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MA 528 HW 3

4.3 6 month & 1 year zero rates are 5%. Bond life is 1.5 years with 5.2% yield, 4% coupon w/ semi-annual payments.

Let the bond have a face value of $100.

$$\text{Bond Price} = \frac{2}{\left(1+\frac{.052}{2}\right)} + \frac{2}{\left(1+\frac{.052}{2}\right)^2} + \frac{102}{\left(1+\frac{.052}{2}\right)^3}$$

Bond Price = 98.29

Bond Price is 98.29% of the Bond's face value

The 18 month zero rate r must be so that:

$$\frac{2}{\left(1+.05/2\right)} + \frac{2}{\left(1+.05/2\right)^2} + \frac{102}{\left(1+r/2\right)^3} = 98.29$$

($.05/2$: 6 month zero rate; $.05/2$: 1 year zero rate)

r = .0520

18 month zero rate is 5.20%

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4.7 If interest rate structure is upward sloping:

More Magnitude ↑
1 Forward rate corresponding to $4.75 \le t \le 5$ years
2 5 year zero rate
3 Yield on 5 year coupon bearing bond

If interest rate structure is downward sloping

More Magnitude ↑
1 Yield on 5 year coupon bearing bond
2 5 year zero rate
3 Forward rate corresponding to $4.75 \le t \le 5$ years

4.11 Face Value is 100, 4% per annum coupon paid semi-annually

$$\text{Cash Price} = 2e^{-.5 \cdot .04} + 2e^{-.042} + 2e^{-1.5 \cdot .044} + 2e^{-2 \cdot .046} + 102e^{-2.5 \cdot .048}$$

Cash Price = \$98.04

4.15 In three years, borrow \$1 million at 5% (annually compounded). Receive 5.5% (annually compounded). Three year zero rate is 3.7% (continuous compounding)

$$\text{FRA value} = (.055 - .05)1000000e^{-.037 \cdot 3}$$

FRA value = \$4,474.69

↑ discounting the cash flow

5.3 Forward Price $= 30e^{.05 \cdot .5}$, assuming no arbitrage

Forward Price = $30.76

5.4 Futures Price $= 350\, e^{(.04-.03)\cdot 1/3}$, assuming no arbitrage

Futures Price = $351.17

5.11 Futures Price is, assuming no arbitrage, $1300\, e^{(.04-.05)\cdot \frac{2}{12}} e^{(.04-.02)\cdot \frac{3}{12}}$

↑ August and November ↑ All other months

Futures Price = $1,304.34

5.15 Futures Price is, assuming no arbitrage, $25e^{.05\cdot 3/4} + (.06 + .06e^{-.05\cdot 1/4} + .06e^{-.05\cdot \frac{1}{2}})e^{.05\cdot \frac{3}{4}}$

Futures Price = $26.14 per ounce

6.20 Eurodollars futures quote is 88 for a contract maturing in 60 days. What is the LIBOR forward rate for the 60 to 150 day period?

Eurodollar futures price = 100 minus the per annum Forward LIBOR Rate w/ quarter

A Eurodollar futures quote of 88 implies that the forward LIBOR rate for the 60 to 150 day period is 12% per annum with quarterly compounding

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6.21 A 3 month Eurodollar futures price for a contract maturing in 6 years is 95.20. The standard deviation of the change in the short-term interest rate in 1 year is 1.1%. Estimate the forward LIBOR rate for 6 years $\leq T \leq$ 6.25 years

Convexity Adjustment:

Forward Rate = Futures Rate $- \frac{1}{2}\sigma^2 T_1 T_2$

$\sigma = .011$, $T_1 = 6$, $T_2 = 6.25$

Futures Rate = 4.8% (quarterly compounding) or 4.77% (continuous compounding)

Forward rate = 4.54% with continuous compounding

6.22 Future contracts are settled daily so profits do not have to be discounted due to time. If daily settlements weren't enacted, futures contracts would be settled at the start of the time period, unlike forwards contracts which are settled at the end.