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h2

555.444: Introduction to Financial Derivatives

Mid Term Exam

1. A company enters into a short futures contract to sell 5,000 bushels of wheat for 450 cents per bushel. The initial margin is \$3,000 and the maintenance margin is \$2,000. (6 points)

   $4.50

   a. What price change would lead to a margin call?. If the price falls below M.M. (\$1000)

      $(450 - x)5000 = (3000-2000)$

      $x = 0.20 \rightarrow$ Price falls below \$4.30

   b. Under what circumstance could \$1,500 be withdrawn from the margin account?

      $(4.50+x)5000 = (3000 + 1500) : x = 0.3$

      $4.80 \rightarrow$ Price rose to 4.80

2. Which of the following statements describe a property of bond convexity? (3 points) I choose D?

   Convexity:

   a. Increases as yields increase. X
   b. Increases with the square of maturity. ?
   c. Measures the rate of change in duration. assoc of
   d. Increases if the coupon on a bond is decreased. Not necessary depends on Duration

3. Who determines when delivery will take place in a corn futures contract (circle one) (3 points)

   a. The party with the long position
   b. The party with the short position
   c. Either party can specify a delivery date
   d. The exchange specifies the exact delivery date

4. Which of the following is(are) $\boxed{\text{not}}$ characteristic of a Forward contract (3 points)

   a. Subject to some credit risk
   b. Flexible in contract structure X
   c. Traded over the counter
   d. Daily Settlement is made X

5. On March 1 the price of oil is \$60 and the July futures price is \$59. On June 1 the price of oil is \$64 and the July futures price is \$63.50. A company entered into a futures contract on March 1 to hedge the purchase of oil on June 1. It closed out its position on June 1. After taking into account the cost of hedging, what is the effective price paid by the company for oil? (5 points)

   Paid \$59 — Sell 63.50 Made \$4.50

   March 1 — June 1

   Price is 64 . lost 4.00

   $\boxed{\text{Effective Price 59.50}}$

WKP.

6. Futures contracts trade with every month a delivery month. A company is hedging the purchase of the underlying asset on June 15. Which futures contract should it use? (3 points)

   a. The June contract
   b. $\boxed{\text{The July contract}}$ mod 2 SA 2
   c. The May Contract
   d. ~~The August contract~~

7. An interest rate is 12% when expressed with quarterly compounding. What is the equivalent rate with semiannual compounding? (4 points)

$q \to C \to S$

$R_C = 4 \cdot \ln\left(1+\frac{0.12}{4}\right) = 0.1182352$

$R_m = 2 \cdot (\exp(0.1182352/2) - 1) = \boxed{0.1218}$

8. The short term risk-free rate usually used by derivatives ~~traders in~~ the over-the-counter market is (3 points)

   ?
   a. ~~The Treasury rate~~ Pg 81 says no
   b. The LIBOR rate - Pre Crisis
   c. The repo rate
   d. The commercial paper rate - ~~Fed Funds Rate~~

9. The yield curve is flat at 6% per annum with semiannual compounding. What is the value of an FRA where the holder receives interest at the rate of 8% per annum for a six-month period on a principal of $1,000 starting in two years? (10 points)

~~$1000(0.08-0.06)(0.5)$~~ Rec 5

Do I need to calculate Rc OR can I use 0.06

R_C for 6 months: $2 \cdot \ln\left(1+\frac{0.06}{2}\right) = 0.0591$ - Continuous

R_m for annual. $1 \cdot [\exp(0.0591) - 1]$ 0.0609

$1000(0.08 - 0.0609)(2.5-2)e^{-(0.0591 \cdot 2.2)}$ $\boxed{8.626}$

10. A company invests $1,000 in a five-year zero-coupon bond and $4,000 in a ten-year zero-coupon bond. ~~What~~ is the duration of the portfolio? (4 points)

$\boxed{\text{15 years 10L}}$

$1000 + 4000 = 5000$

$\frac{1000}{5000} \cdot 5\text{ years} + \frac{4000}{5000} \cdot 10\text{ years} = \boxed{9\text{ years}}$

11. The spot price of an investment assed that provides no income is $30 and the risk-free rate for all maturities (with continuous ~~compounding~~) is 10%. What is the three-year forward price? (4 points)

$30e^{(0.1 \cdot 3)} = \boxed{40.49579}$

12. Repeat question 11 on the assumption that the asset provides an income of $2 at the end of the first year and at the end of the second year? (4 points)

Discount the income 1 & 2 years

$I = 2 \cdot e^{-0.1 \cdot 1} + 2e^{-0.1 \cdot 2} = 2.69972 + 2.4428 = 5.142524$

Need to subtract this from 30

$(30 - 5.142524)e^{0.1 \cdot 3} = 33.55409$

13. In question 11, what is the value of a three-year forward contract with a ~~delivery~~ price of $30? (4 points)

$(40.49579 - 30)e^{-0.10 \cdot 3} = 7.77545$

14. A trader enters into a long position in one Eurodollar futures contract. How much does the trader gain or lose when the futures price quote increases by 6 basis points (4 points)

1 Basis Point = $25 so

$25 \cdot 6 = 150$ agree to buy later at original so now you're getting a better deal

$\boxed{\text{gain } \$150}$

15. Suppose that the 9-month LIBOR interest rate is 8% per annum and the 6-month LIBOR interest rate is 7.5% per annum (both with actual/365 and continuous compounding). Estimate the 3-month Eurodollar futures price quote for a contract maturing in 6 months. (Consider if a convexity adjustment is necessary. Why?) (10 points)

The volatility should already be baked into the LIBOR Rates — No need for convexity adjustment

9mon - 0.08
6mon - 0.075
3mon - ? ← for contract in 6 mon

$\frac{Rt - Rt}{t - t} = \frac{0.08(9/12) - 0.075(9/12)}{6/12 - 9/12}$

~~0.065~~

~~this should be higher~~

9 months: 8% + 3 month: X%

9 - 3 months

8%
9% 9 mon
?% 6 mon

$RC\ Rt = \frac{0.08(9/12) - 0.075(6/12)}{9 - 6}$

0.09 ← forward rate for 6 month

convert 9% forward C.C. 12 mon to 9% forward 3 month

$4(e^{0.09/4} - 1) = 0.09102$ ← 3 mon interest

Price quote is 100 - R

100 - 0.09102

$\boxed{90.898}$ - I don't think convex adjustment needed

16. Company A, a British manufacturer, wishes to borrow US dollars at a fixed rate of interest. Company B, a US multinational, wishes to borrow sterling at a fixed rate of interest. They have been quoted the following rates per annum (adjusted for differential tax effects) (15 points)

	Sterling		US Dollars	
Company A	11.0%	−	7.0%	- 0.25
Company B	10.6%	- 0.25	6.0%	4.4

a. Show that it would be justified (via the idea of comparative advantage) for a bank to intermediate a swap where it nets 10 basis points and produces a gain of 25 basis points for each of the two companies.

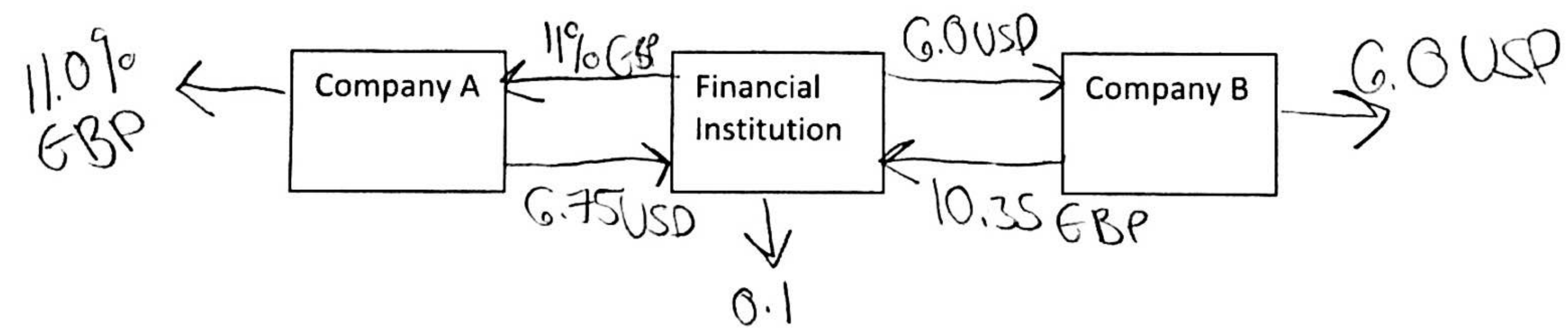
10.6/.17 = 1.57 = 11/7

(11.0 - 10.6) = 0.4 · company A has a 0.4% advantage in GBP

(7 - 6) = 1.0 company B has a 1.0% advantage in USD

(1.0 - 0.4) = 0.6 - .1 = 0.5 / 2 = 0.25

b. Show a possible swap implementing this transaction through a cash flow diagram (fill in below)



c. What risk does the bank take on? Can it hedge this risk? How?

Credit Risk since A might not give them the sterling and B might not give the USD

Market risk If the exchange Rates move so there the amount from one currency to another is not good. You could hedge this with eurodollar futures

17. A semi-annual pay interest rate swap where the $\boxed{\text{fixed}}$ rate is 5.00% (with semi-annual compounding) has a remaining life of nine months. The six-month LIBOR rate observed three months ago was 4.85% with semi-annual compounding. Today's three and nine month LIBOR rates are 5.3% and 5.8% (continuously compounded) respectively. From this it can be calculated that the forward LIBOR rate for the period between three- and nine-months is 6.14% with semi-annual compounding. If the swap has a principal value of $15,000,000, what is the value of the swap to the party receiving a fixed rate of interest? (15 points)

3mon: 5.3 · C.C.
9mon: 5.8 - C.C.

So the contract was originated 3 months ago the amount to be paid is based on 4.85%

0.5 0.0485

Time	Fixed	Float
3months	0.05	
9months	0.05	

1. convert 5.3, 5.8 to quarterly compounding

$4(e^{(0.053 \cdot 4)} - 1) = 0.05335268$

$4(e^{0.058 \cdot 4} - 1) = 0.05842252$

2. $F = \frac{Rt - Rt}{t - t} = 0.06095747$

is the c.c. for period between 3-9 months

3. convert c.c. 3-9 to semiannual

$2 \cdot \ln(1 + \frac{0.0609}{2}) = 0.06185 \sim 6.14$

* I did something wrong w/ 15

$\frac{4.85\%}{2}$ 3 months ago $= 2.425\%$

$\frac{6.14}{2}$ amounts $= 3.07\%$

$15{,}000{,}000 \cdot (0.025 - 0.02425) e^{(-0.053 \cdot 3/12)}$
$+ \; 15{,}000{,}000 \cdot (0.025 - 0.0307) e^{(0.058 \cdot 9/12)}$

$\boxed{\$70{,}760}$

value of swap to the party receiving