1) EURGBP moves from 0.8350 to 0.8164. Which one of the following is true?

a) GBP is stronger versus EUR

b) EUR is stronger versus GBP

c) GBP and EUR have not changed in value relative to each other

d) Not enough information to determine whether a), b) or c) are true

EURGBP represents to value of EUR 1 (foreign or base currency) in terms of GBP (numeraire or terms currency). So a lower rate indicates a weaker EUR versus GBP, which means GBP is stronger.

2) USDCHF is 1.1304 and then moves one big figure with CHF weakening. Where is USDCHF now?

a) 1.1404
b) 1.1305
c) 1.1303
d) 1.1204

CHF weakening means the USDCHF rate is higher. One “big figure” is 0.0100 (also called “100 pips).

3) If EURCHF is 1.2100, how many EUR can CHF 1,000,000 buy?

a) 82,644
b) 121,000
c) 826,446
d) 1,210,000

EUR 1 = CHF 1.21, so CHF 1,000,000 = EUR 1,000,000 / 1.21 or roughly 19% less than 1,000,000.

4) A CAD-based car manufacturing company sources parts from the United States. What is the company’s immediate FX exposure, and what type of hedge would reduce the company’s FX risk?

a) Long USDCAD, and an FX forward to buy USD / sell CAD

b) Long USDCAD, and an FX forward to sell USD / buy CAD

c) Short USDCAD, and an FX forward to sell USD / buy CAD

d) Short USDCAD, and an FX forward to buy USD / sell CAD

The company will need to pay USD in order to buy parts, so the company will benefit if USD is lower. In other words, the company is short USD. Since the company is CAD-based, its short USD exposure is versus CAD. If the company buys USD / sells CAD it will reduce currency risk.

5) A USD-based trader has the following position, selling GBP 100 million versus JPY at 80.00. The current spot GBPJPY rate is 70.00, and current spot GBPUSD is 1.50. What is the market-to-market value of the trader's position (in USD, rounded to the nearest 100,000)?

a) 1,000 million
b) 21.4 million
c) 14.3 million
d) 9.5 million

The trader sold GBP 100m and bought JPY 8,000m. The new GBP-value of JPY 8,000m is now 8,000/70, or about GBP 114m. This means the trader has a profit of about GBP 14m. In USD terms this must be approximately 14m * 1.5, or about USD 21 million.

6) Assume USDCHF is 0.9200 and USDJPY is 92.00, what is the implied CHFJPY cross rate?

a) 100.00
b) 92.92
c) 84.64
d) 0.0100

USD 1 = CHF 0.92, so CHF 1 = USD 1/0.92. Since USD 1 = JPY 92, then CHF 1 = JPY 92 * 1/0.92 = JPY 100

7) Find the all-in 1-year forward rate assuming the following: EURUSD spot is 1.2900, the EUR deposit rate is 2.00%, the USD deposit rate is 1.00% and there are 360 days between spot and the forward date

a) 1.3153
b) 1.3028
c) 1.2774
d) 1.2652

The interest rate differential is 1.00% for 1 year, and EUR is the higher yielding currency. This means forward EURUSD will be lower than spot by approximately 1%, or roughly 1.2900 - 0.0129 = 1.2771

8) A trader executes a EURCHF spot transaction at 1.2200, buying EUR, and soon after that swaps the position to the 1-month date. If the forward point quote (with bid-ask) is -24/-12 what is the trader's all-in forward rate?

a) 1.2188
b) 1.2176
c) 1.2080
d) 1.1960

The trader must sell/buy on the EURCHF swap, so we use the offer side of -12. Subtracting 12 points from 1.2200 is 1.2200 - 0.0012 = 1.2188

9) If CNY deposit rates are higher than USD deposit rates for a particular maturity, then must the USDCNY non-deliverable forward rate for the same maturity be higher than the USDCNY spot rate?

a) Yes, lower USD deposit rates imply the USD is stronger on a forward basis

b) No, lower USD deposit rates imply the USD is weaker on a forward basis

c) No, non-deliverable forward rates can violate the covered interest rate parity formula

d) Yes, non-deliverable forward rates are always above spot rates

(This question was in the homework.)

10) If the EURUSD spot rate is 1.4000, EUR deposit rates are 0.60% and USD deposit rates 0.10%, what might the 1 year forward points in EURUSD be?

a) -705

b) -70.5

c) 70.5

d) 705

EUR rates are 0.50% higher than USD rates, so the 1 year forward rate will be approximately 0.50% lower than the spot rate, or approximately 0.0070 = 1.4000*0.50% lower. One point is 0.0001, so this represents approximately 70.5, with a negative sign since the forward rate is lower than the spot rate.

11) Let ***S*** be the spot rate, ***rd*** domestic deposit rate, ***rf*** the foreign deposit rate, and T time to maturity. Which of the following is a formula for forward points?

a) S * (1+ rf *T)/ (1+ rd *T) * 10,000

b) S * (1+ rd *T)/ (1+ rf *T) * 10,000

c) S * { (1+ rf *T)/ (1+ rd *T) - 1 } * 10,000

d) S * { (1+ rd *T)/ (1+ rf *T) - 1 } * 10,000

Forward rate formula: F = S * (1+ rd *T)/ (1+ rf *T)
Forward points = F - S (times a constant, which is 10,000 for some currencies)
So, forward points (for some currencies) = { S * (1+ rd *T)/ (1+ rf *T) - S } * 10,000

12) Why does the derivation of the Garman-Kohlhagen PDE for foreign exchange differ from the derivation of the Black-Scholes PDE for a non-dividend-paying stock?

a) Foreign exchange positions must be present valued using the foreign interest rate

b) Foreign interest rates and spot FX rates are correlated, so adjustment terms must be introduced

c) The FX spot rate is not a traded asset, so no riskless portfolio can be constructed

d) A foreign currency position must be carried using a foreign risk free bond

(This question was challenging for most of the class, so if you did not answer correctly you are in the majority.)

c) can be eliminated – although the spot rate is not a traded asset, we can still construct a riskless portfolio. b) can also be eliminated since no adjustment terms for the correlation between foreign interest rates and spot rates appear in the Garman-Kohlhagen PDE. Finally, a) is not correct – the foreign interest rate is analogous to a continuous dividend on a stock. It influences the risk neutral drift, but not the discounting (present valuing).

The difference between the two self-financing portfolios—for a non-dividend paying stock versus for an FX position—the FX position is carried using a foreign risk free bond, and unlike the stock it creates positive yield (similar to a dividend). This changes the risk-neutral growth rate, and is the only difference in the Garman-Kohlhagen PDE versus the Black-Scholes PDE for a non-dividend-paying stock.

13) Let the EURUSD spot rate be 1.3000 and the 1-year forward rate 1.2900. If the strike of a EUR call USD put is 1.4190 and its implied volatility is 10% then which of the following might be its premium (expressed as USD pips)

a) 0.0123
b) 0.0516
c) 0.1290
d) 0.1410

(I meant for this to be a challenging question, to see if you had learned from the lectures to estimate the value of an option in at least very rough terms.)

A 1-standard deviation change in the FX rate would be about 10% * 1 (year) * 1.2900 = 0.1290. Here we use the forward rate as the mean since we are considering risk-neutral valuation.

From the lectures we know that even an at-the-money option is worth less than a half of a standard deviation (so c) and d) can be eliminated), and since the option is well out-of-the money (it is 0.1290, or one full standard deviation out-of-the-money) it must be worth significantly less than half.

Alternative: this is not necessary to solve the problem, but if you remembered the approximation that an at-the-money option premium is about 40% of 1 standard deviation, then the answer a) is clear.

14) Assume USDCAD spot is 1.1150, the 1-year forward is 1.1200 and implied volatility is 10%. Which of the following could be the delta of a 1-year 1.2310 USD call CAD put?

a) 0.50

b) 0.33

c) <u>0.17</u>

d) 0.05

This problem was also challenging. You need to have considered standard deviations and the area under a normal density function to solve this easily.

One standard deviation is about 10% * 1.1200, or roughly 0.1120. It helps to notice that the option is about 1 standard deviation out of the money. Although delta is not exactly a measure of "the probability of being in-the-money at expiry" delta is approximately that.

So we can consider the probability of the spot rate being 1 standard deviation higher at expiry. There is roughly a 2/3 probability of finishing within +/- 1 standard deviation. So the two tails—below -1 stdev and above +1 stdev—together have about 1/3 probability. We are interested in only the second tail, which has about 1/6 probability.

15) Let the EURUSD spot rate be 1.3000 and the forward rate 1.2800. If a EUR put USD call has a strike of 1.2000 and a premium of 0.0390 in USD pips, then which of the following might be its premium in EUR%

a) <u>3.00%</u>

b) 3.05%

c) 3.25%

d) 3.90%

The most reliable approach is to simply think of the premium for EUR 1 of notional. Given the 0.0390 USD pips price, the premium must be USD 0.0390 (for EUR 1 of notional). We should convert this using the spot rate (we use the spot rate since premium is paid on the spot delivery date), so the premium expressed in EUR would be EUR 0.0390 / 1.30 = EUR 0.0300, which is 3.00% of the EUR 1 notional.

16) A USD-based trader buys a USD put JPY call with a strike of 90.00 and notional of USD 100 million. The option premium is 0.95 in JPY pips, the spot rate is 95.00 and the option delta is -0.20 (this is an unadjusted delta, from the Black-Scholes formula with JPY as the domestic currency.)

What spot hedge should the USD-based trader execute to delta hedge the option position?

a) Buy USD 19.0 million versus JPY

b) Buy USD 20.0 million versus JPY

c) Buy USD 21.0 million versus JPY

d) Buy USD 21.1 million versus JPY

The best approach is to think of the risk from the USD-based trader's viewpoint. If the trader uses the unadjusted delta and buys USD 20m versus JPY then s/he will hedge the JPY-value of the option. (As stated, this delta comes from the Black-Scholes formula with JPY as the domestic currency.)

So the trader will have additional risk, which is the JPY value of the option. The option premium is 0.95 JPY pips, or JPY 100m * 0.95 = JPY 95m. So the trader must sell JPY 95m versus USD to hedge this value. In other words the trader must buy an additional USD 95m / 95.00= USD 1m.

17) The price of an AUD put USD call struck at 0.9500 is 0.0200 USD pips. If the spot rate is 1.0200 and the forward rate is 0.9900, then what is the price of an AUD call USD put struck at 0.9500? (Assume USD deposit rates are zero.)

a) 0.0200
b) 0.0500
c) 0.0600
d) 0.0900

This is a put-call parity question. Call - Put = discounted (Forward - Strike).

So, Call - 0.0200 = 0.9900 - 0.9500. Thus, Call = 0.0200 + 0.0400 = 0.0600

18) The EURGBP spot rate is 0.8400. The one week outright is 0.8420 and the one month outright is 0.8480. Which of these options have the highest vega?

a) 0.7480 EUR call expiring in one month
b) 0.8480 EUR call expiring in one month
c) 0.7400 EUR call expiring in one hour
d) 0.8400 EUR call expiring in one hour

Vega is greatest when the strike is at-the-money. And, in general, for a fixed strike vega increases as time-to-maturity increases.

19) A trader buys a 25 delta AUDUSD butterfly where the notional amounts of all legs are equal. In other words, the trader buys both a 25 delta call and put in equal notionals, and sells at-the-money (delta neutral strike) call and put also the same notional. Regarding the risk position of the total strategy, is it:

a) Both vega neutral and delta neutral

b) Neither vega neutral nor delta neutral

c) Delta neutral but long vega

d) Delta neutral but short vega

The position is clearly delta neutral—the 25 delta call and put will be delta neutral as a pair (the put will have delta -0.25 and call will have delta 0.25, so together the two legs have offsetting deltas). The at-the-money, delta neutral straddle will also be delta neutral (the strike is chosen so that the put will have an offsetting delta to the call.)

However, if the notional of all legs are the same, the vega will be larger for the at-the-money strikes. Since the trader will selling the ATM straddle, the position must be net short vega.

20) If EURUSD risk reversals are strongly negative (puts are favored over calls), then which of the following is true of the market implied EURUSD distribution?

a) The distribution has fat tails relative to a lognormal distribution
b) The distribution is skewed to the downside
c) The mean of the distribution is lower
d) Both b) and c) are true

First, c) and d) must be false because the forward rate is always the mean of the market-implied (because the forward rate is the expected value of the spot rate under this distribution).

A risk reversal is created by buying an out-of-the-money call and selling an out-of-the-money put. In this question “puts are favored over calls”, which means that the Black-Scholes implied volatility for the OTM put is higher than that for the OTM call. This suggests that the lower tail of the distribution has more mass than the upper tail.