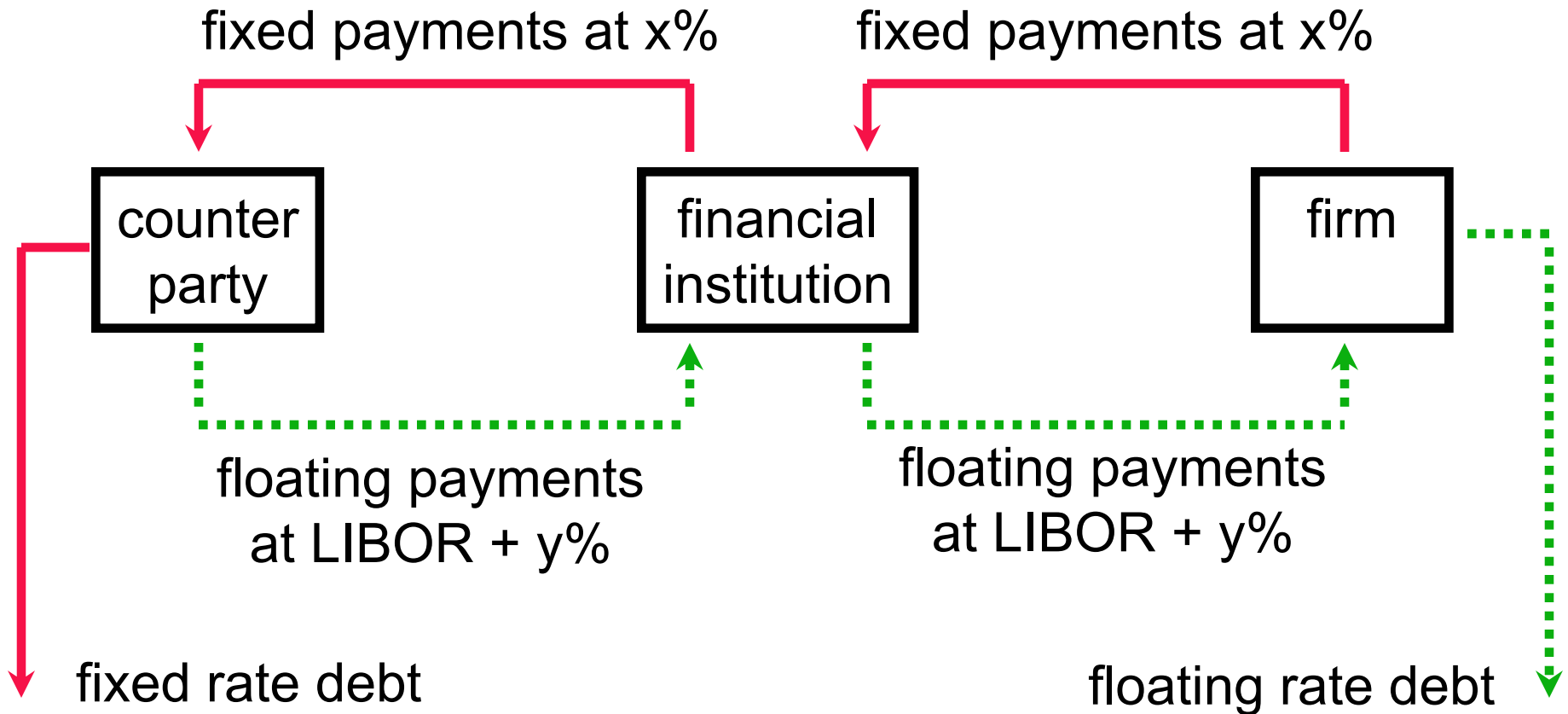
Definition of Interest Rate Swaps

- 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

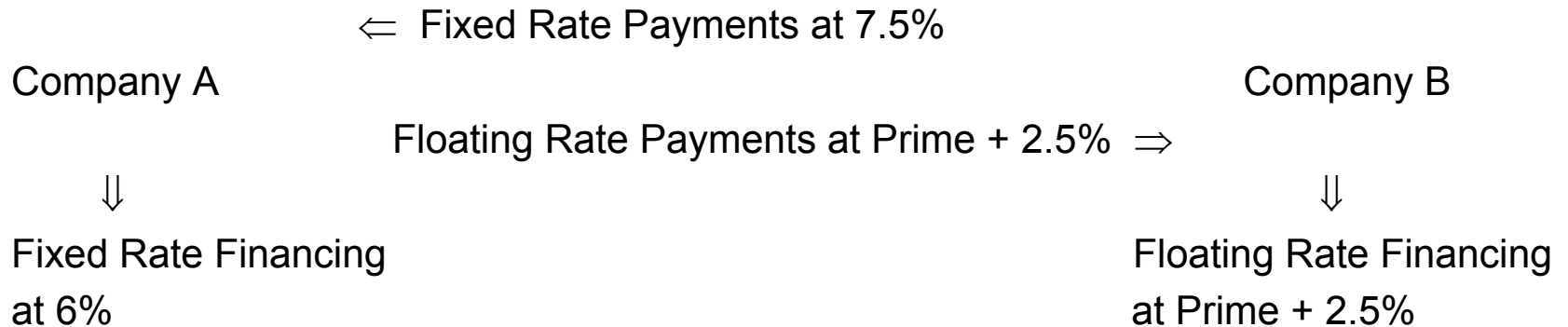


Numerical Example (Plain Vanilla Swap)

Without Swap

	<u>Fixed Rate Financing</u>	<u>Floating Rate Financing</u>	<u>Seeks</u>
Co. A (AAA rated)	6%	Prime + 1.5%	Floating
Co. B (BBB rated)	8%	Prime + 2.5%	Fixed

With Swap



- 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	+6% (fixed rate)
	Pays floating to Company B	+(Prime + 2.5%)
	<u>Receives from Company B</u>	<u>-7.5%</u>
	Net being paid by A	Prime + 1% (vs Prime+1.5%)

Company B:	Pays its lender	+Prime + 2.5% (floating)
	Pays fixed to Company A	+7.5%
	<u>Receives from Company B</u>	<u>-(Prime + 2.5%)</u>
	Net being paid by B	7.5% (vs. 8.0%)

- 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 **7.25%** in return for paying Prime + 2.5%? If it had been promised 7.75%?
 - What about B, how would it feel about these new terms?

Company A:	Pays its lender	+6% (fixed rate)
	Pays floating to Company B	+(Prime + 2.5%)
	<u>Receives from Company B</u>	<u>-7.25%</u>
	Net being paid by A	Prime + 1.25% (vs Prime+1.5%)

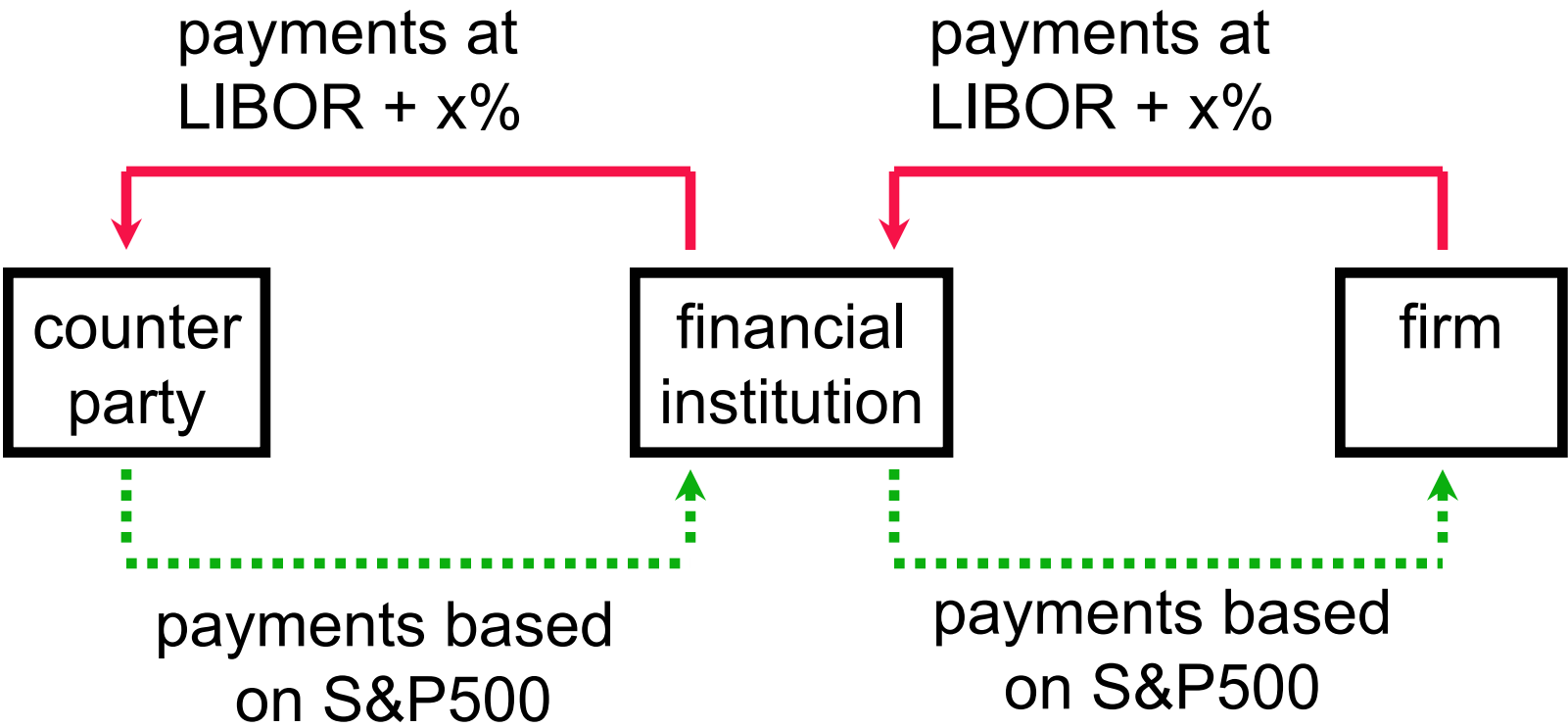
Company B:	Pays its lender	+Prime + 2.5% (floating)
	Pays fixed to Company A	+7.25%
	<u>Receives from Company B</u>	<u>-(Prime + 2.5%)</u>
	Net being paid by B	7.25% (vs. 8.0%)

- How are these terms 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 “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 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
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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
			<hr/>
			Total \$777.36

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

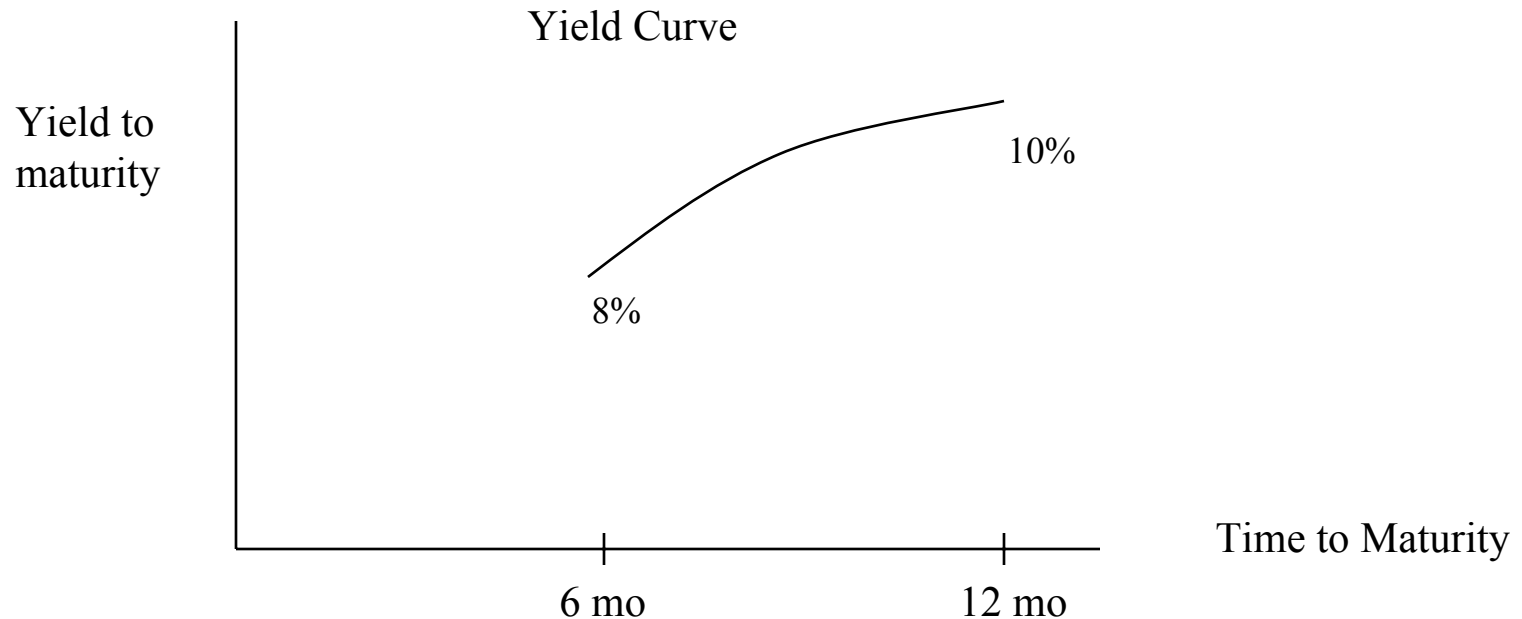
Example 2: Pricing a Swap

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:

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

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

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

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

- 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:

$$\begin{aligned} & [100(0.08/2)] / (1 + 0.08/2) + [100(0.115/2)] / (1 + 0.10) = \\ & \$4/(1.04) + \$5.75/(1.10) = \$9.07 \end{aligned}$$

- 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?

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

- 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?

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

- 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:

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

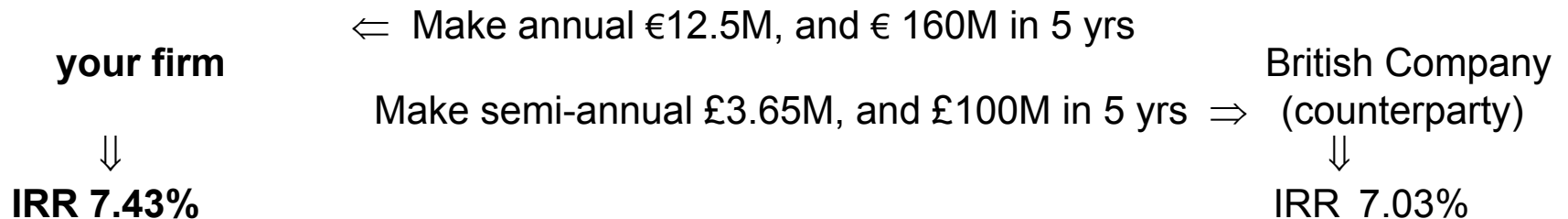
- The IRR for this is 3.65% semi-annually or 7.43% annually. This is better than the term loan!

Example 3 cont'd

Without Swap, your choices are

	<u>Fixed Rate Financing</u>	<u>IRR</u>
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



- Note: 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
 - Off-balance sheet
- Disadvantages
 - Credit risk (counter-party risk)
 - Timing risk
 - Balance sheet effects – economic versus accounting exposure