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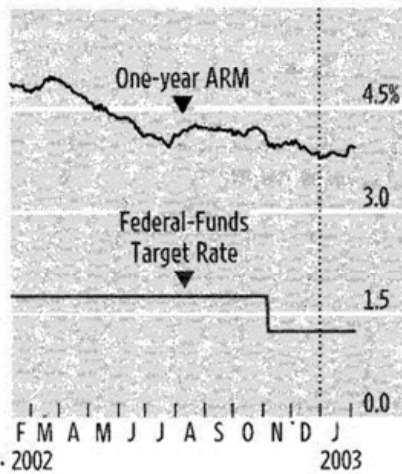
# Swaps

- Mechanics of Interest Rate swaps
- Swap Quotes and LIBOR zero rates
- Valuing interest rate swaps
- Currency swaps

## INTEREST RATES & BONDS

### Consumer Rates

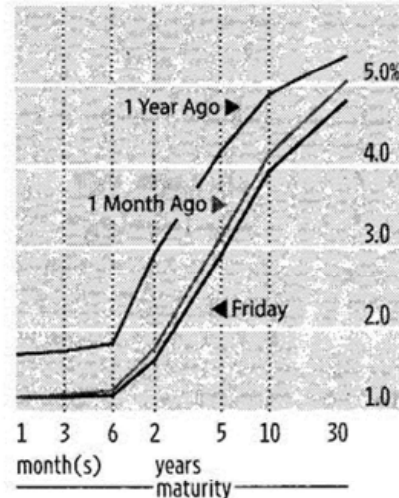
Benchmark personal borrowing rate vs. Federal-funds target rate, the interest rate on overnight loans between banks.



	NAT'L AVG	WK'S CHG
Credit card	13.80%	...
Money market APY	1.42	-0.01

### Treasury Yield Curve

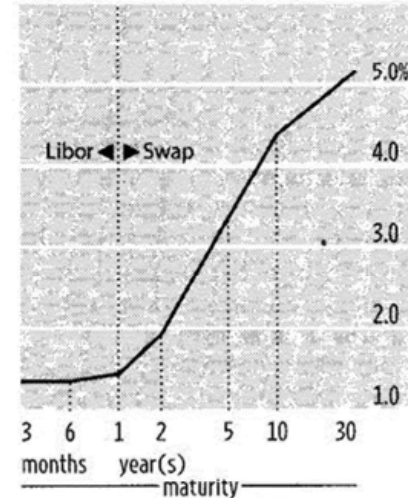
Yield to maturity of current bills, notes and bonds.



Source: Reuters

### Libor/Swap Curve

Counterparty receives (mid-market) semi-annual swap rates for 2 to 30 years and pays floating 3-month Libor.



Source: Prebon Yamane (USA)

### Major Bond Indexes

## 2 Swaps

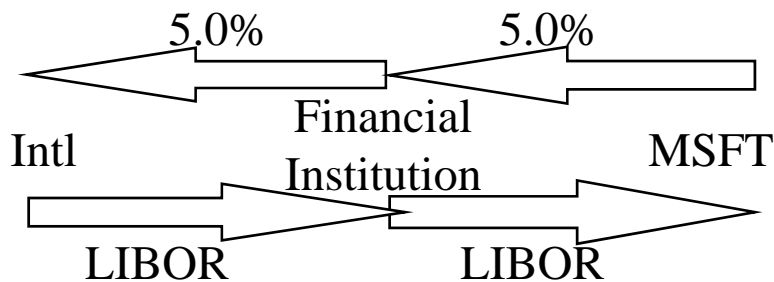
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- Swap – an agreement to exchange cash flows at specified future times.
  - used to convert liability (or investment) between fixed and floating rate.
  - Forwards are a simple swap that exchange just one cash flow.
  - Underlying may be currency, interest rates, stock or commodity
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- Market makers
  - Financial institutions (swap banks) usually make markets; 3-4 b.p. spread.
  - Hedge price risk of offered contracts (forwards/futures), bearing credit risk.
  - Back-to-back transaction –
- Additional issues
  - Floating rates “determined in advance and paid in arrears” and netted.
  - Principal on interest rate swaps not usually exchanged.
  - Confirmation – the legal agreement, facilitated by Intl Swap Derv Assoc.
  - Why swaps?
- Day counts – mostly ignored, but floating actual/360 and fixed actual/365.
  - Fixed pymts usually use actual day counts, so pymts may vary.

# 3 Swap in Interest Rates 1

- Plain Vanilla Interest Rate Swap - agreement on 3/1/07 that MSFT receives 6-mo LIBOR & pays fixed 5%/annum every 6-mo for 3 years (tenor) on *notional principal* of \$100M. (Fixed rate usually quoted as spread over 10-yr T-bond.
  - Note:
  - Intel:

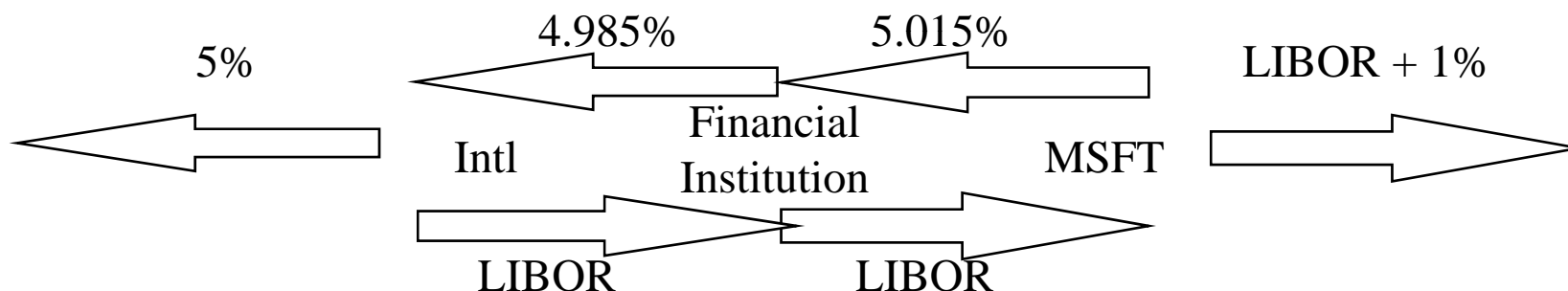
Date	LIBOR Rate	FLOATING \$CF	FIXED \$CF	Net \$CF on Swap
Mar.1, 2007	4.2%			
Sept. 1, 2007	4.8%	+2.10	-2.50	-0.40
Mar.1, 2008	5.3%	+2.40	-2.50	-0.10
Sept. 1, 2008	5.5%	+2.65	-2.50	+0.15
Mar.1, 2009	5.6%	+2.75	-2.50	+0.25
Sept. 1, 2009	5.9%	+2.80	-2.50	+0.30
Mar.1, 2010	6.4%	+2.95	-2.50	+0.45



## 4 Swap in Interest Rates 2

- Swap bank – generic term for financial institution serving as intermediary.
  - Swap bank may warehouse one side until offsetting party found (dealer).
  - Spreads avg 3-4 b.p. Cash flows on swap are:
 

MSFT Cash Flow:	LIBOR–5.015%
Intl Cash Flow:	4.985%–LIBOR
Dealer Cash Flow:	5.015%–4.985% = 0.03% on \$100M



- Swap markets are now huge. Why?
  - Maybe MSFT uses swap to offset floating loan (at, say LIBOR+1%).
  - If so, MSFT hedged CF:  $\text{LIBOR} - 5.015\% - (\text{LIBOR} + 1\%) = -6.015\%$ .
  - Why didn't MSFT just borrow fixed, rather borrow floating and swap?
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## 5 Swap Markets

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- Why might fixed rate on swap be lower than fixed rate on MSFT bonds?
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- (1) MSFT must reborrow principal every 6-mo (when floating rate reset).
  - Creditworthiness is reevaluated, and spread over LIBOR may be reset.
  - Firms with low credit ratings more likely to worsen, so risk-premium in long term rates is larger. Swap avoids long-term risks.
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- (2) Swap dealer's credit risk relates only to interest payments.
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- (3) Swap dealer will often require collateral from MSFT.
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- (4) Swaps with longer maturities may contain *credit triggers*
  - If credit falls below investment grade, counter party has right to demand cash payment to enable replacement with another swap counter-party.

# 6 Valuing Interest Rate Swaps as Bonds

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- Swap valuation as difference between floating and fixed rate bonds.
  - If receiving floating,  $V(\text{swap}) = B(\text{floating}) - B(\text{fixed})$
  - Fixed rate initially set so value is zero;
  
- Valuing in terms of bonds
  - Fixed side valued as PV of CF.
  - Floating rate bond worth par immediately after next pymt; add in pymt.
  - Usually discounted at LIBOR, denoted  $r_i$  (need zero LIBOR curve).
  - Let  $L$  be notional principal;  $k$  the fixed payment;  $k^*$  next floating pymt.

$$B(\text{floating}) = (L + k^*)e^{-r_1 t_1} \qquad B(\text{fixed}) = \sum_{i=1}^n k e^{-r_i t_i} + L e^{-r_n T_n}$$

- Q1: A financial institution has agreed to pay 6-mo LIBOR and receive 8%/annum s.a. on notional principal of \$100M for remaining 1.25 yrs. LIBOR rates for 3, 9, and 15-mo are 10%, 10.5%, 11% c.c. 6-mo LIBOR at last pymt was 10.2% s.a.
  
- A1:  $B(\text{fixed}) =$
- A2:  $B(\text{floating}) =$
- A3:  $V(\text{swap}) =$

## 7 More on Swaps

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- Swap can be valued in terms of FRA – each exchange is a FRA.
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- Notes on swaps
  - Swap fixed rate usually set “at-the-money”, so it costs nothing to enter.
  - Swap fixed rate will be weighted average of forward rates.
  - Over time, value changes. Falling rates erode value of pay fixed.
  - Company exposed to credit risk only when its value is positive.
  - I.e., counter-party might default only if its side has negative value.
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- More notes/risks in swaps
  - For portfolio mgr, swaps are cheaper than exchanging relevant bonds.
  - For borrowers, fast and easy method to restructure balance sheets.
  - Interest rate risk – exposure if swap bank has unhedged position.
  - Basis risk – possible if floating rates of two counterparties not on same index.
  - Credit risk – counterparty may default. Swap bank bears risk.
  - Mismatch risk –

# 8 Currency (Interest Rate) Swaps

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- Currency Swap – Converts CF in one currency to CF in another.
  - Ex: BP and IBM may enter an agreement where BP pays 11% on sterling principal of £10M & receives 8% (from IBM) on US\$ principal of \$15M annually for 5 years.
  
- Why are currency swaps popular?
  - (1) IBM can issue dollar denominated debt, but may want to fund a project in Britain and retire debt with pound denominated revenues.
  - (2) IBM may earn pounds on British investment, but wants \$.
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- Valuing Currency Swaps –
  - Valued same way as interest rate swaps.
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	Dollars \$	Pounds £
Years	-----millions-----	
0	-15.00	+10.00
1	+1.20	-1.10
2	+1.20	-1.10
3	+1.20	-1.10
4	+1.20	-1.10
5	+16.20	-11.10

## 9 Other types of Swaps

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- Other flavored interest rate swaps
  - Amortizing swap – notional principal is reduced over time; used to manage interest rate risk related to loans such as mortgages
  - Accreting swap – notional principal increases over time (construction finance)
  - Seasonal swap – notional principal varies according to fixed plan (retailers).
  - Roller coaster – notional principal increases then decreases.
  - Forward swap – swap that will begin at a future date.
  - Extension swap – extends the tenor of an existing swap
  - Basis swap – both floating, but on different indices (LIBOR vs T-bills).
  - Yield curve swap – both floating, but different maturities (T-bill vs 10-yr).
  - Constant maturity swap – Ex. LIBOR vs constant maturity 10-yr index.
  - Rate differential swap – payment in \$US on short rates in different countries.
  - Corridor swap – pay and receive only when LIBOR is between, say, 5%-7%
  - Capped and floored swaps – limit floating payments.
- Equity TR swaps – payments based on specified stock index. SP500 TR for 2.5%.
- Commodity swaps – payments based on price of a commodity.
  - Gold mining firms use swaps to hedge delivery of gold.
  - Also, swaps trade based on electricity, weather, natural gas...
- Swaptions – options to enter a swaps.

# 10 Summary on Swaps

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- Swap – an agreement to exchange cash flows at specified future times.
  - Market is now very large.
- Plain-vanilla interest rate swap
  - Notional principal not exchange
  - Floating rate “determined in advance and paid in arrears”.
  - Payments typically netted.
  - Large financial firms serve as market makers.
- Valuing interest rate swaps – you just need to be good at discounting.
  - Swap value is difference between PV of floating and PV of fixed sides.
  - If receiving floating,  $V(\text{swap}) = B(\text{floating}) - B(\text{fixed})$
  - Pretend principal exchanged (will cancel)
- There are many other kinds of swaps!