Introduction to Derivatives Review: Questions

(1) Forward contract

You have contracted to make a forward delivery of Yen in exchange for $100 one-year in the future.

To hedge your Yen delivery obligation, you have borrowed $X amount of USD, sold it in the spot market for Yen, and have invested the Yen received in a one-year Yen deposit.

You intend to redeem the Yen deposit at the end of the year to fund the Yen delivery of the forward contract, and will use the $100 received to repay the USD loan.

Data: One-year USD interest rate = 5%
Spot exchange rate (Y/$) = 120
One-year Yen interest rate = 1%

(a) How much USD should you borrow today in order to exactly repay the loan with the $100 you will receive one year from now?

(b) How much Yen will you redeem from your Yen deposit one year from now?

(c) If your were offered a one-year forward rate of 114 (Y/$), how much profit or loss would you make? Would you be willing to enter into the forward contract at that forward rate?

(d) If the one-year forward rate were 116 (Y/$), how much profit or loss would you make? If that rate were the prevailing forward rate in the market, what do you expect to happen to the forward rate?

(e) What is the equilibrium forward rate with the data above?

(2) Options

Data: A call option on an underlying asset has a strike price of $100.

The price of the underlying asset is currently $100, with a 25% chance that it falls by $10, a 25% chance that it rises by $10, and a 50% chance that the price remains unchanged.

(a) What are the intrinsic values of the option at each of the three possible prices of the underlying asset?

(b) With the data above, what is the value of the option with risk-neutral preferences[1] (hint what is the expected value)?

(c) If the possible price changes of the underlying asset are $20 up or down with the same probabilities as above, what is the value of the option?

(d) If the initial price is $95, with a 25% probability that it rises or falls by $10, what is the value of the option.

(e) If the initial price is $105, with a 25% probability that it rises or falls by $10, what is the value of the option.

(f) What is the change in the value of the option between the cases in (d) and (b) (i.e. price of the underlying asset increases from 95 to 100), and what is the ratio of the change in the option value relative to the change in the underlying asset price? If you were to look at the analogous changes between cases (b) and (e) (i.e. price increase from 100 to 105) what would you find?

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[1]/ There is no premium or discount for risk.