4. Suppose that you buy a €1,000,000 call option against dollars with a strike price of $1.2750/€. Describe this option as the right to sell a specific amount of dollars for euros at a particular exchange rate of euros per dollar. Explain why this latter option is a dollar put option against the euro.

*Answer:* The €1,000,000 call option against dollars with a strike price of $1.2750/€ gives the buyer the right, but not the obligation, to buy €1,000,000 at the strike price of $1.2750/€ in which case the person would pay $1,275,000 for the euros. Clearly, this is the same as an option to sell $1,275,000 at a strike price of \[
\frac{1}{(1.2750/€)} = €0.784314/$.
\] This latter option is a $1,275,000 dollar put option against euros with a strike price of €0.784314/$.

5. Assume that today is March 7, and, as the newest hire for Goldman Sachs, you must advise a client on the costs and benefits of hedging a transaction with options. Your client (a small U.S. exporting firm) is scheduled to receive a payment of €6,250,000 on April 20, 44 days in the future. Assume that your client can borrow and lend at a 6% p.a. U.S. interest rate.

a. Describe the nature of your client’s transaction exchange risk.

*Answer:* Your client is scheduled to receive €6,250,000 in 44 days. If no hedging is done, and the euro weakens in value relative to the dollar, the client will lose money. The amount of the loss could be substantial if a major weakening occurs.

b. Use the appropriate American option with an April maturity and a strike price of 129¢/€ to determine the dollar cost today of hedging the transaction with an option strategy. The cost of the call option is 3.93¢/€, and the cost of the put option is 1.58¢/€.

*Answer:* To hedge foreign currency revenue with an option, you must purchase a put option that gives you the right to sell euros. This puts a floor on your revenue. The cost of the option would be 1.58¢/€, or

\[
\frac{0.0158}{€} \times €6,250,000 = $98,750
\]

c. What is the minimum dollar revenue your client will receive in April? Remember to take account of the opportunity cost of doing the option hedge.

*Answer:* If the exchange rate is less than $1.29/€ in April, your client will be able to sell euros at that value. If the future spot exchange rate is higher, the client will sell euros at
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the future spot exchange rate. In either case, if they hedge with the option contract, they will have less revenue. The future value of $98,750 at 6% for 44 days is

$$98,750 \times \left[ 1 + \left( \frac{6}{100} \right) \left( \frac{44}{360} \right) \right] = 99,474.17$$

Thus, the minimum net revenue that the client will have is

$$\left( \frac{1.29}{€} \times €6,250,000 \right) - 99,474.17 = 7,963,025.83$$

d. Determine the value of the spot rate ($/€) in April that would make your client indifferent ex post to having done the option transaction or a forward hedge. The forward rate for delivery on April 20 is $1.30/€.

Answer: If the client does the forward hedge, their revenue will be

$$\frac{1.30}{€} \times €6,250,000 = 8,125,000$$

If the client does the option hedge and does not have to exercise the option, they will sell the euros in 42 days, and their revenue will

$$\left( S(t+42,$/€) \times €6,250,000 \right) - 99,474.17$$

If this option revenue is to equal the forward revenue, we know

$$\left( S(t+42,$/€) \times €6,250,000 \right) - 99,474.17 = 8,125,000$$

Solving this equation gives

$$S(t+42,$/€) = \frac{1.3159}{€}.$$

6. Assume that today is September 12. You have been asked to help a British client who is scheduled to pay €1,500,000 on December 12, 91 days in the future. Assume that your client can borrow and lend pounds at 5% p.a.

a. Describe the nature of your client’s transaction exchange risk.

Answer: Your client is scheduled to pay €1,500,000 in 91 days. If no hedging is done, and the euro strengthens in value relative to the pound, the client will lose money. The amount of the loss could be substantial if a major strengthening occurs.

b. What is the option cost for a December maturity and a strike price of £0.72/€ to hedge the transaction? The option premiums per 100 euros are £1.70 for calls and £2.40 for puts.

Answer: To hedge foreign currency costs with an option, you must purchase a call option that gives you the right to buy euros. This puts a ceiling on your costs. The cost of the option would be £1.70 per 100 euro, or

$$\frac{£1.70}{€100} \times €1,500,000 = £25,500$$

c. What is the maximum pound cost your client will experience in December?
Answer: If the exchange rate is greater than £0.72/€ in December, your client will be able to buy euros at that value. If the future spot exchange rate is lower than £0.72/€, the client will buy euros at the future spot exchange rate. In either case, if they hedge with the option contract, they will have higher costs. The future value of £25,500 at 5% for 91 days is

\[
£25,500 \times \left[1 + \left(\frac{5}{100}\right)\left(\frac{91}{365}\right)\right] = £25,817.88
\]

Thus, the minimum net cost that the client will face is

\[
\left(\frac{£0.72}{€} \times €1,500,000\right) + £25,817.88 = £1,105,817.88
\]

d. Determine the value of the spot rate (£/€) in December that makes your client indifferent ex post to having done the option transaction or a forward hedge if the forward rate for delivery on December 11 is £0.70/€.

Answer: If the client does the forward hedge, their cost will be

\[
\left(\frac{£0.70}{€} \times €1,500,000\right) = £1,050,000
\]

If the client does the option hedge and does not have to exercise the option, they will buy the euros in 91 days, and their cost will be

\[
(S(t+89,£/€) \times €1,500,000) + £25,817.88
\]

If this option cost is to equal the forward cost, we know

\[
(S(t+89,£/€) \times €1,500,000) + £25,817.88 = £1,050,000
\]

Solving this equation gives

\[
S(t+89,£/€) = \frac{£0.6828}{€}.
\]