**Chapter 19**

**Problem 19-1**

*(Related to Checkpoint 19.1) (Converting currencies)* An American business needs to pay (a) 10,000 Canadian dollars, (b) 2 million yen, and (c) 50,000 Swiss francs to businesses abroad. What are the dollar payments to the respective countries?

<table>
<thead>
<tr>
<th>Selling Quotes for Foreign Currencies in New York</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country-Currency</strong></td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Canada – dollar</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Japan – yen</td>
</tr>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Switzerland – franc</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

The key determinant of the number of U.S. dollars required to purchase the 10,000 Canadian dollars is the rate of exchange between the U.S. dollars and Canadian dollars, which in this case is U.S. $0.8437 per Canadian dollar.

The key determinant of the number of U.S. dollars required to purchase the 2,000,000 Japanese yen is the rate of exchange between the U.S. dollars and Japanese yen.
Chapter 19

Problem 19-1 (cont.)

Japanese yen, which in this case is U.S. $0.004684 per Japanese yen.

The key determinant of the number of U.S. dollars required to purchase the 50,000 Swiss francs is the rate of exchange between the U.S. dollars and Swiss francs, which in this case is U.S. $0.8437 per Swiss franc.
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Problem 19-1 (cont.)

**STEP 2: Decide on a solution strategy**

To determine the number of U.S. dollars needed to purchase the foreign currency, we need to know the dollar price of one foreign currency, that is, the direct quote, and multiply it times the amount we need.

**STEP 3: Solve**

**Using the Mathematical Formula:**

**a.** Canadian dollars:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. S / Canadian dollar)}
\]

\[
\text{U.S. dollar payment} = 10,000 \text{ Canadian dollars} \times \text{U.S. } 0.8437 / \text{ Canadian dollar} = 8,437
\]

Thus, in order to buy 10,000 Canadian dollars, given an exchange rate of U.S. $0.8437/Canadian dollar, the American business needs $8,437.

**b.** Japanese yen:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. S / Japanese yen)}
\]

\[
\text{U.S. dollar payment} = 2,000,000 \text{ yen} \times \text{U.S. } 0.004684 / \text{ yen} = 9,368
\]

In order to buy 2 million yen, given an exchange rate of U.S. $0.004684/yen, the American business needs $9,368.

**c.** Swiss francs:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. S / Swiss franc)}
\]

\[
\text{U.S. dollar payment} = 50,000 \text{ Swiss francs} \times \text{U.S. } 0.5139 / \text{ Swiss franc} = 25,695
\]

Therefore, to buy 50,000 Swiss francs, given an exchange rate of U.S. $0.5139/Swiss franc, the American business needs $25,695.
Problem 19-1 (cont.)

**STEP 4: Analyze**

The American business needs $8,437 to buy 10,000 Canadian dollars, $9,368 to buy 2 million yen, and $25,695 to buy 50,000 Swiss francs.
Problem 19-2

(Converting currencies) An American business pays $10,000, $15,000, and $20,000 to suppliers in Japan, Switzerland, and Canada, respectively. How much, in local currencies, do the suppliers receive?

<table>
<thead>
<tr>
<th>Selling Quotes for Foreign Currencies in New York</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country-Currency</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Canada – dollar</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Japan – yen</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switzerland – franc</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

We are given the direct quote; however, we need the indirect quote (the reciprocal of the direct quote) to solve this. The indirect quotes are shown in the graphs below.
Problem 19-2 (cont.)

**STEP 2: Decide on a solution strategy**

This is a typical spot transaction by which one currency is traded for another currency today. The price of foreign currency in terms of the domestic currency is the exchange rate. Notice that the quoted exchange rates shown in this problem are direct quotes. However, you need to compute the amount suppliers will receive by using an indirect quote. An indirect quote is the foreign currency/U.S. dollar (FC/U.S. $) rate. Bear in mind that an indirect quote is the reciprocal of a direct quote and vice versa.

In each case you can calculate the amount of foreign currency to pay as follows:

\[
\text{Foreign Currency Amount} = \text{Dollar amount} \times \text{Exchange rate}
\]

* Please note that the equation is incomplete and missing an asterisk. In a typical financial context, the exchange rate would be multiplied by the dollar amount to determine the foreign currency amount.
Problem 19-2 (cont.)

(* ) An indirect quote must be used to express the exchange rate. For the indirect quote, use as many decimals as the direct quote does. Calculate each indirect quote as the reciprocal of the corresponding direct quote.

\[
\text{Indirect quote} = \frac{1}{\text{direct quote}}
\]

**STEP 3: Solve**

**Using the Mathematical Formula:**

**a. Japanese suppliers:**

\[
\text{Indirect quote} = \frac{1}{\text{U.S. } \$0.004684} = 213.492741 \text{ (yen / U.S. \$)}
\]

Foreign Currency Amount = U.S. \$10,000 × 213.492741 (¥ / U.S. \$) = ¥2,134,927

Therefore, if the American business pays $10,000, suppliers in Japan will receive 2,134,927 Japanese yen.

**b. Swiss suppliers:**

\[
\text{Indirect quote} = \frac{1}{\text{U.S. } \$0.5139} = 1.9459 \text{ (Swiss franc / U.S. \$)}
\]

Foreign Currency Amount = U.S. \$15,000 × 1.9459 (SFr / U.S. \$) = 29,189SFr

If the American business pays $15,000, suppliers in Switzerland will receive 29,189 Swiss francs.

**c. Canadian suppliers:**
Problem 19-2 (cont.)

\[
\text{Indirect quote} = \frac{1}{\text{U.S. $0.8437}} = 1.1853 \text{ (Canadian dollar/U.S. $)}
\]

\[
\text{Foreign Currency Amount} = \text{U.S. $20,000} \times 1.1853 \text{ (C$/ U.S. $)} = \text{C$23,705}
\]

Finally, if the American business pays $20,000, suppliers in Canada will receive 23,705 Canadian dollars.

**STEP 4: Analyze**

The Japanese suppliers will receive 2,134,927 yen, the Swiss suppliers will receive 29,189 Swiss francs, and the Canadian suppliers will receive 23,705 Canadian dollars.
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Problem 19-3

(Indirect quotes) Compute the indirect quote for the spot and forward Canadian dollar, yen, and Swiss franc contracts.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8437</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.8417</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.8395</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004684</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004717</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004781</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.5139</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.5169</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.5315</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

We can visualize the problem by considering the information we are given:

![Graph showing exchange rates](#)
Problem 19-3 (cont.)

**STEP 2: Decide on a solution strategy**

An indirect quote indicates the number of units of a foreign currency that can be bought for one unit of the home currency. An indirect quote is the foreign currency/U.S. dollar (FC/U.S. $) rate. Notice that an indirect quote is the reciprocal of a direct quote and vice versa. Also notice that the quoted exchange rates in the data table above are direct quotes.
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Problem 19-3 (cont.)

You must compute an indirect quote as follows:

\[
\text{Indirect quote} = \frac{1}{\text{direct quote}}
\]

**STEP 3: Solve**

**Using the Mathematical Formula:**

**a. Canadian rates:**

Calculate the spot, 30-day, and 90-day Canadian dollar rates:

\[
\begin{align*}
\text{Indirect quote}_{\text{spot}} &= \frac{1}{\text{U.S. } \$0.8437 / \text{C$}} = 1.1853 \text{ C$ / U.S. } \$
\text{Indirect quote}_{30-\text{day}} &= \frac{1}{\text{U.S. } \$0.8417 / \text{C$}} = 1.1881 \text{ C$ / U.S. } \$
\text{Indirect quote}_{90-\text{day}} &= \frac{1}{\text{U.S. } \$0.8395 / \text{C$}} = 1.1912 \text{ C$ / U.S. } \$
\end{align*}
\]

**b. Japanese rates:**

Calculate the spot, 30-day, and 90-day yen rates:

\[
\begin{align*}
\text{Indirect quote}_{\text{spot}} &= \frac{1}{\text{U.S. } \$0.004684 / \text{¥}} = 213.4927 \text{ ¥ / U.S. } \$
\text{Indirect quote}_{30-\text{day}} &= \frac{1}{\text{U.S. } \$0.004717 / \text{¥}} = 211.9992 \text{ ¥ / U.S. } \$
\text{Indirect quote}_{90-\text{day}} &= \frac{1}{\text{U.S. } \$0.004781 / \text{¥}} = 209.1613 \text{ ¥ / U.S. } \$
\end{align*}
\]
Problem 19-3 (cont.)

c. Swiss rates:

Calculate the spot, 30-day, and 90-day Swiss franc rates:

\[
\text{Indirect quote}_{\text{spot}} = \frac{1}{\text{U.S. } \$0.5139 / \text{SFr}} = 1.9459 \text{ SFr} / \text{U.S. } \$
\]

\[
\text{Indirect quote}_{30\text{-day}} = \frac{1}{\text{U.S. } \$0.5169 / \text{SFr}} = 1.9346 \text{ SFr} / \text{U.S. } \$
\]

\[
\text{Indirect quote}_{90\text{-day}} = \frac{1}{\text{U.S. } \$0.5315 / \text{SFr}} = 1.8815 \text{ SFr} / \text{U.S. } \$
\]

**STEP 4: Analyze**

The results are tabulated below:

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>Foreign Currency/U.S. $ (Indirect Quote)</th>
<th>U.S. $/Foreign Currency (Direct Quote)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>1.1853</td>
<td>0.8437</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>1.1881</td>
<td>0.8417</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>1.1912</td>
<td>0.8395</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>213.4927</td>
<td>0.004684</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>211.9992</td>
<td>0.004717</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>209.1613</td>
<td>0.004781</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>1.9459</td>
<td>0.5139</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>1.9346</td>
<td>0.5169</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>1.8815</td>
<td>0.5315</td>
</tr>
</tbody>
</table>
Problem 19-4

(Bid, spot, and forward rates) The spreads on the contracts as a percent of the asked rates are 2 percent for yen, 3 percent for Canadian dollars, and 5 percent for Swiss francs. Show, in a table similar to the table on the right, the bid rates for the different spot and forward rates.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8437</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.8417</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.8395</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004684</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004717</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004781</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.5139</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.5169</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.5315</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

We can visualize the problem by considering the information we are given:
Problem 19-4 (cont.)

STEP 2: Decide on a solution strategy

Two types of rates are quoted in the exchange market: the asked and the bid rates. The asked rate is the rate the bank or the foreign exchange trader asks the customer to pay in home currency for foreign currency when the bank is selling and the customer is buying. The bid rate is the rate at which the bank buys the foreign currency from the customer by paying in home currency. The bank sells a unit of foreign currency for more than it pays for it. This means that a direct asked quote is greater than a direct bid quote.
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Problem 19-4 (cont.)

STEP 3: Solve

a. Canadian rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Canadian dollars is 97% of the asked quote.

\[
\text{Canadian dollar spot} = \text{U.S. } \$0.8437 / \text{C$} \times 0.970 = \text{U.S. } \$0.8184 / \text{C$} \\
\text{Canadian dollar 30-day forward} = \text{U.S. } \$0.8417 / \text{C$} \times 0.970 = \text{U.S. } \$0.8164 / \text{C$} \\
\text{Canadian dollar 90-day forward} = \text{U.S. } \$0.8395 / \text{C$} \times 0.970 = \text{U.S. } \$0.8143 / \text{C$}
\]

b. Japanese rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Japanese yen is 98% of the asked quote.

\[
\text{Japanese yen spot} = \text{U.S. } \$0.004684 / \text{¥} \times 0.980 = \text{U.S. } \$0.004590 / \text{¥} \\
\text{Japanese yen 30-day forward} = \text{U.S. } \$0.004717 / \text{¥} \times 0.980 = \text{U.S. } \$0.004623 / \text{¥} \\
\text{Japanese yen 90-day forward} = \text{U.S. } \$0.004781 / \text{¥} \times 0.980 = \text{U.S. } \$0.004685 / \text{¥}
\]

c. Swiss rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Swiss francs is 95% of the asked quote.

\[
\text{Swiss franc spot} = \text{U.S. } \$0.5139 / \text{SFr} \times 0.950 = \text{U.S. } \$0.4882 / \text{SFr} \\
\text{Swiss franc 30-day forward} = \text{U.S. } \$0.5169 / \text{SFr} \times 0.950 = \text{U.S. } \$0.4911 / \text{SFr} \\
\text{Swiss franc 90-day forward} = \text{U.S. } \$0.5315 / \text{SFr} \times 0.950 = \text{U.S. } \$0.5049 / \text{SFr}
\]

STEP 4: Solve

The results are tabulated below:
## Problem 19-4 (cont.)

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>Bid Quotes U.S. S/Foreign Currency</th>
<th>Ask Quotes U.S. S/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.8184</td>
<td>0.8437</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.8164</td>
<td>0.8417</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.8143</td>
<td>0.8395</td>
</tr>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.004590</td>
<td>0.004684</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004623</td>
<td>0.004717</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004685</td>
<td>0.004781</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.4882</td>
<td>0.5139</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.4911</td>
<td>0.5169</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.5049</td>
<td>0.5315</td>
</tr>
</tbody>
</table>
Chapter 19

Problem 19-5

(Foreign exchange arbitrage) You own $10,000. The U.S. dollar rate in Tokyo is ¥216.6743/U.S. $. The yen rate in New York is given in the table. Are arbitrage profits possible? Set up an arbitrage scheme with your capital. What is the gain in dollars?

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. S/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004684</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004717</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004781</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

In this problem, you will be buying Japanese yen with dollars and at the same time selling the yen in New York at the prevailing price.


STEP 2: Decide on a solution strategy

Using the equation below we can convert the indirect quote (¥216.6743/U.S. $) into a direct quote:

\[
\text{Direct quote} = \frac{1}{\text{Indirect Quote}}
\]

From that, we can determine if profits can be made by comparing the direct exchange rate quote in Tokyo with the direct exchange rate quote in New York.

STEP 3: Solve

Using the given equation, we can solve for the direct quote in Tokyo:

\[
\text{Direct Quote} = \frac{1}{¥216.6743 / \text{U.S. $}}
\]
Problem 19-5 (cont.)

The direct quote in Tokyo, ¥0.004615/ U.S $, is less than the direct quote in New York, ¥0.004684/ U.S $.

**STEP 4: Analyze**

Since the direct quotes in the two cities are different, arbitrage profits are possible.

**STEP 1: Picture the problem**

In this problem you will be buying Japanese yen with dollars and at the same time selling the yen in New York at the prevailing price.

![Diagram showing buy and sell of Japanese yen]

**STEP 2: Decide on a solution strategy**

To determine the dollar value gain or loss from arbitrage, use the equation below:

\[
\text{Arbitrage Gain / Loss} = [(\text{Dollar Amount}) \times (¥/ \text{U.S.$ in Tokyo}) \times (\text{U.S.$/ ¥ in New York})] - \text{(Dollar Amount)}
\]

You want to use your dollars to buy the most yen possible and then sell your yen to buy the most dollars possible.

**STEP 3: Solve**

First: In Tokyo you can buy ¥216,6743/ U.S $ and in New York you can buy ¥213,4927/ U.S. $ (=1/ U.S. $0.004684/ ¥). Because you can buy more yen per U.S. dollar in Tokyo, you should buy $10,000 worth of yen in Tokyo. Therefore, the number of yen purchased would be U.S. $10,000 \times ¥216,6743 / U.S. $ = ¥2,166,743.

Then: In Tokyo you can buy U.S. $0.004615/ ¥ and in New York you can buy U.S. $0.004684/ ¥; therefore, you simultaneously sell the yen in New York at the higher prevailing rate. The amount received upon the sale of the yen would be: ¥2,166,743 \times \text{U.S. $0.004684/ ¥} = ¥10,149.02. The net gain is...
Problem 19-5 (cont.)

$10,149.02 – $10,000 = $149.02.

STEP 4: Analyze

The net gain is $149.02.
Problem 19-6

**(Spot rates)** Compute the Canadian dollar/yen and the yen/Swiss franc spot rate from the data in the given table.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8437</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004684</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.5139</td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

A cross rate is the computation of an exchange rate for a currency from the exchange rates of two other currencies. Below is a chart of each country’s spot rate.

![Bar chart showing spot rates](chart)

**STEP 2: Decide on a solution strategy**

Use the following formulas to determine the appropriate cross rate:

\[
\text{(Canadian dollar / yen)} = (\text{U.S.$ / yen}) \times (\text{Canadian dollar / U.S.$})
\]

where,

\[
\text{(Canadian dollar / U.S.$)} = \frac{1}{(\text{U.S.$ / Canadian dollar})}
\]

**STEP 3: Solve**
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Problem 19-6 (cont.)

First, we need to calculate the yen/U.S.$ spot rate:

\[
\frac{1}{0.8437 \text{ U.S. $} / \text{C$}} = 1.1853 \text{ C$} / \text{U.S. $}
\]

We then use the yen/U.S.$ spot rate to find the yen/Swiss franc cross rate:

\[
(\text{Canadian dollar / yen}) = (0.004684 \text{ U.S. $} / ¥) \times (1.1853 \text{ C$} / \text{U.S. $}) = 0.00555 \text{ C$} / ¥
\]

**STEP 4: Analyze**

The Canadian dollar/yen spot rate is 0.00555C$ / ¥.

**STEP 1: Picture the problem**

A cross rate is the computation of an exchange rate for a currency from the exchange rates of two other currencies. Below is a chart of each country's spot rate.

![Cross Rate Chart]

**STEP 2: Decide on a solution strategy**

Use the following formulas to determine the appropriate cross rate:
Problem 19-6 (cont.)

\[(\text{yen} / \text{Swiss franc}) = (\text{U.S.} \ $ / \text{Swiss franc}) \times (\text{yen} / \text{U.S.} \ $)\]

where,

\[(\text{yen} / \text{U.S.} \ $) = \frac{1}{(\text{U.S.} \ $ / \text{yen})}\]

**STEP 3: Solve**

First, we need to calculate the yen/U.S.$ spot rate:

\[(\text{yen} / \text{U.S.} \ $) = \frac{1}{0.004684 \text{ U.S.} \ $ / \text{¥}} = 213.4927 \text{ ¥} / \text{U.S.} \ $\]

We then use the yen/U.S.$ spot rate to find the yen/Swiss franc cross rate:

\[(\text{yen} / \text{Swiss franc}) = (0.5139 \text{ U.S.} \ $ / \text{SFr}) \times (213.4927 \text{ ¥} / \text{U.S.} \ $) = 109.7139 \text{ ¥} / \text{SFr}\]

**STEP 4: Analyze**

The yen/Swiss franc spot rate is 109.7139¥ / SFr.
Problem 19-7

(Related to Checkpoint 19.2) (Determining the percent-per-annum premium or discount) You are in need of Canadian dollars in six months, but before entering a forward contract to buy them, you would like to know their premium or discount from the existing spot rate. Calculate the premium or discount from the existing spot rate for the 6-month Canadian dollar as of January 8, 2010 using the data given in the table.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>In U.S. $</th>
<th>Per U.S. $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>0.9700</td>
<td>1.0309</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.9698</td>
<td>1.0311</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>0.010798</td>
<td>92.6097</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.010803</td>
<td>92.5669</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>0.9772</td>
<td>1.0233</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.9783</td>
<td>1.0222</td>
</tr>
<tr>
<td>UK – pound</td>
<td>1.6028</td>
<td>0.6239</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>1.6008</td>
<td>0.6247</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

The prices in the table are used to determine the size of the premium. After determining the size of the premium, annualize it to arrive at the solution. Below is a chart of each country's spot rate and 6-month forward rate.

![Chart showing exchange rates and forward rates for different countries]

STEP 2: Decide on a solution strategy

Using the table above, find the forward rate (F), the spot rate (S), and the number of months of the forward contract (n). Then, input those variables into the following formula:
Problem 19-7 (cont.)

Annualized percentage = \( \frac{F - S}{S} \times \frac{12}{n} \times 100 \)

**STEP 3: Solve**

Computing the percent-per-annum premium on the 6-month Canadian dollar:

First: Identify \( F, S, \) and \( n. \)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F )</td>
<td>0.9698</td>
</tr>
<tr>
<td>( S )</td>
<td>0.9700</td>
</tr>
<tr>
<td>( n )</td>
<td>6 months</td>
</tr>
</tbody>
</table>

Then: Using those values, we compute the annualized percentage premium:

Annualized percentage = \( \frac{0.9698 - 0.9700}{0.9700} \times \frac{12}{6} \times 100 = -0.0412\% \)

**STEP 4: Analyze**

The discount from the existing Canadian dollar spot rate is \(-0.0412\%.\)
Problem 19-8

(Related to Checkpoint 19.1) (Converting currencies) An American business needs to pay (a) 15,000 Canadian dollars, (b) 1.5 million yen, and (c) 55,000 Swiss francs to businesses abroad. What are the dollar payments to the respective countries?

| Selling Quotes for Foreign Currencies in New York |
|--------------------------------------------------|------------------|
| Country-Currency                  | Contract | U.S. $/Foreign Currency |
| Canada – dollar                   | Spot     | 0.8439                   |
|                                   | 30-day   | 0.8410                   |
|                                   | 90-day   | 0.8390                   |
| Japan – yen                       | Spot     | 0.004680                 |
|                                   | 30-day   | 0.004720                 |
|                                   | 90-day   | 0.004787                 |
| Switzerland – franc               | Spot     | 0.5140                   |
|                                   | 30-day   | 0.5179                   |
|                                   | 90-day   | 0.5335                   |

**STEP 1: Picture the problem**

The key determinant of the number of U.S. dollars required to purchase the 15,000 Canadian dollars is the rate of exchange between the U.S. dollars and Canadian dollars, which in this case is U.S. $0.8439 per Canadian dollar.

The key determinant of the number of U.S. dollars required to purchase the 1,500,000 Japanese yen is the rate of exchange between the U.S. dollars and
Problem 19-8 (cont.)

Japanese yen, which in this case is U.S. $0.004680 per Japanese yen.

The key determinant of the number of U.S. dollars required to purchase the 55,000 Swiss francs is the rate of exchange between the U.S. dollars and Swiss francs, which in this case is U.S. $0.5140 per Swiss franc.

STEP 2: Decide on a solution strategy

To determine the number of U.S. dollars needed to purchase the foreign dollar, we need to know the U.S. dollar price of one foreign dollar, that is, the direct
Problem 19-8 (cont.)

quote, and multiply it times the amount we need.

**STEP 3: Solve**

**Using the Mathematical Formula:**

**a.** Canadian dollars:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. \$ / Canadian dollar)}
\]

\[
\text{U.S. dollar payment} = \text{C}\$15,000 \times \text{U.S. \$0.8439 / C}\$ = \text{\$12,659}
\]

In order to buy 15,000 Canadian dollars, given an exchange rate of U.S. $0.8439/C$, the American business needs $12,659.

**b.** Japanese yen:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. \$ / Japanese yen)}
\]

\[
\text{U.S. dollar payment} = \text{¥1,500,000} \times \text{U.S. \$0.004680 / ¥} = \text{¥7,020}
\]

In order to buy 1.5 million yen, given an exchange rate of U.S. $0.004680/yen, the American business needs $7,020.

**c.** Swiss francs:

\[
\text{U.S. dollar payment} = \text{Amount of foreign currency} \times \text{Exchange rate (U.S. \$ / Swiss franc)}
\]

\[
\text{U.S. dollar payment} = 55,000 \text{ SFr} \times \text{U.S. \$0.5140 / SFr} = \text{\$28,270}
\]

Therefore, to buy 55,000 Swiss francs, given an exchange rate of U.S. $0.5140/Swiss franc, the American business needs $28,270.

**STEP 4: Analyze**

The American business needs $12,659 to buy 15,000 Canadian dollars, $7,020 to buy 1.5 million yen, and $28,270 to buy 55,000 Swiss francs.
Problem 19-9

(Converting currencies) An American business pays $20,000, $5,000, and $15,000 to suppliers in Japan, Switzerland, and Canada, respectively. How much, in local currencies, do the suppliers receive?

<table>
<thead>
<tr>
<th>Selling Quotes for Foreign Currencies in New York</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country-Currency</strong></td>
</tr>
<tr>
<td>Canada – dollar</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Japan – yen</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Switzerland – franc</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

We are given the direct quote; however, we need the indirect quote (the reciprocal of the direct quote) to solve this. The indirect quote is shown in the graphs below.
STEP 2: Decide on a solution strategy

This is a typical spot transaction by which one currency is traded for another currency today. The price of foreign currency in terms of the domestic currency is the exchange rate. Notice that the quoted exchange rates shown in this problem are direct quotes. However, you need to compute the amount suppliers will receive by using an indirect quote. An indirect quote is the foreign currency/U.S. dollar (FC/U.S. $) rate. Bear in mind that an indirect quote is the reciprocal of a direct quote and vice versa.

In each case you can calculate the amount of foreign currency to pay as follows:

Foreign Currency Amount = Dollar amount × Exchange rate

*
Problem 19-9 (cont.)

( * ) An indirect quote must be used to express the exchange rate. For the indirect quote, use as many decimals as the direct quote does. Calculate each indirect quote as the reciprocal of the corresponding direct quote.

\[
\text{Indirect quote} = \frac{1}{\text{direct quote}}
\]

**STEP 3: Solve**

**Using the Mathematical Formula:**

**a.** Japanese suppliers:

\[
\text{Indirect quote} = \frac{1}{\text{U.S. \$0.004680 / yen}} = 213.675214 \text{ (yen / U.S. \$)}
\]

Foreign Currency Amount = U.S. $20,000 \times 213.675214 \text{ (yen / U.S. \$)} = ¥4,273,504

Therefore, if the American business pays $20,000, suppliers in Japan will receive 4,273,504 Japanese yen.

**b.** Swiss suppliers:

\[
\text{Indirect quote} = \frac{1}{\text{U.S. \$0.5140 / Swiss franc}} = 1.9455 \text{ (Swiss franc / U.S. \$)}
\]

Foreign Currency Amount = U.S. $5,000 \times 1.9455 \text{ (Swiss franc / U.S. \$)} = 9,728 SFr

If the American business pays $5,000, suppliers in Switzerland will receive 9,728 Swiss francs.

**c.** Canadian suppliers:
Problem 19-9 (cont.)

Indirect quote = \[ \frac{1}{\text{U.S. } \$0.8439 / \text{CS}} = 1.1850 \text{ (C$ / U.S.$)} \]

Foreign Currency Amount = U.S. $15,000 \times 1.1850 \text{ (C$ / U.S.$)} = \text{C$17,775}

Finally, if the American business pays $15,000, suppliers in Canada will receive 17,775 Canadian dollars.

**STEP 4: Analyze**

The Japanese suppliers will receive 4,273,504 yen, the Swiss suppliers will receive 9,728 Swiss francs, and the Canadian suppliers will receive 17,775 Canadian dollars.
**Problem 19-10**

*(Indirect quotes)* Compute the indirect quote for the spot and forward Canadian dollar, yen, and Swiss franc contracts.

| Selling Quotes for Foreign Currencies in New York |
|---------------------------------|--------|----------------|
| Country-Currency               | Contract | U.S. $/Foreign Currency |
| Canada – dollar                | Spot    | 0.8439          |
|                                 | 30-day   | 0.8410          |
|                                 | 90-day   | 0.8390          |
| Japan – yen                    | Spot    | 0.004680        |
|                                 | 30-day   | 0.004720        |
|                                 | 90-day   | 0.004787        |
| Switzerland – franc            | Spot    | 0.5140          |
|                                 | 30-day   | 0.5179          |
|                                 | 90-day   | 0.5335          |

**STEP 1: Picture the problem**

We can visualize the problem by considering the information we are given:

![Graph showing exchange rates](image_url)
STEP 2: Decide on a solution strategy

An indirect quote indicates the number of units of a foreign currency that can be bought for one unit of the home currency. An indirect quote is the foreign currency/U.S. dollar (FC/U.S. $) rate. Notice that an indirect quote is the reciprocal of a direct quote and vice versa. Also notice that the quoted exchange rates in the data table above are direct quotes.

You must compute an indirect quote as follows:
Problem 19-10 (cont.)

Indirect quote = \( \frac{1}{\text{direct quote}} \)

**STEP: Solve**

**Using the Mathematical Formula:**

**a. Canadian rates:**

Calculate the spot, 30-day, and 90-day Canadian dollar rates:

\[
\text{Indirect quote}_{\text{spot}} = \frac{1}{\text{U.S. } \$0.8439 / \text{C}\$} = 1.1850 \text{ C}\$ / \text{U.S. } \$
\]
\[
\text{Indirect quote}_{30-\text{day}} = \frac{1}{\text{U.S. } \$0.8410 / \text{C}\$} = 1.1891 \text{ C}\$ / \text{U.S. } \$
\]
\[
\text{Indirect quote}_{90-\text{day}} = \frac{1}{\text{U.S. } \$0.8390 / \text{C}\$} = 1.1919 \text{ C}\$ / \text{U.S. } \$
\]

**b. Japanese rates:**

Calculate the spot, 30-day, and 90-day yen rates:

\[
\text{Indirect quote}_{\text{spot}} = \frac{1}{\text{U.S. } \$0.004680 / \text{¥}} = 213.675214 \text{ ¥} / \text{U.S. } \$
\]
\[
\text{Indirect quote}_{30-\text{day}} = \frac{1}{\text{U.S. } \$0.004720 / \text{¥}} = 211.864407 \text{ ¥} / \text{U.S. } \$
\]
\[
\text{Indirect quote}_{90-\text{day}} = \frac{1}{\text{U.S. } \$0.004787 / \text{¥}} = 208.899102 \text{ ¥} / \text{U.S. } \$
\]
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Problem 19-10 (cont.)

c. Swiss rates:

Calculate the spot, 30-day, and 90-day Swiss franc rates:

\[
\text{Indirect quote}_{\text{spot}} = \frac{1}{\text{U.S. } \$0.5140 / \text{SFr}} = 1.9455 \text{ SFr/ U.S. } \$
\]

\[
\text{Indirect quote}_{\text{30-day}} = \frac{1}{\text{U.S. } \$0.5179 / \text{SFr}} = 1.9309 \text{ SFr/ U.S. } \$
\]

\[
\text{Indirect quote}_{\text{90-day}} = \frac{1}{\text{U.S. } \$0.5335 / \text{SFr}} = 1.8744 \text{ SFr/ U.S. } \$
\]

**STEP 4: Analyze**

The results are tabulated below:

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>Foreign Currency/U.S. $ (Indirect Quote)</th>
<th>U.S. $/Foreign Currency (Direct Quote)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>1.1850</td>
<td>0.8439</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>1.1891</td>
<td>0.8410</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>1.1919</td>
<td>0.8390</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>213.675214</td>
<td>0.004680</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>211.864407</td>
<td>0.004720</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>208.899102</td>
<td>0.004787</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>1.9455</td>
<td>0.5140</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>1.9309</td>
<td>0.5179</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>1.8744</td>
<td>0.5335</td>
</tr>
</tbody>
</table>
Problem 19-11

(Bid, spot, and forward rates) The spreads on the contracts as a percent of the asked rates are 4 percent for yen, 3 percent for Canadian dollars, and 6 percent for Swiss francs. Show, in a table similar to the table on the right, the bid rates for the different spot and forward rates.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8439</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.8410</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.8390</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004680</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004720</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004787</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.5140</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.5179</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.5335</td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

We can visualize the problem by considering the information we are given:

![Graph showing exchange rates](image-url)
Problem 19-11 (cont.)

**STEP 2: Decide on a solution strategy**

Two types of rates are quoted in the exchange market: the asked and the bid rates. The asked rate is the rate the bank or the foreign exchange trader asks the customer to pay in home currency for foreign currency when the bank is selling and the customer is buying. The bid rate is the rate at which the bank buys the foreign currency from the customer by paying in home currency. The bank sells a unit of foreign currency for more than it pays for it. This means that a direct asked quote is greater than a direct bid quote.
Problem 19-11 (cont.)

**STEP 3: Solve**

a. Japan rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Japanese yen is 96% of the asked quote.

- Japanese yen spot = U.S. $0.004680 / ¥ × 0.960 = U.S. $0.004493 / ¥
- Japanese yen 30-day forward = U.S. $0.004720 / ¥ × 0.960 = U.S. $0.004531 / ¥
- Japanese yen 90-day forward = U.S. $0.004787 / ¥ × 0.960 = U.S. $0.004596 / ¥

b. Canadian rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Canadian dollars is 97% of the asked quote.

- Canadian dollar spot = U.S. $0.8439 / C$ × 0.970 = U.S. $0.8186 / C$
- Canadian dollar 30-day forward = U.S. $0.8410 / C$ × 0.970 = U.S. $0.8158 / C$
- Canadian dollar 90-day forward = U.S. $0.8390 / C$ × 0.970 = U.S. $0.8138 / C$

c. Swiss rates:

Recall that the direct asked quote is greater than the direct bid quote. Consequently, the direct bid quote for the Swiss francs is 94% of the asked quote.

- Swiss franc spot = U.S. $0.5140 / SFr × 0.940 = U.S. $0.4832 / SFr
- Swiss franc 30-day forward = U.S. $0.5179 / SFr × 0.940 = U.S. $0.4868 / SFr
- Swiss franc 90-day forward = U.S. $0.5335 / SFr × 0.940 = U.S. $0.5015 / SFr

**STEP 4: Solve**

The results are tabulated below:
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Problem 19-11 (cont.)

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>Bid Quotes U.S. $/Foreign Currency</th>
<th>Ask Quotes U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8186</td>
<td>0.8439</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.8158</td>
<td>0.8410</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.8138</td>
<td>0.8390</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004493</td>
<td>0.004680</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004531</td>
<td>0.004720</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004596</td>
<td>0.004787</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.4832</td>
<td>0.5140</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.4868</td>
<td>0.5179</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.5015</td>
<td>0.5335</td>
</tr>
</tbody>
</table>
Problem 19-12

(Foreign exchange arbitrage) You own $10,000. The U.S. dollar rate in Tokyo is ¥216.6752/U.S. $. The yen rate in New York is given in the table. Are arbitrage profits possible? Set up an arbitrage scheme with your capital. What is the gain in dollars?

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004680</td>
</tr>
<tr>
<td></td>
<td>30-day</td>
<td>0.004720</td>
</tr>
<tr>
<td></td>
<td>90-day</td>
<td>0.004787</td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

In this problem, you will be buying Japanese yen with dollars and at the same time selling the yen in New York at the prevailing price.


**STEP 2: Decide on a solution strategy**

Using the equation below we can convert the indirect quote (¥216.6752/U.S. $) into a direct quote:

\[
\text{Direct quote} = \frac{1}{\text{Indirect Quote}}
\]

From that, we can determine if profits can be made by comparing the direct exchange rate quote in Tokyo with the direct exchange rate quote in New York.

**STEP 3: Solve**

Using the given equation, we can solve for the direct quote in Tokyo:

\[
\frac{1}{¥216.6752 / \text{U.S. $}} = \text{U.S. $0.004615 / ¥}
\]
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Problem 19-12 (cont.)

The direct quote in Tokyo, ¥0.004615/U.S. $, is less than the direct quote in New York, ¥0.004680/U.S. $.

**STEP 4: Analyze**

Since the direct quotes in the two cities are different, arbitrage profits are possible

**STEP 1: Picture the problem**

In this problem, you will be buying Japanese yen with dollars and at the same time selling the yen in New York at the prevailing price.


**STEP 2: Decide on a solution strategy**

To determine the dollar value gain or loss from arbitrage, use the equation below:

\[
\text{Arbitrage Gain / Loss} = [(\text{Dollar Amount}) \times (¥ / \text{U.S. $ in Tokyo}) \times (\text{U.S. $ / ¥ in New York})] - (\text{Dollar Amount})
\]

You want to use your dollars to buy the most yen possible and then sell your yen to buy the most dollars possible.

**STEP 3: Solve**

First: In Tokyo you can buy ¥216.6752/U.S. $ and in New York you can buy ¥213.6752/U.S. $ (=1/U.S. $0.004680/¥). Because you can buy more yen per dollar in Tokyo, you should buy $10,000 worth of yen in Tokyo. Therefore, the number of yen purchased would be $10,000 \times ¥216.6752 / \text{U.S. $} = ¥2,166,752. Then: In Tokyo you can buy U.S. $0.004615/¥ and in New York you can buy U.S. $0.004680/¥; therefore, you simultaneously sell the yen in New York at the higher prevailing rate. The amount received upon the sale of the yen would be: ¥2,166,752 \times \text{U.S. $0.004680/¥} = ¥10,140.40. The net gain is $10,140.40 – $10,000 = $140.40.
Problem 19-12 (cont.)

**STEP 4: Analyze**

The net gain is $140.40.
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Problem 19-13

(Spot rates) Compute the Canadian dollar/yen and the yen/Swiss franc spot rate from the data in the given table.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>Contract</th>
<th>U.S. $/Foreign Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>Spot</td>
<td>0.8439</td>
</tr>
<tr>
<td>Japan – yen</td>
<td>Spot</td>
<td>0.004680</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>Spot</td>
<td>0.5140</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

A cross rate is the computation of an exchange rate for a currency from the exchange rates of two other currencies. Below is a chart of each country’s spot rate.

STEP 2: Decide on a solution strategy

Use the following formulas to determine the appropriate cross rate:

\[
\text{(Canadian dollar / yen)} = (\text{U.S. $ / yen}) \times (\text{Canadian dollar / U.S. $})
\]

where,

\[
\frac{1}{\text{(U.S. $ / Canadian dollar)}}
\]

STEP 3: Solve
Problem 19-13 (cont.)

First, we need to calculate the yen/U.S.$ spot rate:

\[
\frac{1}{0.8439 \text{ U.S. } \$/ C\$} = 1.1850 \text{ C\$/ U.S. }$
\]

We then use the yen/U.S.$ spot rate to find the yen/Scottish franc cross rate:

\[
\frac{\text{Canadian dollar / yen}}{0.004680 \text{ U.S. } \$/ ¥} \times 1.1850 \text{ C\$/ U.S. } = 0.00555 \text{ C\$/ ¥}
\]

**STEP 4: Analyze**

The Canadian dollar/yen spot rate is 0.00555C\$/ ¥.

**STEP 1: Picture the problem**

A cross rate is the computation of an exchange rate for a currency from the exchange rates of two other currencies. Below is a chart of the each country's spot rate.

![Cross Rate Chart]

**STEP 2: Decide on a solution strategy**
Chapter 19

Problem 19-13 (cont.)

Use the following formulas to determine the appropriate cross rate:

\[
\text{(yen / Swiss franc)} = \left(\frac{\text{U.S. $}}{\text{Swiss franc}}\right) \times \left(\frac{\text{yen}}{\text{U.S. $}}\right)
\]

where,

\[
\left(\frac{\text{yen}}{\text{U.S. $}}\right) = \frac{1}{\left(\frac{\text{U.S. $}}{\text{yen}}\right)}
\]

**STEP 3: Solve**

First, we need to calculate the yen/U.S.$ spot rate:

\[
\left(\frac{\text{yen}}{\text{U.S. $}}\right) = \frac{1}{0.004680 \frac{\text{U.S. $}}{\text{yen}}} = 213.6752 \text{ ¥ / U.S. $}
\]

We then use the yen/U.S.$ spot rate to find the yen/Swiss franc cross rate:

\[
\text{(yen / Swiss franc)} = (0.5140 \frac{\text{U.S. $}}{\text{SFr}}) \times (213.6752 \text{ ¥ / U.S. $}) = 109.8291 \text{ ¥ / SFr}
\]

**STEP 4: Analyze**

The yen/Swiss franc spot rate is 109.8291¥ / SFr.
Problem 19-14

(Related to Checkpoint 19.2) (Determining the percent-per-annum premium or discount) You are in need of Swiss francs in six months, but before entering a forward contract to buy them, you would like to know their premium or discount from the existing spot rate. Calculate the premium or discount from the existing spot rate for the 6-month Swiss franc as of January 8, 2010 using the data given in the table.

<table>
<thead>
<tr>
<th>Country-Currency</th>
<th>In U.S. ($)</th>
<th>Per U.S. ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada – dollar</td>
<td>0.9700</td>
<td>1.0309</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.9698</td>
<td>1.0311</td>
</tr>
<tr>
<td>Japanese – yen</td>
<td>0.010798</td>
<td>92.6097</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.010803</td>
<td>92.5669</td>
</tr>
<tr>
<td>Switzerland – franc</td>
<td>0.9772</td>
<td>1.0233</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>0.9783</td>
<td>1.0222</td>
</tr>
<tr>
<td>UK – pound</td>
<td>1.6028</td>
<td>0.6239</td>
</tr>
<tr>
<td>6-mos forward</td>
<td>1.6008</td>
<td>0.6247</td>
</tr>
</tbody>
</table>

STEP 1: Picture the problem

The prices in the table are used to determine the size of the premium. After determining the size of the premium, annualize it to arrive at the solution. Below is a chart of each country's spot rate and 6-month forward rate.

![Exchange Rate Chart]

STEP 2: Decide on a solution strategy

Using the table above, find the forward rate \( F \), the spot rate \( S \), and the number of months of the forward contract \( n \). Then, input those variables into the following formula:
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Problem 19-14 (cont.)

Annualized percentage = \( \frac{F - S}{S} \times \frac{12}{n} \times 100 \)

**STEP 3: Solve**

Computing the percent-per-annum premium on the 6-month Swiss franc:

First: Identify \( F \), \( S \), and \( n \).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F )</td>
<td>0.9783</td>
</tr>
<tr>
<td>( S )</td>
<td>0.9772</td>
</tr>
<tr>
<td>( n )</td>
<td>6 months</td>
</tr>
</tbody>
</table>

Then: Using those values, we compute the annualized percentage premium:

\[
\text{Annualized percentage} = \frac{0.9783 - 0.9772}{0.9772} \times \frac{12}{6} \times 100 = 0.2251\%
\]

**STEP 4: Analyze**

The premium from the existing Swiss franc spot rate is 0.2251\%.
Problem 19-15

(Interest rate parity) On August 8, 2008 the six-month risk-free rate of interest in Switzerland was 4%. If the spot exchange rate for U.S. dollars for Swiss francs is 0.9252 and the six-month forward exchange rate is 0.9270, what would you expect the U.S. six-month risk-free rate to be?

**STEP 1: Picture the problem**

In this problem, we are determining what the six-month risk-free rate will be in the U.S.

![](image)

**STEP 2: Decide on a solution strategy**

The interest rate parity is a theory that can be used to relate differences in the interest rates in two countries to the ratios of spot and forward exchange rates of the two countries' currencies. In this case, we know everything except the domestic interest rate.

\[
(1 + \text{Domestic Rate of Interest}) = \left( \frac{\text{Forward Exchange Rate}}{\text{Spot Exchange Rate}} \right) \times (1 + \text{Foreign Rate of Interest})
\]

**STEP 3: Solve**

**Using the Mathematical Formula:**

\[
(1 + \text{Domestic Rate of Interest}) = \left( \frac{\text{Forward Exchange Rate}}{\text{Spot Exchange Rate}} \right) \times (1 + \text{Foreign Rate of Interest})
\]

\[
(1 + \text{Domestic Rate of Interest}) = \left( \frac{\text{U.S. } \$0.9270 / \text{SFr}}{\text{U.S. } \$0.9252 / \text{SFr}} \right) \times (1 + 0.04)
\]

\[
(1 + \text{Domestic Rate of Interest}) = (1.001946) \times (1.0400)
\]
Problem 19-15 (cont.)

Domestic Rate of Interest (in percent) = \((1.0420238 - 1) \times 100\)

Domestic Rate of Interest (in percent) = 4.202380%

**STEP 4: Analyze**

The interest rate parity theory states that the U.S. six-month risk-free rate is 4.20%.
Problem 19-16

(Interest rate parity) On January 8, 2010, the three-month risk-free rate of interest in the U.S. was 3.75% and it was 3.00% in Japan. If the spot exchange rate were U.S. $0.009074/¥, what would you expect the forward exchange rate to be? How does this estimate compare to the 3-month forward exchange rate found in the given table? What, if anything, does the difference imply to you about arbitrage opportunities?

| U.S.-dollar foreign-exchange rates in late New York trading: |
|-------------------|----------------|-------------------|
| Country-Currency  | Contract       | U.S. S/Foreign Currency |
| Japan – yen       | Spot           | 0.010798          |
|                   | 30-day         | 0.010798          |
|                   | 90-day         | 0.010800          |

**STEP 1: Picture the problem**

In this problem, we are determining the expected three-month forward rate for yen. To do this, we will use an equation based upon the idea of interest rate parity.

Buy Japanese yen in Tokyo with U.S. dollars \[\text{Sell Japanese yen in New York for U.S. dollars} \]

**STEP 2: Decide on a solution strategy**

This problem can be easily solved using a variation of the interest rate parity equation. In this case, we know everything except the three-month forward rate.

\[
\frac{1 + \text{Domestic Rate of Interest}}{1 + \text{Foreign Rate of Interest}} = \frac{\text{Forward Exchange Rate}}{\text{Spot Exchange Rate}}
\]

**STEP 3: Solve**

Using the Mathematical Formula:

\[
\frac{1 + \text{Domestic Rate of Interest}}{1 + \text{Foreign Rate of Interest}} = \frac{\text{Forward Exchange Rate}}{\text{Spot Exchange Rate}}
\]
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Problem 19-16 (cont.)

\[
\text{Spot Exchange Rate} \times \left( \frac{1 + \text{Domestic Rate of Interest}}{1 + \text{Foreign Rate of Interest}} \right) = \text{Forward Exchange Rate}
\]

U.S. $0.009074 / ¥ \times \left( \frac{1 + 0.0375}{1 + 0.0300} \right) = \text{Forward Exchange Rate}

U.S. $ 0.009074 / ¥ \times 1.0072816 = \text{Forward Exchange Rate}

U.S. $0.009140 / ¥ = \text{Forward Exchange Rate}

STEP 4: Analyze

The forward exchange rate is U.S.$0.009140/¥. The estimate is greater than the 3-month forward exchange rate in the given table; therefore, there is an arbitrage opportunity. You could borrow yen, convert it to dollars, invest the dollars and pay back the yen, locking in a risk-free gain.

For example, you could borrow $100 worth of yen at 2.1%, that is ¥9260.974 (= U.S. $100/(U.S. $0.010798/¥)), convert it to $100 (= ¥9260.974 × U.S. $0.010798/¥). Then you would invest the $100 at 3.75% resulting in $104.20 in 3 months. In 3 months you would owe ¥9455.455 (= ¥9260.974 × 1.021) from the yen you borrowed, which would mean you would have to convert $102.12 to yen (¥9455.455 = $102.12/U.S. $0.0108/¥) at the forward rate from the table. The result is you would lock in a risk-free gain of $2.08 (= $104.20-$102.12) per $100 investment.

Interest rate parity is based upon the idea that you get the same total return whether you change your dollars to yen, invest in the risk-free rate in Japan, and then convert them back to dollars, or whether you simply invest your dollars in the U.S. risk-free rate of interest. In effect, interest rate differentials are considered when spot and forward rates are determined in the marketplace.
Problem 19-17

(Purchasing-power parity) If a new iMac costs $1,400 and the spot rate for euros is €0.76/$, what is the price in euros for the iMac?

**STEP 1: Picture the problem**

The key determinant to the price of the iMac in euros is the price of the iMac in U.S. dollars, which is $1,400, and the rate of exchange between the U.S. dollars and euros, which in this case is €0.76 per U.S. dollar.

**STEP 2: Decide on a solution strategy**

According to the theory of purchasing-power parity (PPP), exchange rates adjust so that identical goods cost the same amount regardless of where in the world they are purchased. To determine the number of euros needed to purchase the iMac, we need to know the spot exchange rate, and multiply it times the price of the iMac in U.S. dollars.

\[
\text{Spot Exchange Rate for Euros} \times \text{U.S. Price of iMac} = \text{Euro Price of iMac}
\]

**STEP 3: Solve**

**Using the Mathematical Formula:**

\[
\text{Spot Exchange Rate for Euros} \times \text{U.S. Price of iMac} = \text{Euro Price of iMac}
\]

\[
€0.76 / \text{U.S. $} \times 1,400 = \text{Euro Price of iMac}
\]

\[
€1,064 = \text{Euro Price of iMac}
\]

**STEP 4: Analyze**

According to the theory of purchasing-power parity (PPP), the price of the iMac in euros is €1,064.
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Problem 19-18

(Purchasing-power parity) If a new Samsung Blu-Ray machine costs ¥40,000 in Japan, and the current spot rate is ¥92.6097 / U.S. $, how much should this machine cost in the United States?

Step 1: Picture the problem

The key determinant to the price of the Samsung Blu-Ray machine in dollars is the price of the Samsung Blu-Ray machine in Japan, which is ¥40,000, and the rate of exchange between the U.S. dollars and yen, which in this case is ¥92.6097 per U.S. dollar.

Step 2: Decide on a solution strategy

According to the theory of purchasing-power parity (PPP), exchange rates adjust so that identical goods cost the same amount regardless of where in the world they are purchased. To determine the number of dollars needed to purchase the Samsung Blu-Ray machine, we need to know the spot exchange rate, and divide it into the price of the Samsung Blu-Ray machine in yen.

\[
\text{U.S. Price of the Samsung Blu-Ray machine} = \frac{\text{Yen Price of the Samsung Blu-Ray machine}}{\text{Spot Exchange Rate for Yen}}
\]

Step 3: Solve

Using the Mathematical Formula:

\[
\text{U.S. Price of the Samsung Blu-Ray machine} = \frac{¥40,000}{¥92.6097 / \text{U.S. $}}
\]

U.S. Price of the Samsung Blu-Ray machine = $432
Problem 19-18 (cont.)

**Step 4: Analyze**

According to the theory of purchasing-power parity (PPP), the price of the Samsung Blu-Ray machine is $432.
Problem 19-19

(Related to Checkpoint 19.3) (International capital budgeting) Assume you are working for a firm based in America that is considering a new project in the country of Tambivia. This new project will produce the cash flows shown in the table measured in TABs (the currency of Tambivia), which are expected to be repatriated to the parent company in the U.S. In addition, assume the risk-free rate in the United States is 5%, and that this project is riskier than most, and as such, the firm has determined that it should require a premium of 12% over the risk-free rate. Thus, the appropriate discount rate for this project is 17%. In addition, the current spot exchange rate is 0.6000TAB/U.S. $, and the 1-year forward exchange rate is 0.5700TAB/U.S. $. What is the project's NPV?

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow (in millions of TABs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-12</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

### STEP 1: Picture the problem

The cash flows measured in millions of TABs can be displayed as:

<table>
<thead>
<tr>
<th>Time Period (years)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Flow</td>
<td>-12</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

### STEP 2: Decide on a solution strategy

To calculate the project's NPV, we must first convert the Tambivian TABs into U.S. dollars. Unfortunately, the futures market (the Chicago Mercantile Exchange) only provides exchange rates for the TAB for about a year forward. However, we can use the following equation to calculate the interest rate differential in the two countries:

\[ 1 - \text{year forward exchange rate} = (\text{Interest rate differential})^{1} \times (\text{Spot Exchange Rate}) \]

We can then use the forward exchange rate to convert the cash flows measured in TABs into U.S. dollars. From there, we simply calculate the project's NPV in U.S. dollars using a 17% required rate of return.

### STEP 3: Solve
Problem 19-19 (cont.)

In this problem we have a one year forward rate of 0.5700TAB/$ and a spot rate of 0.6000TAB/$; from this we can calculate the interest rate differential in two countries. We can then use the interest rate differential to calculate the forward exchange rate and then convert the cash flows measured in TABs into U.S. dollars. Using the interest rate differential, we then determine the implied forward exchange rates for the project as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Spot Exchange Rate</th>
<th>(interest rate differential)^n</th>
<th>Forward Exchange Rate for Year n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.6000TAB/U.S. $</td>
<td></td>
<td>0.6000TAB/U.S. S or U.S. $1.6667/TAB</td>
</tr>
<tr>
<td>1</td>
<td>0.6000TAB/U.S. $</td>
<td>× 0.9500</td>
<td>0.5700TAB/U.S. S or U.S. $1.7544/TAB</td>
</tr>
<tr>
<td>2</td>
<td>0.6000TAB/U.S. $</td>
<td>× (0.9500)^2</td>
<td>0.5415TAB/U.S. S or U.S. $1.8467/TAB</td>
</tr>
<tr>
<td>3</td>
<td>0.6000TAB/U.S. $</td>
<td>× (0.9500)^3</td>
<td>0.5144TAB/U.S.$ or U.S. $1.9440/TAB</td>
</tr>
<tr>
<td>4</td>
<td>0.6000TAB/U.S. $</td>
<td>× (0.9500)^4</td>
<td>0.4887TAB/U.S.$ or U.S. $2.0462/TAB</td>
</tr>
</tbody>
</table>

We can now use these forward exchange rates to convert the cash flows measured in TABs to dollars as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow (in millions of TABs)</th>
<th>Implied Forward Rate</th>
<th>Cash Flow (in millions of U.S.$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>−12</td>
<td>× U.S. $1.6667/TAB</td>
<td>−$20,000</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>× U.S. $1.7544/TAB</td>
<td>$8,772</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>× U.S. $1.8467/TAB</td>
<td>$11,080</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>× U.S. $1.9440/TAB</td>
<td>$13,608</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>× U.S. $2.0462/TAB</td>
<td>$14,324</td>
</tr>
</tbody>
</table>

By discounting these cash flows back to the present at the required rate of return of 17%, we get a net present value of:

\[
NPV = \frac{-20,000}{(1 + 0.17)^1} + \frac{8,772}{(1 + 0.17)^2} + \frac{11,080}{(1 + 0.17)^3} + \frac{13,608}{(1 + 0.17)^4} + \frac{14,324}{(1 + 0.17)^4} = 11.73\text{ million}
\]

Using a Financial Calculator.
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Problem 19-19 (cont.)

Before using the CF button, make sure you clear your calculator.

<table>
<thead>
<tr>
<th>Data and Key Input</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF0; −20.000; Enter</td>
<td>CF0 = −20.000</td>
</tr>
<tr>
<td>↓; 8.772; ENTER</td>
<td>CF1 = 8.772</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F01 = 1</td>
</tr>
<tr>
<td>↓; 11.080; ENTER</td>
<td>CF2 = 11.080</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F02 = 1</td>
</tr>
<tr>
<td>↓; 13.608; ENTER</td>
<td>CF3 = 13.608</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F03 = 1</td>
</tr>
<tr>
<td>↓; 14.324; ENTER</td>
<td>CF4 = 14.324</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F04 = 1</td>
</tr>
<tr>
<td>NPV; 17; ENTER</td>
<td>I = 17</td>
</tr>
<tr>
<td>↓; CPT</td>
<td>NPV = 11.73</td>
</tr>
</tbody>
</table>

**STEP 4: Analyze**

The project's NPV is $11.73 million.
Problem 19-20

(Related to Checkpoint 19.3) (International capital budgeting) An American firm is considering a new project in the country of Geeblaistan. This new project will produce the cash flows shown in the table measured in BLAs, the currency of Geeblaistan, which are expected to be repatriated to the parent company in the U.S. In addition, assume the risk-free rate in the United States is 4 percent, and that this project is riskier than most, and as such, the firm has determined that it should require a 14 percent premium over the risk-free rate. Thus, the appropriate discount rate for this project is 18 percent. In addition, the current spot exchange rate is 0.9000BLA / U.S. $, and the 1-year forward exchange rate is 0.9300BLA / U.S. $. What is the project's NPV?

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow (in millions of BLAs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>−20</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**STEP 1: Picture the problem**

The cash flows measured in millions of BLAs can be displayed as:

<table>
<thead>
<tr>
<th>Time Period (years)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Flow</td>
<td>−20</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

**STEP 2: Decide on a solution strategy**

To calculate the project's NPV, we must first convert the Geeblaistan BLAs into U.S. dollars. Unfortunately, the futures market (the Chicago Mercantile Exchange) only provides exchange rates for the BLA for about a year forward. However, we can use the following equation to calculate the interest rate differential in the two countries:

\[ 1 - \text{year forward exchange rate} = \text{(interest rate differential)}^{\frac{1}{n}} \times \text{(Spot Exchange Rate)} \]

We can then use the forward exchange rate to convert the cash flows measured in BLAs into U.S. dollars. From there, we simply calculate the project's NPV in U.S. dollars using a required rate of return of 18%.

**STEP 3: Solve**
In this problem we have a one-year forward rate of 0.9300BLA/U.S. $ and a spot rate of 0.9000BLA/U.S. $; from this we can calculate the interest rate differential in two countries. We can then use the interest rate differential to calculate the forward exchange rate and then convert the cash flows measured in BLAs into U.S. dollars. Using the interest rate differential, we then determine the implied forward exchange rates for the project as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Spot Exchange Rate</th>
<th>(interest rate differential)^n</th>
<th>Forward Exchange Rate for Year n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.9000BLA/U.S. $</td>
<td>×</td>
<td>= 0.9000BLA/U.S. $ or U.S. $1.1111/BLA</td>
</tr>
<tr>
<td>1</td>
<td>0.9000BLA/U.S. $</td>
<td>× 1.0333</td>
<td>= 0.9300BLA/U.S. $ or U.S. $1.0753/BLA</td>
</tr>
<tr>
<td>2</td>
<td>0.9000BLA/U.S. $</td>
<td>× (1.0333)^2</td>
<td>= 0.9609BLA/U.S. $ or U.S. $1.0407/BLA</td>
</tr>
<tr>
<td>3</td>
<td>0.9000BLA/U.S. $</td>
<td>× (1.0333)^3</td>
<td>= 0.9929BLA/U.S. $ or U.S. $1.0072/BLA</td>
</tr>
<tr>
<td>4</td>
<td>0.9000BLA/U.S. $</td>
<td>× (1.0333)^4</td>
<td>= 1.0260BLA/U.S. $ or U.S. $0.9747/BLA</td>
</tr>
</tbody>
</table>

We can now use these forward exchange rates to convert the cash flows measured in BLAs to dollars as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow (in millions of BLAs)</th>
<th>Implied Forward Rate</th>
<th>Cash Flow (in millions of U.S. $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-20</td>
<td>U.S. $1.1111/BLA</td>
<td>- $22,222</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>U.S. $1.0753/BLA</td>
<td>$8,602</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>U.S. $1.0407/BLA</td>
<td>$8,325</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>U.S. $1.0072/BLA</td>
<td>$7,050</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>U.S. $0.9747/BLA</td>
<td>$4,873</td>
</tr>
</tbody>
</table>

By discounting these cash flows back to the present at the required rate of return of 18%, we get a net present value of:

\[
NPV = -22,222 + \frac{8,602}{(1 + 0.18)^1} + \frac{8,325}{(1 + 0.18)^2} + \frac{7,050}{(1 + 0.18)^3} + \frac{4,873}{(1 + 0.18)^4} = -2.15
\]

Using a Financial Calculator.
Problem 19-20 (cont.)

Before using the CF button, make sure you clear your calculator.

<table>
<thead>
<tr>
<th>Data and Key Input</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF0; − 22.2222; Enter</td>
<td>CF0 = − 22.2222</td>
</tr>
<tr>
<td>↓; 8.6022; ENTER</td>
<td>CF1 = 8.6022</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F01 = 1</td>
</tr>
<tr>
<td>↓; 8.3255; ENTER</td>
<td>CF2 = 8.3255</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F02 = 1</td>
</tr>
<tr>
<td>↓; 7.0501; ENTER</td>
<td>CF3 = 7.0501</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F03 = 1</td>
</tr>
<tr>
<td>↓; 4.8733; ENTER</td>
<td>CF4 = 4.8733</td>
</tr>
<tr>
<td>↓; 1; ENTER</td>
<td>F04 = 1</td>
</tr>
<tr>
<td>NPV; 18; ENTER</td>
<td>I = 18</td>
</tr>
<tr>
<td>↓; CPT</td>
<td>NPV = − 2.15</td>
</tr>
</tbody>
</table>

**STEP 4: Analyze**

The project's NPV is $−2.15 million.