CHAPTER 5  THE MARKET FOR FOREIGN EXCHANGE
ANSWERS & SOLUTIONS TO END-OF-CHAPTER QUESTIONS AND PROBLEMS

QUESTIONS

1. Give a full definition of the market for foreign exchange.

Answer: Broadly defined, the foreign exchange (FX) market encompasses the conversion of purchasing power from one currency into another, bank deposits of foreign currency, the extension of credit denominated in a foreign currency, foreign trade financing, and trading in foreign currency options and futures contracts.

2. What is the difference between the retail or client market and the wholesale or interbank market for foreign exchange?

Answer: The market for foreign exchange can be viewed as a two-tier market. One tier is the wholesale or interbank market and the other tier is the retail or client market. International banks provide the core of the FX market. They stand willing to buy or sell foreign currency for their own account. These international banks serve their retail clients, corporations or individuals, in conducting foreign commerce or making international investment in financial assets that requires foreign exchange. Retail transactions account for only about 14 percent of FX trades. The other 86 percent is interbank trades between international banks, or non-bank dealers large enough to transact in the interbank market.

3. Who are the market participants in the foreign exchange market?

Answer: The market participants that comprise the FX market can be categorized into five groups: international banks, bank customers, non-bank dealers, FX brokers, and central banks. International banks provide the core of the FX market. Approximately 100 to 200 banks worldwide make a market in foreign exchange, i.e., they stand willing to buy or sell foreign currency for their own account. These international banks serve their retail clients, the bank customers, in conducting foreign commerce or making international investment in financial assets that requires foreign exchange. Non-bank dealers are large non-bank financial institutions, such as investment banks, mutual funds, pension funds, and hedge
funds, whose size and frequency of trades make it cost-effective to establish their own dealing rooms to trade directly in the interbank market for their foreign exchange needs.

Most interbank trades are speculative or arbitrage transactions where market participants attempt to correctly judge the future direction of price movements in one currency versus another or attempt to profit from temporary price discrepancies in currencies between competing dealers.

FX brokers match dealer orders to buy and sell currencies for a fee, but do not take a position themselves. Interbank traders use a broker primarily to disseminate as quickly as possible a currency quote to many other dealers.

Central banks sometimes intervene in the foreign exchange market in an attempt to influence the price of its currency against that of a major trading partner, or a country that it “fixes” or “ pegs” its currency against. Intervention is the process of using foreign currency reserves to buy one’s own currency in order to decrease its supply and thus increase its value in the foreign exchange market, or alternatively, selling one’s own currency for foreign currency in order to increase its supply and lower its price.

4. How are foreign exchange transactions between international banks settled?

Answer: The interbank market is a network of correspondent banking relationships, with large commercial banks maintaining demand deposit accounts with one another, called correspondent bank accounts. The correspondent bank account network allows for the efficient functioning of the foreign exchange market. As an example of how the network of correspondent bank accounts facilitates international foreign exchange transactions, consider a U.S. importer desiring to purchase merchandise invoiced in guilders from a Dutch exporter. The U.S. importer will contact his bank and inquire about the exchange rate. If the U.S. importer accepts the offered exchange rate, the bank will debit the U.S. importer’s account for the purchase of the Dutch guilders. The bank will instruct its correspondent bank in the Netherlands to debit its correspondent bank account the appropriate amount of guilders and to credit the Dutch exporter’s bank account. The importer’s bank will then debit its books to offset the debit of U.S. importer’s account, reflecting the decrease in its correspondent bank account balance.

5. What is meant by a currency trading at a discount or at a premium in the forward market?

Answer: The forward market involves contracting today for the future purchase or sale of foreign exchange. The forward price may be the same as the spot price, but usually it is higher (at a
premium) or lower (at a discount) than the spot price.

6. Why does most interbank currency trading worldwide involve the U.S. dollar?

Answer: Trading in currencies worldwide is against a common currency that has international appeal. That currency has been the U.S. dollar since the end of World War II. However, the euro and Japanese yen have started to be used much more as international currencies in recent years. More importantly, trading would be exceedingly cumbersome and difficult to manage if each trader made a market against all other currencies.

7. Banks find it necessary to accommodate their clients’ needs to buy or sell FX forward, in many instances for hedging purposes. How can the bank eliminate the currency exposure it has created for itself by accommodating a client’s forward transaction?

Answer: Swap transactions provide a means for the bank to mitigate the currency exposure in a forward trade. A swap transaction is the simultaneous sale (or purchase) of spot foreign exchange against a forward purchase (or sale) of an approximately equal amount of the foreign currency. To illustrate, suppose a bank customer wants to buy dollars three months forward against British pound sterling. The bank can handle this trade for its customer and simultaneously neutralize the exchange rate risk in the trade by selling (borrowed) British pound sterling spot against dollars. The bank will lend the dollars for three months until they are needed to deliver against the dollars it has sold forward. The British pounds received will be used to liquidate the sterling loan.

8. A CAD/$ bank trader is currently quoting a small figure bid-ask of 35-40, when the rest of the market is trading at CAD1.3436-CAD1.3441. What is implied about the trader’s beliefs by his prices?

Answer: The trader must think the Canadian dollar is going to appreciate against the U.S. dollar and therefore he is trying to increase his inventory of Canadian dollars by discouraging purchases of U.S. dollars by standing willing to buy $ at only CAD1.3435/$1.00 and offering to sell from inventory at the slightly lower than market price of CAD1.3440/$1.00.

9. What is triangular arbitrage? What is a condition that will give rise to a triangular arbitrage
opportunity?

Answer: *Triangular arbitrage* is the process of trading out of the U.S. dollar into a second currency, then trading it for a third currency, which is in turn traded for U.S. dollars. The purpose is to earn an arbitrage profit via trading from the second to the third currency when the direct exchange between the two is not in alignment with the cross exchange rate.

Most, but not all, currency transactions go through the dollar. Certain banks specialize in making a direct market between non-dollar currencies, pricing at a narrower bid-ask spread than the cross-rate spread. Nevertheless, the implied cross-rate bid-ask quotations impose a discipline on the non-dollar market makers. If their direct quotes are not consistent with the cross exchange rates, a triangular arbitrage profit is possible.

10. Over the past five years, the exchange rate between British pound and U.S. dollar, $/£, has changed from about 1.90 to about 1.45. Would you agree that over this five-year period that British goods have become cheaper for buyers in the United States?

CFA Guideline Answer:

The value of the British pound in U.S. dollars has gone up from about 1.90 to about 1.45. Therefore, the dollar has appreciated relative to the British pound, and the dollars needed by Americans to purchase British goods have decreased. Thus, the statement is correct.

PROBLEMS

1. Using the American term quotes from Exhibit 5.4, calculate a cross-rate matrix for the euro, Swiss franc, Japanese yen, and the British pound so that the resulting triangular matrix is similar to the portion above the diagonal in Exhibit 5.6.

Solution: The cross-rate formula we want to use is:

\[
S(j/k) = S(\$/k)/S(\$/j).
\]

The triangular matrix will contain \(4 \times (4 + 1)/2 = 10\) elements.
<table>
<thead>
<tr>
<th></th>
<th>¥</th>
<th>SF</th>
<th>£</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro</td>
<td>129.70</td>
<td>1.2335</td>
<td>.8499</td>
<td>1.3092</td>
</tr>
<tr>
<td>Japan (100)</td>
<td>.9510</td>
<td>.6552</td>
<td>1.0094</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>.6890</td>
<td>1.0614</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.K</td>
<td></td>
<td></td>
<td>1.5405</td>
<td></td>
</tr>
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</table>

2. Using the American term quotes from Exhibit 5.4, calculate the one-, three-, and six-month forward cross-exchange rates between the Australian dollar and the Swiss franc. State the forward cross-rates in “Australian” terms.

Solution: The formulas we want to use are:

\[ F_N(AD/SF) = \frac{F_N(SF/AD)}{F_N(SF/$)} \]

or

\[ F_N(AD/SF) = \frac{F_N(AD/$)}{F_N(SF/$)}. \]

We will use the top formula that uses American term forward exchange rates.

\[ F_1(AD/SF) = \frac{1.0617}{.9521} = 1.1151 \]

\[ F_3(AD/SF) = \frac{1.0624}{.9482} = 1.1204 \]

\[ F_6(AD/SF) = \frac{1.0636}{.9425} = 1.1285 \]

3. A foreign exchange trader with a U.S. bank took a short position of £5,000,000 when the $/£ exchange rate was 1.55. Subsequently, the exchange rate has changed to 1.61. Is this movement in the exchange rate good from the point of view of the position taken by the trader? By how much has the bank’s liability changed because of the change in the exchange rate?

CFA Guideline Answer:

The increase in the $/£ exchange rate implies that the pound has appreciated with respect to the dollar. This is unfavorable to the trader since the trader has a short position in pounds.

Bank’s liability in dollars initially was 5,000,000 x 1.55 = $7,750,000

Bank’s liability in dollars now is 5,000,000 x 1.61 = $8,050,000

4. Restate the following one-, three-, and six-month outright forward European term bid-ask quotes in forward points.
5. Using the spot and outright forward quotes in problem 4, determine the corresponding bid-ask spreads in points.

Solution:

<table>
<thead>
<tr>
<th></th>
<th>Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>5</td>
</tr>
<tr>
<td>One-Month</td>
<td>10</td>
</tr>
<tr>
<td>Three-Month</td>
<td>15</td>
</tr>
<tr>
<td>Six-Month</td>
<td>20</td>
</tr>
</tbody>
</table>

6. Using Exhibit 5.4, calculate the one-, three-, and six-month forward premium or discount for the Japanese yen versus the U.S. dollar using American term quotations. For simplicity, assume each month has 30 days. What is the interpretation of your results?

Solution: The formula we want to use is:

\[
f_{N,CD} = [(F_N($/¥) - S($/¥)/S($/¥))] x 360/N
\]

\[
f_{1,CD} = [(.010095 - .010094)/.010094] x 360/30 = .0012
\]

\[
f_{3,CD} = [(.010099 - .010094)/.010094] x 360/90 = .0020
\]

\[
f_{6,CD} = [(.010106 - .010094)/.010094] x 360/180 = .0024
\]

The pattern of forward premiums indicates that the Japanese yen is trading at a premium versus the U.S. dollar. That is, it becomes more expensive to buy a Japanese yen forward for U.S. dollars (in absolute and percentage terms) the further into the future one contracts.

7. Using Exhibit 5.4, calculate the one-, three-, and six-month forward premium or discount for the U.S. dollar versus the British pound using European term quotations. For simplicity, assume each
month has 30 days. What is the interpretation of your results?

Solution: The formula we want to use is:

\[
 f_N,\$ = \left[ \frac{(F_N \, (£/$) - S(£/$))/S(£/$)}{S(£/$)} \right] \times 360/N \\
 f_1,\$ = \left[ \frac{(.6493 - .6491)/.6491}{360/30} \right] = .0037 \\
 f_3,\$ = \left[ \frac{(.6494 - .6491)/.6491}{360/90} \right] = .0018 \\
 f_6,\$ = \left[ \frac{(.6498 - .6491)/.6491}{360/180} \right] = .0022 
\]

The pattern of forward premiums indicates that the dollar is trading at a premium versus the British pound. The one-month premium is larger than the either the three-month or six-month premium in percentage but not absolute terms.

8. A bank is quoting the following exchange rates against the dollar for the Swiss franc and the Australian dollar:

\[
 SFr/\$ = 1.5960--70 \\
 A$/\$ = 1.7225--35 
\]

An Australian firm asks the bank for an A$/SFr quote. What cross-rate would the bank quote?

CFA Guideline Answer:

The SFr/A$ quotation is obtained as follows. In obtaining this quotation, we keep in mind that SFr/A$ = SFr/$/A$/$, and that the price (bid or ask) for each transaction is the one that is more advantageous to the bank.

The SFr/A$ bid price is the number of SFr the bank is willing to pay to buy one A$. This transaction (buy A$—sell SFr) is equivalent to selling SFr to buy dollars (at the bid rate of 1.5960 and the selling those dollars to buy A$ (at an ask rate of 1.7235). Mathematically, the transaction is as follows:

\[
 \text{bid SFr/A$} = \frac{\text{bid SFr/$}}{\text{ask A$/$}} = \frac{1.5960}{1.7235} = 0.9260 
\]

The SFr/A$ ask price is the number of SFr the bank is asking for one A$. This transaction (sell A$—buy SFr) is equivalent to buying SFr with dollars (at the ask rate of 1.5970 and then simultaneously purchasing these dollars against A$ (at a bid rate of 1.7225). This may be
expressed as follows:

\[
\text{ask SFr/A$} = \frac{\text{ask SFr/$}}{\text{bid A$/$}} = \frac{1.5970}{1.7225} = 0.9271
\]

The resulting quotation by the bank is

\[
\text{SFr/A$} = 0.9260—0.9271
\]

9. Given the following information, what are the NZD/SGD currency against currency bid-ask quotations?

<table>
<thead>
<tr>
<th>Country</th>
<th>American Terms</th>
<th>European Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bid</td>
<td>Ask</td>
<td>Bid</td>
</tr>
<tr>
<td>New Zealand dollar</td>
<td>.7265</td>
<td>.7272</td>
</tr>
<tr>
<td>Singapore dollar</td>
<td>.6135</td>
<td>.6140</td>
</tr>
</tbody>
</table>

Solution: Equation 5.12 from the text implies

\[
S_b(NZD/SGD) = S_b(\$/SGD) \times S_b(NZD/$) = .6135 \times 1.3751 = .8436.
\]

The reciprocal, \(1/S_b(NZD/SGD) = S_a(SGD/NZD) = 1.1854\). Analogously, it is implied that \(S_a(NZD/SGD) = S_a(\$/SGD) \times S_a(NZD/$) = .6140 \times 1.3765 = .8452\). The reciprocal, \(1/S_a(NZD/SGD) = S_b(SGD/NZD) = 1.1832\). Thus, the NZD/SGD bid-ask spread is NZD0.8436-NZD0.8452 and the SGD/NZD spread is SGD1.1832-SGD1.1854.

10. Doug Bernard specializes in cross-rate arbitrage. He notices the following quotes:

- Swiss franc/dollar = SFr1.5971?$
- Australian dollar/U.S. dollar = A$1.8215/$
- Australian dollar/Swiss franc = A$1.1440/SFr

Ignoring transaction costs, does Doug Bernard have an arbitrage opportunity based on these quotes? If there is an arbitrage opportunity, what steps would he take to make an arbitrage profit, and how would he profit if he has $1,000,000 available for this purpose.

CFA Guideline Answer:

A. The implicit cross-rate between Australian dollars and Swiss franc is A$/SFr = A$/SFr =
(A$/S)/(SFr/$) = 1.8215/1.5971 = 1.1405. However, the quoted cross-rate is higher at A$1.1.1440/SFr. So, triangular arbitrage is possible.

B. In the quoted cross-rate of A$1.1440/SFr, one Swiss franc is worth A$1.1440, whereas the cross-rate based on the direct rates implies that one Swiss franc is worth A$1.1405. Thus, the Swiss franc is overvalued relative to the A$ in the quoted cross-rate, and Doug Bernard’s strategy for triangular arbitrage should be based on selling Swiss francs to buy A$ as per the quoted cross-rate. Accordingly, the steps Doug Bernard would take for an arbitrage profit is as follows:

i. Sell dollars to get Swiss francs: Sell $1,000,000 to get $1,000,000 x SFr1.5971/$ = SFr1,597,100.

ii. Sell Swiss francs to buy Australian dollars: Sell SFr1,597,100 to buy SFr1,597,100 x A$1.1440/SFr = A$1,827,082.40.

iii. Sell Australian dollars for dollars: Sell A$1,827,082.40 for A$1,827,082.40/A$1.8215/$ = $1,003,064.73.

Thus, your arbitrage profit is $1,003,064.73 - $1,000,000 = $3,064.73.

11. Assume you are a trader with Deutsche Bank. From the quote screen on your computer terminal, you notice that Dresdner Bank is quoting €0.7627/$1.00 and Credit Suisse is offering SF1.1806/$1.00. You learn that UBS is making a direct market between the Swiss franc and the euro, with a current €/SF quote of .6395. Show how you can make a triangular arbitrage profit by trading at these prices. (Ignore bid-ask spreads for this problem.) Assume you have $5,000,000 with which to conduct the arbitrage. What happens if you initially sell dollars for Swiss francs? What €/SF price will eliminate triangular arbitrage?

Solution: To make a triangular arbitrage profit the Deutsche Bank trader would sell $5,000,000 to Dresdner Bank at €0.7627/$1.00. This trade would yield €3,813,500= $5,000,000 x .7627. The Deutsche Bank trader would then sell the euros for Swiss francs to Union Bank of Switzerland at a price of €0.6395/SF1.00, yielding SF5,963,253 = €3,813,500/.6395. The Deutsche Bank trader will resell the Swiss francs to Credit Suisse for $5,051,036 = SF5,963,253/1.1806, yielding a triangular arbitrage profit of $51,036.

If the Deutsche Bank trader initially sold $5,000,000 for Swiss francs, instead of euros, the trade would yield SF5,903,000 = $5,000,000 x 1.1806. The Swiss francs would in turn be traded for euros to UBS for €3,774,969= SF5,903,000 x .6395. The euros would be resold to Dresdner Bank for $4,949,481 = €3,774,969/.7627, or a loss of $50,519. Thus, it is necessary to conduct the triangular arbitrage in the correct order.
The $S(€/SF)$ cross exchange rate should be \(0.7627/1.1806 = 0.6460\). This is an equilibrium rate at which a triangular arbitrage profit will not exist. (The student can determine this for himself.) A profit results from the triangular arbitrage when dollars are first sold for euros because Swiss francs are purchased for euros at too low a rate in comparison to the equilibrium cross-rate, i.e., Swiss francs are purchased for only €0.6395/SF1.00 instead of the no-arbitrage rate of €0.6460/SF1.00. Similarly, when dollars are first sold for Swiss francs, an arbitrage loss results because Swiss francs are sold for euros at too low a rate, resulting in too few euros. That is, each Swiss franc is sold for €0.6395/SF1.00 instead of the higher no-arbitrage rate of €0.6460/SF1.00.

12. The current spot exchange rate is $1.95/£ and the three-month forward rate is $1.90/£. Based on your analysis of the exchange rate, you are pretty confident that the spot exchange rate will be $1.92/£ in three months. Assume that you would like to buy or sell £1,000,000.

a. What actions do you need to take to speculate in the forward market? What is the expected dollar profit from speculation?

b. What would be your speculative profit in dollar terms if the spot exchange rate actually turns out to be $1.86/£.

Solution:

a. If you believe the spot exchange rate will be $1.92/£ in three months, you should buy £1,000,000 forward for $1.90/£. Your expected profit will be:
\[
$20,000 = £1,000,000 \times ($1.92 - $1.90).
\]

b. If the spot exchange rate actually turns out to be $1.86/£ in three months, your loss from the long position will be:
\[
-$40,000 = £1,000,000 \times ($1.86 - $1.90).
\]