37011 Financial Markets Instruments

Whiteboard Tutorial 7

1. Suppose that the term structure of instantaneous forward rates is given by

$$f(0,T) = 0.025 + 0.01T, \qquad 0 \leq T \leq 5$$

   What should be the semi-annual coupon on a five-year coupon bond issued at par?

2. Assume the term structure that you extracted in Question 2 of Whiteboard Tutorial 2 is the term structure of domestic interest rates. Suppose further that the term structure of foreign instantaneous forward rates is given by

$$\tilde{f}(0,T) = 0.025 + 0.035e^{-0.2T}$$

   and the spot exchange rate (in units of domestic currency per unit of foreign currency) is 1.6. Plot the term structure of forward exchange rates. Use loglinear interpolation of discount factors where necessary.

3. Consider a September futures contract to sell silver for \$8.20 per ounce. The size of the contract is 5,000 ounces, the initial margin is \$8,200 and the maintenance margin is \$6,000. What change in the silver futures price results in a margin call?

4. Suppose that the standard deviation of quarterly changes in the price of an asset is \$0.65, the standard deviation of quarterly changes in a three-month futures price on a related security is \$0.81, and the correlation between the two is 0.8. What is the optimal hedge ratio for a three-month futures contract?

5. Suppose that the standard deviation of the change in the price of an asset over two years is \$1.75, the standard deviation of changes in a two-year futures price on a related security is \$2.3, and the correlation between the two is 0.7.

   (a) If interest rates are negligible, what is the optimal hedge ratio for a two-year futures contract?

   (b) If interest rates a constant at 9% continuously compounded for all maturities, what is the optimal hedge ratio for a two-year futures contract?

6. Let F_0 be the forward price of a T-maturity forward struck at time zero. At some time t, $0 < t < T$, the forward price is F_t. If r is the continuously compounded yield at time t for maturity T, show that at time t the no-arbitrage value of a long contract struck at time zero is

$$(F_t - F_0)e^{-r(T-t)}$$

7. Suppose that the 90-day US Treasury bill futures maturing in 30 days time has the quoted price 96.2. If an investor requires a 30–to–120 day forward deposit of

$10,000,000, then what position in the futures is required? Assume that the face value of the bill underlying the futures contract is $100,000 and the contract is deliverable.

8. Suppose the following instruments are traded in the Australian market:

Instrument	Face value	Market quote
60-day bill	$100,000	$r_{60d} = 4.60\%$
150-day bill	$100,000	$r_{150d} = 4.45\%$
90-day bill futures	$1,000,000	$F_0 = 95.50$

where the futures matures in 60 days' time. How can you make a riskless profit today?