Swaps

Swaps

- like a forwards, but in series.

Example

100,000 barrels

- IP Inc. - need to buy oil in 1 yr and 2 yr

Forward price	$20	in 1 yr	6%	risk-free rate for 1 yr
	$21	in 2 yr	6.5%	" 2 yr

If we enter long in 2 forwards, we need to come up with cash

- 2 M in 1 yr.
- 2.1 M in 2 yr.

$$PV = \text{[illegible]}\ 2M\left(\frac{1}{1.06}\right) + 2.1M\left(\frac{1}{1.65}\right)^2$$

$$= \$3{,}738{,}300$$

Prepaid Swap : pay $3,738,300 ~~to~~ today, get 100,000 barrel in 1yr and in 2yr.

Swap

Pay X in 1yr for 100,000 barrel of oil.

X in 2yr for 100,000 barrel of oil.

where

$$\frac{X}{1.06} + \frac{X}{1.065^2} = \frac{20}{1.06} + \frac{21}{1.065^2} = 37.38300$$

$$X = \$20.483 \times 100{,}000$$

↑ 2yr swap price.

This is physical Settlement.

Financial Settlement.

pay $20.483 × 100,000 in 1yr + 2yr.

seller of this swap compensates the difference

	1yr	2yr
Swap Price	$20	$21
Spot price	$21	$20.5

notional amount

$1 − $.5 × 100,000

Market Value of a Swap

	1y	2y	
Agreed to pay	\$20.483	\$20.483	is stead of
	\$20	\$21	

Value of Swap = 0, until 1st swap is struck,

What if right after the agreement, Spot price of oil rises, and forwards are available at

\$22	1y
\$23	2y.

New swap $\quad \frac{22}{1.06} + \frac{23}{1.065^2} = \frac{X}{1.06} + \frac{X}{1.065^2}$

$$X = 22.483$$

Difference

$$\frac{2}{1.06} + \frac{2}{1.065^2} = 3.650$$

Value of old swap = 3.650

Interest Rate Swaps

XYZ Corp. $200M debt at floating-rate. LIBOR

London Inter-Bank offer rate

want fixed rate.

1. refinance with fixed-rate. (transaction cost)
2. may forward rate agreements (Cost will vary each year)
3. Interest rate Swaps.

P206 4 ways to present risk-free rates

Years	① Zero Coupon Yield	② Zero Coupon Bond Price	③ 1yr Implied Forward rate	④ Par Coupon (annual)	⑤ Continuously Compounded
1	6%	.943396	6%	6%	5.82689%
2	6.5%	.881659	7.00236%	6.48423%	6.29748%
3	7%	.816298	8.00705%	6.95483%	6.76586%

Year n	① Zero-Coupon Yield Yield Curve Spot rate	② Zero-coupon Bond Price PV of $1 in year n	③ 1yr Implied Forward rate
1	1.06	$\frac{1}{1.06}$	1.06
2	1.065	$\frac{1}{1.065^2}$	$\frac{1.065^2}{1.06}$
3	1.07	$\frac{1}{1.07^3}$	$\frac{1.07^3}{1.065^2}$

④ Par Coupon (annual)

Bond with PV = 1
Face = 1
Coupon = c

$$1 = c\left(\frac{1}{1.06}\right) + 1\left(\frac{1}{1.06}\right)$$

$$1 = c\left(\frac{1}{1.06}\right) + c\left(\frac{1}{1.065^2}\right) + 1\left(\frac{1}{1.065^2}\right)$$

$$1 = c\left(\frac{1}{1.06}\right) + c\left(\frac{1}{1.065^2}\right) + c\left(\frac{1}{1.07^3}\right) + 1\left(\frac{1}{1.07^3}\right)$$

⑤ Continuously Compounded

$\ln(1.06)$

$\ln(1.065)$

$\ln(1.07)$

Interest Rate Swaps

1yr Forward rate — we can lock in today.

use Fwd rate

① Zero-Coupon Yield	③ Fwd rate
6%	6%
6.5%	7.00236%
7%	8.00705%

$$\frac{R-6\%}{1.06} - \frac{R-7.0024}{1.065^2} - \frac{R-8.0070\frac{5}{}}{1.07^3} = 0$$

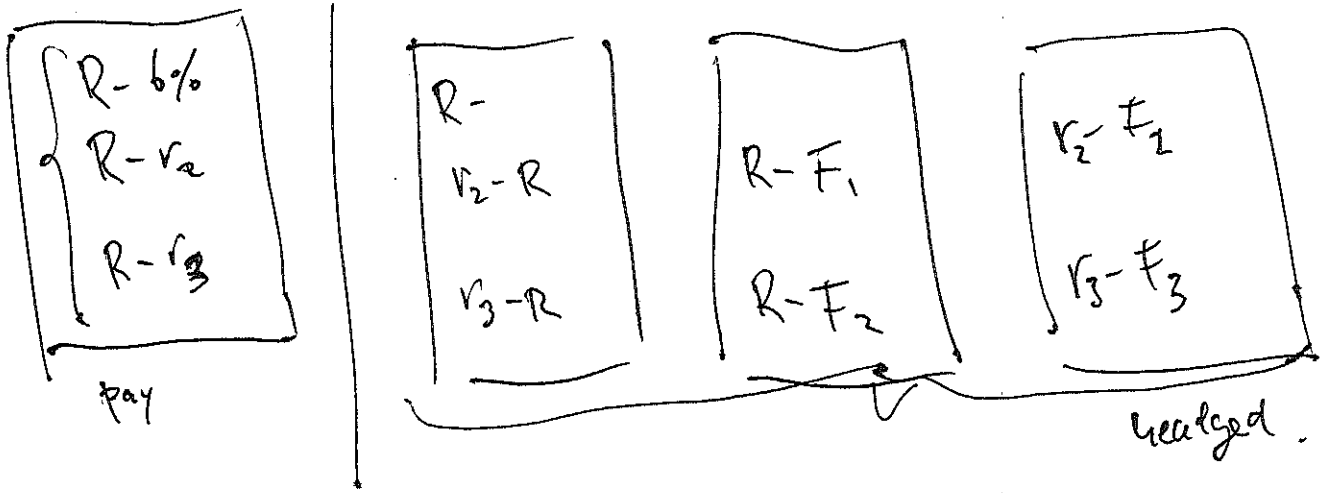
$$\Rightarrow R = 6.9548\%$$

swap rate = Par coupon rate.

Lock in rate for 3 yrs.

Swap rate = par bond coupon.

Zero-coupon bond yield.	One-year implied Fw	per Coupon
6.00	6.00	6.00.
6.50	$\frac{(6.50)^2}{6.00} = 7.00236$	$1 = \frac{c}{1.06} + \frac{c}{1.065^2} + \frac{1}{1.065^2}$ $c = .06484$
7.0.	$\frac{1.07^3}{(1.065)^2} = 8.00905$	$1 = \frac{c}{1.06} + \frac{c}{1.065^2} + \frac{c+1}{1.065^3}$ $c = .06954$



You

Counter party.