Chapter 11
Currency Risk Management

Note: In these problems, the notation / is used to mean “per.” For example, ¥158/$ means “¥158 per $”.

1. To lock in the rate at which yen can be converted into U.S. dollars, the investor should enter into a contract to sell ¥160 million forward at a forward exchange rate of $:¥ = 160. The hedge will be imperfect for the following reasons:
   • If the price of the Japanese stocks changes. For example, if the value of the portfolio suddenly goes up to ¥180 million, the investor will have underhedged ¥20 million. To remain fully hedged, the investor should continually adjust the amount hedged.
   • Another reason for an imperfect hedge is the possibility of a change in the forward basis caused by a change in interest rate differential.

2. a. The return on the unhedged portfolio in dollar terms is

\[
\frac{5,150,000 - 5,000,000}{5,000,000} = 0.03 = 3.0\%
\]

The return on the unhedged portfolio in euro terms is

\[
\frac{(5,150,000)(1.1) - (5,000,000)(0.974)}{(5,000,000)(0.974)} = 0.1632 = 16.32\%
\]

The return on the hedged portfolio in euro terms is determined as follows:

The portfolio profit in euros = (5,150,000)(1.1) − (5,000,000)(0.974) = €5,665,000

− €4,870,000 = €795,000

The loss on the futures contract in euros = (5,000,000) (1.02 − 1.15) = − €650,000

The net profit on the hedged position = €795,000 − €650,000 = €145,000

The return on the hedged portfolio in euros = €145,000/€4,870,000 = 0.0298

= 2.98%

This indicates that the position is almost perfectly hedged because a return of 3 percent in dollars has been transformed into a return of 2.98 percent in euros.

b. The return on a portfolio with a hedge ratio of 0.5 is calculated as follows:

Profit in euros = (0.5)(− €650,000) + €795,000 = €470,000

Return on partially hedged portfolio = €470,000/€4,870,000 = 0.0965 = 9.65%
3. a. The return on the unhedged portfolio in euros is

\[
\frac{10,050,000 - 10,000,000}{10,000,000} = 0.005 = 0.5\%
\]

The return on the unhedged portfolio in dollar terms is

\[
\frac{(10,050,000)(1.05) - (10,000,000)(1.1)}{(10,000,000)(1.1)} = -0.0407 = -4.07\%
\]

The return on the hedged portfolio in dollar terms is determined as follows:

The portfolio loss in dollars = \((10,050,000)(1.05) - (10,000,000)(1.1)\) = $10,552,500

\(\quad - 11,000,000 = -447,500\)

The gain on the futures contract in dollars = \((10,000,000)(1 - 0.95)\) = $500,000

The net profit on the hedged position = $500,000 - $447,500 = $52,500

The return on the hedged portfolio in dollars = $52,500/$11,000,000 = 0.0048

\(\quad = 0.48\%\)

This indicates that the position is almost perfectly hedged because a return of 0.5% in euros has been transformed into a return of 0.48% in dollars.

b. The return on a portfolio with a hedge ratio of 0.35 is calculated as follows:

\[
\text{Profit in dollars} = (0.35)(500,000) - 447,500 = -272,500
\]

\[
\text{Return on partially hedged portfolio} = -272,500/11,000,000
\]

\(\quad = -0.0248\)

\(\quad = -2.48\%\)

4. The investor should sell ¥160 million forward against euros, a transaction that combines two forward operations:

- Sell ¥160 million for $1 million (\(1,000,000 = ¥160,000,000/¥160/$\))
- Sell $1 million for €833,333 = $1,000,000/$1.20/€

5. a. The one-year forward exchange rate is

\[
F = (2) \left[ \frac{1.06}{1.10} \right] = €1.9273/$
\]

b. Calculated portfolio values are summarized in the following table. To illustrate the calculations, assume an exchange rate of €1.6 per $1 year from now.

- The value of the unhedged portfolio at the end of one year is €100,000,000(1/1.6) = $62,500,000
• To hedge using forward contracts, you would sell euros forward at €1.9273 per dollar. The value of the portfolio hedged with the currency forward contract is calculated as follows:

The profit on the portfolio in dollar terms is

\[ €100,000,000 \left( \frac{1}{1.6} - \frac{1}{2.0} \right) = $12,500,000 \]

The profit on the forward contract in dollars terms is

\[ €100,000,000 \left( \frac{1}{1.9273} - \frac{1}{1.6} \right) = -$10,613,941.78 \]

The overall profit on the hedged portfolio is

\[ 12,500,000 - 10,613,941.78 = $1,886,058.22 \]

Thus, the value of the portfolio is

\[ $50,000,000 + $1,886,058.22 = $51,886,058.22, \text{ or } $51.89 \text{ million rounded.} \]

• To ensure using options you will need to buy puts on the euro. Because the premium is paid in dollars, there is no exchange risk on the option premium. Assuming that the premium is financed at a dollar interest rate of 0 percent, you would buy €100 million worth of puts on the euro at a cost of

\[ \text{Premium} = (0.012 \text{ per euro}) \times (€100,000,000) = $1,200,000 \]

The profit on the put is calculated as follows:

If Strike price > Current price, Profit = (Strike price – Current price) \times Quantity

If Strike price \leq Current price, Profit = 0

The strike price is $0.50/€ and the current price is €1.6/$ = $0.625/€. Because 0.5 is less than 0.625, the profit is zero.

The currency gain = €100,000,000(1/1.6 – 1/2.0) = $12,500,000

The net profit on the position = $12,500,000 – $1,200,000 = $11,300,000

The value of the portfolio = $50,000,000 + $11,300,000 = $61,300,000

<table>
<thead>
<tr>
<th>Portfolio Value (in $ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exchange Rate (€/$)</strong></td>
</tr>
<tr>
<td>1.6</td>
</tr>
<tr>
<td>1.8</td>
</tr>
<tr>
<td>2.0</td>
</tr>
<tr>
<td>2.2</td>
</tr>
<tr>
<td>2.4</td>
</tr>
</tbody>
</table>

c. Basis risk, transactions costs, and cross-hedge risk.
6. a. As a Swiss investor with dollar investments, you would want to buy puts to sell the U.S dollar ($) for Swiss francs (SFr). Puts on the $ are not available. However, puts on the $ are equivalent to calls to buy SFr for $. Therefore, you should buy calls on the SFr to insure the SFr value of the portfolio. Because the option premium is paid in dollars while you care about SFr, the purchase of the call will reduce the dollar currency exposure. Hence, the quantity of calls purchased should reflect this reduction in currency risk. To determine the exact amount of calls to be bought, we will start the reasoning by looking at how we can ensure one SFr. The option will be needed when the value of the SFr goes above $0.73. When the call is exercised, the total dollar cost to buy one SFr is:

\[
0.73 + 0.0243 = \$0.7543
\]

Because you have $10 million, you can buy

\[
\frac{10,000,000}{0.7543} = \text{SFr 13,257,325}
\]

Note that the dollar cost of the premium paid is

\[
\frac{(0.0243)(10,000,000)}{0.7543} = \$322,153
\]

b. If you hedge using forward currency contracts, the portfolio will have a fixed SFr value of

\[
\frac{10,000,000}{0.7389} = \text{SFr 13,533,631}
\]

This looks better than the insured SFr 13, 257, 325, but the disadvantage is that the hedged value will remain fixed, even if the dollar appreciates against the SFr.

7. a. To protect against a decline in share value, you should sell futures. You should sell 600 contracts:

\[
\frac{20,000,000 \times 1.2}{10 \times 4,000} = 600
\]

b. To hedge against a decline in the euro, you should sell €20 million forward. Because the euro and dollar interest rates are equal, the forward rate is equal to the spot rate, $1.10/€.

c. If you worry about a € depreciation, you should buy puts on the € worth €20 million. The cost is

\[
\text{Premium} = (0.02 \text{ per } €)(€20 \text{ million}) = $400,000
\]

d. Assuming that the investor can get this amount from some other sources, that is, borrow at a zero-dollar interest rate (this is a dollar investment not exposed to currency risk), we get the final dollar simulated portfolio values in the following table. To illustrate, the calculations are explained, assuming an exchange rate of $1.0 per € in March.

- The value of the unhedged portfolio at the end of March is

\[
€20,000,000(1) = €20,000,000
\]

- To hedge using forward contracts, you would sell euros forward at $1.1 per €. The value of the portfolio hedged with the currency forward contract is calculated as follows:

The profit on the portfolio in dollar terms is

\[
€20,000,000(1 - 1.1) = -€2,000,000
\]
The profit on the forward contract in dollars terms is

\[ €20,000,000(1.1 - 1) = $2,000,000 \]

The overall profit on the hedged portfolio is $0

Thus, the value of the portfolio is $22,000,000 + $0 = $22,000,000

- To insure using options, you will need to buy puts on the euro. You would buy €20 million worth of puts on the euro at a cost of

  \[ \text{Premium} = ($0.02 \text{ per euro}) (€20,000,000) = $400,000 \]

The profit on the put is calculated as follows:

If Strike price > Current price, Profit = (Strike price − Current price) × Quantity

If Strike price ≤ Current price, Profit = 0

Because $1.10 > $1, Profit = (1.1 − 1)(€20,000,000) = $2,000,000

The currency gain = €20,000,000(1 - 1.1) = - $2,000,000

The net profit on the position = − $400,000

The value of the portfolio = $22,000,000 - $400,000 = $21,600,000

<table>
<thead>
<tr>
<th>Portfolio Value (in $ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate ($/€)</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>1.00</td>
</tr>
<tr>
<td>1.10</td>
</tr>
<tr>
<td>1.20</td>
</tr>
</tbody>
</table>

8. a. The three-month forward rate (MXP/$) is

\[ F = (10) \left[ \frac{1 + 0.12}{4} \right] = (10) \left[ \frac{1.03}{1.02} \right] = 10.0980 \]


c. You would want to buy a put to sell $ for MXP. This is equivalent to buying a call to buy MXP for $. Thus, you should buy MXP calls to insure the U.S. dollar cash flow. If you have cash available, you should buy 20 contracts:

\[ N = \frac{$1,000,000}{($0.10 / \text{MXP})(\text{MXP 500,000})} = 20 \]

at a cost of

\[ \text{Premium} = (20)(500,000)(0.005) = $50,000, \text{ or } \text{MXP 500,000} \]

Assuming that the call premiums can be financed by borrowing MXP at a zero interest rate, the resulting cash flows at different exchange rates are shown in the following table.
When the exchange rate is below the strike price of MXP10/$, the option is exercised; for example, when the exchange rate is MXP8/$ the cash flow is

\[ \text{(\\$1,000,000)(10) - MXP 500,000 = MXP 9,500,000} \]

When the exchange rate is above MXP 10/$, the option expires; for example, when the exchange rate is MXP12/$, the cash flow is

\[ \text{(\\$1,000,000)(12) - MXP 500,000 = MXP 11,500,000} \]

<table>
<thead>
<tr>
<th>Exchange Rate $:MPX</th>
<th>MXP Cash Flow (in MXP million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0</td>
<td>9.5</td>
</tr>
<tr>
<td>9.0</td>
<td>9.5</td>
</tr>
<tr>
<td>9.5</td>
<td>9.5</td>
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<tr>
<td>10.0</td>
<td>9.5</td>
</tr>
<tr>
<td>10.5</td>
<td>10.0</td>
</tr>
<tr>
<td>11.0</td>
<td>10.5</td>
</tr>
<tr>
<td>12.0</td>
<td>11.5</td>
</tr>
</tbody>
</table>

9. a. The three-month forward exchange rate is

\[ F = (2) \left[ \frac{1 + 0.06}{1 + 0.08} \right] = $1.9902 \text{ per £} \]

b. The optimal hedge ratio is determined by regressing the dollar returns of the British bonds on returns on the exchange rate. The result is strongly dependent on the correlation between the British interest rates and the pound value. In practice, the proposed strategy uses a hedge ratio of 1. This would be optimal if there were no correlation between interest rate and exchange rate movements.

c. Assume that the American investor buys £1 million of British bonds and sells forward £1 million for U.S. dollars.

If the various interest rates stay constant over the year and the currency hedge is rolled over every three months, the hedged British bonds will yield 12 percent minus 2 percent (the hedge’s cost, i.e., the short-term interest rate differential) or an approximate total of 10%. This yield will be realized no matter what happens to the currency. Therefore, the performance is better than that of a direct investment in U.S. bonds, which would yield only 7 percent. If long-term interest rates move, this advantageous yield differential (10 percent instead of 7 percent) could be offset by a capital loss on the British bond position.

Illustrative Calculations

Initial investment = £1,000,000 or $2,000,000

Value after three months = (£1,000,000)(1 + 0.12/4) = £1,030,000

Hedged value in $ = (£1,030,000)(1.9902) = $2,049,906

Three-month return = ($2,049,906/$2,000,000) − 1 = 0.025

Annualized return on hedged investment = (4)(0.025) = 0.10, or 10%
10. She would use € futures as a proxy for Danish kroner futures because the two exchange rates, €/$ and DKK/$, tend to move together. Denmark is part of the EU, but has not adopted the euro. However, Denmark attempts to maintain a stable exchange rate with the euro. At the current spot exchange rate, the Danish stock portfolio is worth

\[
\frac{\text{DKK}100,000,000}{\text{($1.10/€)(DKK 6.6/$)}} = €13,774,105
\]

Therefore, the American investor should sell €13.774 million of futures contracts against dollars. In Chicago, the € futures contracts have a size of €125,000, so the investor should sell 110 contracts \( \approx 13,774,105/125,000 \)

In practice, the proposed strategy uses a hedge ratio of 1. This would be optimal if there were no correlation between interest rate and exchange rate movements.

11. The following table provides the value of the portfolio in dollars at various exchange rates for the two hedging strategies, as well as the unhedged value. The calculations are explained for an exchange rate of ¥180/$ or $0.005556/¥.

<table>
<thead>
<tr>
<th>Hedge Strategy</th>
<th>Portfolio Value in Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Unhedged portfolio value:</td>
<td>¥160,000,000 ( \frac{¥}{¥180/¥} = 888,889.89 )</td>
</tr>
<tr>
<td>b. Hedged portfolio value, sale of yen futures at ¥160/$:</td>
<td>¥160,000,000 ( \frac{¥}{¥160/¥} = 1,000,000 )</td>
</tr>
<tr>
<td>c. Insured portfolio value, purchase of yen puts at $0.007 per 100 yen:</td>
<td>¥160,000,000 ( \frac{¥}{¥160/¥} = 1,000,000 )</td>
</tr>
</tbody>
</table>

To insure using options you will need to buy puts on the yen. The yen puts give the right to sell 1 yen for $1/160 = $0.00625. You would buy ¥160 million puts on the yen at a cost of

\[
\text{Premium} = ($0.00007 \text{ per yen}) \times ¥160,000,000 = ¥11,200
\]

The profit on the put is calculated as follows:

If Strike price > Current price, Profit = (Strike price – Current price) \( \times \) Quantity
If Strike price \( \leq \) Current price, Profit = 0

It is advantageous to exercise the puts. Since $0.000625 > $0.005556

\[
\text{Profit} = \left( \frac{¥1}{160} - \frac{¥1}{180} \right) \times ¥160,000,000 = ¥111,111
\]

The total value of the insured portfolio is equal to its unhedged value plus the profit on the puts minus the premium cost:

\[
\text{Insured portfolio value} = 888,889 + 111,200 = 988,800
\]

Note that if the exchange rate is below ¥160, the puts are worthless; the ensured portfolio value is equal to the unhedged portfolio value minus the insurance cost (premium of $11,200).
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The following table summarizes the portfolio’s final dollar value as a function of the spot exchange rate:

<table>
<thead>
<tr>
<th>¥ Exchange Rate</th>
<th>140</th>
<th>150</th>
<th>160</th>
<th>170</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unhedged portfolio</td>
<td>1.143</td>
<td>1.067</td>
<td>1.000</td>
<td>0.941</td>
<td>0.889</td>
</tr>
<tr>
<td>Futures sale</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Puts purchase</td>
<td>1.132</td>
<td>1.056</td>
<td>0.989</td>
<td>0.989</td>
<td>0.989</td>
</tr>
</tbody>
</table>

12. a. The Swiss investor wishes to use options as a delta-hedging device; therefore, the delta of the option should be taken into account.

The portfolio is worth $10 million, or SFr 25 million at the spot exchange rate of SFr 2.5/$. Ignoring the correlation of the U.S. stock market with the SFr/$ exchange rate, which is very small anyway, he should buy SFr call contracts as shown below (remember this is equivalent to buying puts on the $):

\[
\frac{25,000,000}{(62,500)(\delta)} = \frac{25,000,000}{(62,500)(0.5)} = 800 \text{ contracts}
\]

This would require payment of a premium of

\[
(800)(62,500)(0.01) = $500,000, \text{ or } (500,000)(2.50 \text{ SFr}$/) = \text{SFr 1,250,000}
\]

b. A few days later, the Swiss investor lost on his portfolio an amount of

\[
($10,000,000)(\text{SFr 2.939}$/ - \text{SFr 2.5}$/) = - \text{SFr 610,000}
\]

But he gained on the option position, because his options are now worth

\[
(800)(62,500)(0.016) = $800,000, \text{ or } ($800,000)(\text{SFr 2.439}$/) = \text{SFr 1,951,200}
\]

hence a gain on the options of 1,951,200 − 1,250,000 = SFr 701,200

The net gain is equal to SFr 91,200 = 701,200 − 610,000. The portfolio has been overhedged because the delta of the option has increased with the appreciation of the SFr.

c. In a dynamic strategy, the Swiss investor could sell part of his option contracts to adjust to the new delta. The investor now needs only 557 contracts, as shown:

- New SFr value of the portfolio: SFr 24,390,000 = ($10,000,000)(2.439SFr/$)
- Contracts needed for a delta hedge:

\[
\frac{24,390,000}{(62,500)(0.70)} = 557.5 \text{ contracts}
\]

13. a. To have a good dynamic hedge, you should buy 160 call contracts on the euro:

\[
\frac{10,000,000}{(125,000)(0.5)} = 160 \text{ contracts}
\]

The € value of the option position is

\[
($0.02/€)(160)(€125,000)(€1/$) = €400,000
\]
b. The portfolio value shows a loss in euros of

\[
\frac{($10,000,000)}{(1.1/€)} - \frac{($10,000,000)(€1/$)}{= - €909,091}
\]

The option position value is

\[
\frac{($0.11/€)(160)}{(€125,000)} \frac{(125,000)}{(1.1/€)} = €2,000,000.
\]

Hence, a gain on the option position of €1,600,000 = €2,000,000 – €400,000. The net gain is equal to €690,909 = €1,600,000 – €909,091

c. This net gain is due to the fact that the delta increased to 0.9, but the hedge was not rebalanced dynamically.

d. We can reduce the number of option contracts to

\[
\frac{9,090,909}{(125,000)(0.9)} = 81 \text{ contracts}
\]

where €9,090,909 is the current portfolio value = ($10,000,000)/(1.1/€)

14. This question can be answered by calculating the impact of the depreciation of the pound in the three strategies for an equivalent claim of one FTSE index.

In a direct investment in the British stock market (e.g., index fund), we must invest £6,000 to get one unit of index. In a future purchase, we only have to deposit £1,500/10 = £150 per unit of index because one futures contract is for the index times 10. In the call purchase, we only invest £20 per unit of index.

a. Direct investment in the FTSE index: You invest £6,000, or (£6000) ($2/£) = $12,000. The £ profit is equal to £6,100 – £6,000 = £100 But converted into dollars, this gives a loss of (£6,100) ($1.8/£) = (£6,000) ($2/£) = $1020

b. December futures on the FTSE index: You invest £150 per unit of index, or $300 = (£150)($2/£). The contract is marked-to-market, so by December you realize a profit of = £6,100 – £6,030 = £70. The final value is therefore £220 (£150 + £70), or $396 = (£220)($1.8/£). The net dollar profit is equal to $396 – $300 = $96

c. December 6050 FTSE call option: You invest £20 per unit of index or $40. The final value is £50, or $90 at the spot exchange rate of $1.8/£. The net dollar profit is equal to $90 – $40 = $50.

15. An American investor hedging the British pound risk has to “pay” the interest rate differential (British minus U.S. interest rate), while a British investor hedging the U.S. dollar risk “receives” it. It seems to be the reason why the journal suggests that Americans should not hedge their British investments, but that British investors should hedge their U.S. investments.

If the interest rate differential simply reflects the expected depreciation of the pound relative to the dollar, there is no expected “cost” of hedging in the sense intended by the journal. Furthermore, short-term currency swings can be very large relative to the interest rate differential, so risk should also be considered. To hedge currency risk could turn out to be a good decision, even if you have to pay an interest rate differential.

The journal could also be suggesting that a currency with a higher interest rate tends to appreciate. Even if this statement is true on the average, exchange rates are very volatile. A currency hedge still allows the reduction of the risk of a loss.
16. a. Traditional ways for the exporter to hedge against a decline in the value of the dollar would be to (i) buy puts on the dollar or, equivalently, (ii) buy calls on the pound. The Range Forward Contract ensures that the exporter will not pay more than $1.470/£, even if the dollar depreciates strongly relative to the pound. Typically the range forward insurance costs nothing. On the other hand, a traditional call on the pound is costly in that it involves payment of a call premium. The same applies to put options on the pound. The disadvantage of the range forward is that the exporter will not fully benefit from an appreciation of the dollar. In the case of options, the exporter can allow the option to expire worthless if the dollar appreciates. With a range forward contract, the exporter will benefit up to an exchange rate of $1.352/£, but not beyond that rate. So, the exporter sacrifices some profit potential to get “free” insurance.

b. This contract is the sum of
- a call pound, giving the exporter the right to buy pounds at $1.470/£; and
- a put pound, giving Salomon Brothers the right to sell pounds at $1.352/£.

In other words, the exporter buys a call with a strike of $1.470/£ and sells a put with a strike of $1.352/£. The fair value of the Range Forward Contract should be the difference between the call premium and the put premium. The fair value should be much smaller than that of the call alone. Typically, the strike prices are chosen so that the option costs nothing.

17. Again, assume that we buy the calls by borrowing pounds at a zero interest rate. For example, to “insure” with $1.50 strike calls on the £, we need to buy calls on £10 million. The cost is $300,000, which we finance with £200,000, given the spot exchange rate.

The following table provides portfolio values at various exchange rates. To explain, portfolio values are calculated at an exchange rate of $1.7/£.

a. Unhedged portfolio value:

$15,000,000/$1.7 per pound = £8,823,529

b. Hedged portfolio value, using forward contract $1.5 per pound:

$15,000,000/$1.5 per pound = £10,000,000

c. Insured portfolio, using March 1.50 calls: Once again, remember that you can insure using a put to sell S for £, or buying a call to buy £ using $ . The call option will be exercised if Current price > Strike price. Otherwise, it will expire worthless, and you lose only the option premium:

\[
\text{Option premium} = \frac{15,000,000}{1.5} \times (0.03) = $300,000
\]

or

\[
£200,000 = $300,000/1.5.
\]

Current price = $1.7/£ and the Strike price = $1.5/£. The option is exercised because it allows the exporter to buy pounds at a cheaper rate:

\[
\text{Profit on call} = \frac{15,000,000}{1.5} - \frac{15,000,000}{1.7} = £1,176,471
\]
The dollar depreciation leads to a currency loss:

\[
\frac{15,000,000}{1.7} - \frac{15,000,000}{1.5} = -£1,176,471
\]

The net profit on the position = £1,176,471 – £1,176,471 – £200,000 = –£200,000

The portfolio value = £10,000,000 – £200,000 = £9,800,000

<table>
<thead>
<tr>
<th>Exchange Rate (S/£)</th>
<th>Unhedged</th>
<th>Hedged</th>
<th>Insured with Call (150)</th>
<th>Insured with Call (155)</th>
<th>Insured with Call (160)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3</td>
<td>11,538</td>
<td>10,000</td>
<td>11,338</td>
<td>11,438</td>
<td>11,505</td>
</tr>
<tr>
<td>1.4</td>
<td>10,714</td>
<td>10,000</td>
<td>10,514</td>
<td>10,614</td>
<td>10,681</td>
</tr>
<tr>
<td>1.5</td>
<td>10,000</td>
<td>10,000</td>
<td>9,800</td>
<td>9,900</td>
<td>9,967</td>
</tr>
<tr>
<td>1.6</td>
<td>9,375</td>
<td>10,000</td>
<td>9,800</td>
<td>9,577</td>
<td>9,342</td>
</tr>
<tr>
<td>1.7</td>
<td>8,824</td>
<td>10,000</td>
<td>9,800</td>
<td>9,577</td>
<td>9,342</td>
</tr>
<tr>
<td>1.8</td>
<td>8,333</td>
<td>10,000</td>
<td>9,800</td>
<td>9,577</td>
<td>9,342</td>
</tr>
</tbody>
</table>

- Hedging with forward contracts allows to the exporter to eliminate the risk of a decline in the dollar. However, it also means that the British exporter will not benefit if the dollar appreciates.

- Options allow the exporter to “insure” rather than “hedge.” In other words, a floor is set on the total amount of pounds that the exporter will receive. If the dollar is “strong,” the exporter will benefit. However, an insurance has a cost that has to be borne in all cases (i.e., the premium paid to purchase the option).

- An expensive option (in-the-money; in this case, the $1.50 call) provides better protection in the case of a “weak” dollar, but reduces the profit potential in case of a “strong” dollar.

- A cheap option (the out-of-the-money $1.60 call) provides less protection in case of a “weak” dollar, but only slightly reduces the profit potential in case of a “strong” dollar.

The choice between the following five alternatives depends on the expectations and risk aversion of the exporter. We can rank them in decreasing order of protection against a drop in the dollar (e.g., from $1.50 to $1.70 per pound), as follows:

i. Hedge—Portfolio value £10,000,000
ii. Call 150—Portfolio value £9,800,000
iii. Call 155—Portfolio value £9,577,000
iv. Call 160—Portfolio value £9,342,000
v. No Hedge—Portfolio value £8,824,000

18. a. The manager would have to sell

\[
\frac{5,000,000}{(4098)(10)} = 122 \text{ contracts}
\]
b. The profit on the investment in the U.K. company:
   In pounds = \(5,022,000 - 5,000,000 = £22,000\)
   In dollars = \((5,022,000)(1.65) - (5,000,000)(1.58) = $386,300\)

   The loss on the futures contract:
   In pounds = \((122)(1)(4098 - 4200) = -£124,440\)
   In dollars = \((124,440)(1.65) = -$205,326\)

   The net profit or loss on the position:
   In pounds = £22,000 - £124,440 = -£102,440
   In dollars = $386,300 - $205,326 = $180,974

19. a. The manager would have to sell

\[
\frac{10,000,000}{(902)(250)} = 44 \text{ contracts}
\]

b. The profit on the investment in the U.S. company:
   In dollars = \(10,050,000 - 10,000,000 = $50,000\)
   In euros = \((10,050,000)(0.98) - (10,000,000)(1.2) = -€2,151,000\)

   The profit on the futures contract:
   In dollars = \((44)(250) [902 - 890] = $132,000\)
   In euros = \((132,000)(0.98) = €129,360\)

   The net profit or loss on the position:
   In dollars = \$50,000 + $132,000 = $182,000
   In euros = €129,360 - €2,151,000 = -€2,021,640

   Notice that, in this case, the currency losses on the depreciation of the euro swamped the dollar gains on the stock and futures positions.

20. Appreciation of a foreign currency will, indeed, increase the dollar returns that accrue to a U.S. investor. However, the amount of the expected appreciation must be compared with the forward premium or discount on that currency in order to determine whether or not hedging should be undertaken.

   In the present example, the yen is forecast to appreciate from 100 to 98 (2%). However, the forward premium on the yen, as given by the differential in one-year Eurocurrency rates, suggests an appreciation of over 5%:

   \[
   \text{Forward premium} = \left[ \left( \frac{1.06}{1.008} \right) - 1 \right] = 5.16\%.
   \]

   Or, using interest rate parity, the implied forward rate for the yen is

   \[
   (100) \left[ \frac{1.008}{1.06} \right] = ¥95.09/$
   \]

   Thus, the manager’s strategy to leave the yen unhedged is not appropriate. The manager should hedge, because, by doing so, a higher rate of yen appreciation can be locked in. Given the one-year Eurocurrency rate differentials, the yen position should be left unhedged only if the yen is forecast to appreciate to an exchange rate of less than 95.09 yen per U.S. dollar.