Chapter 1. Currency Exchange Rates

Finally, we note that interest rate parity is sometimes called covered interest rate parity (covered by a forward contract) to distinguish it from uncovered interest rate parity. Uncovered interest rate parity is based on economic theory rather than on arbitrage and involves expected exchange rates rather than forward rates. Uncovered interest rate parity is an economic theory that links interest rate differentials and the difference between the spot and expected exchange rate. We leave it and other parity theories for Chapter 2. On the other hand, interest rate parity, discussed in this chapter, is a pure arbitrage condition imposed by efficient markets.

Summary

- A direct exchange rate is the domestic price of foreign currency. An indirect exchange rate is the amount of foreign currency equivalent that one unit of the domestic currency purchases.
- The spread on a foreign currency transaction is the difference between the rate at which the bank is willing to commit itself today to buy (bid) foreign currency and to sell (ask). When given as a percentage, this spread is given as $100 \times (ask - bid)/ask$.
- Spreads differ as a result of market conditions and trading volume but not dealer positions. The size of the bid-ask spread increases with exchange rate uncertainty (volatility) because of bank/dealer risk aversion. Spreads are larger for currencies that have a low trading volume (thinly traded currencies).
- To work with currency cross rates and bid-ask spreads, we can use two principles: The ask exchange rate for the quoted currency is the reciprocal of the bid exchange rate for the measurement currency in which the price is expressed.
- To calculate the profit on a triangular arbitrage opportunity, the basic step is to determine whether the quoted cross rate is different from the implied cross rate.
- Spot exchange rates are quoted for immediate currency transactions, but forward change rates are rates contracted today for delivery and settlement in the future.
- As with spot rates, forward contract bid-ask spreads differ as a result of market conditions and trading volume but not bank/dealer positions. Bid-ask spreads increase with increasing maturity of the contract.
- The forward discount (negative) or premium (positive) is defined as the forward rate minus the spot rate expressed as a percentage of the spot rate.
- The forward discount or premium is often calculated as an annualized percentage deviation from the spot rate as given by the discount or premium multiplied by 12 over the number of months forward.
- The interest rate parity relationship is that the forward discount (premium) equals the interest rate differential between the two currencies: what is gained on the interest rate of a currency is lost on its discount.
Covered interest arbitrage is the process of simultaneously borrowing the domestic currency, transferring it into foreign currency at the spot exchange rate, lending it, and buying a forward exchange rate contract to repatriate the foreign currency into domestic currency at a known forward exchange rate. The net result of such an arbitrage should be nil.

Problems

1. If the exchange rate value of the British pound goes from U.S. $1.80 to U.S. $1.60, then
   a. The pound has appreciated, and the British will find U.S. goods cheaper.
   b. The pound has appreciated, and the British will find U.S. goods more expensive.
   c. The pound has depreciated, and the British will find U.S. goods more expensive.
   d. The pound has depreciated, and the British will find U.S. goods cheaper.

2. If the exchange rate between the Australian dollar and the U.S. dollar, $A\$/U\$, changes from A$1.60 to A$1.50, then
   a. The Australian dollar has appreciated, and the Australians will find U.S. goods cheaper.
   b. The Australian dollar has appreciated, and the Australians will find U.S. goods more expensive.
   c. The Australian dollar has depreciated, and the Australians will find U.S. goods more expensive.
   d. The Australian dollar has depreciated, and the Australians will find U.S. goods cheaper.

3. Over a period of time in the past, the exchange rate between the Swiss franc and the U.S. dollar, $SFr/U\$, changed from about 1.20 to about 1.60. Would you agree that over this period, Swiss goods became cheaper for Americans?

4. Over a period of time in the past, you noticed that the exchange rate between the Thai baht and the dollar changed considerably. In particular, the $Bht/\$U$ exchange rate increased from 25 to 30.
   a. Did the Thai baht appreciate or depreciate with respect to the dollar? By what percentage?
   b. By what percentage did the value of the dollar change with respect to the Thai baht?

5. A foreign exchange trader with a U.S. bank took a short position of $5 million when the £/\$ exchange rate was 1.45. Subsequently, the exchange rate changed to 1.51. Is this movement in the exchange rate good from the point of view of the position taken by the trader? By how much did the bank's liability change because of the change in exchange rate?

6. A financial newspaper provided the following midquotes spot exchange rates. Compute all the cross exchange rates based on these quotes.
   
   £/\$ = 0.9119
   
   $SFr/U$ = 1.5971
   
   $¥/\$ = 128.17
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7. You visited the foreign exchange trading room of a major bank when a trader asked for quotes of the euro from various correspondents and heard the following:

Bank A 1.1210–15
Bank B 12–17

What do these quotes mean?

8. Do you think the dollar exchange rate of the British pound or the Polish zloty has a higher percentage bid–ask spread? Why?

9. Here are some historical quotes of the USD:JPY (yen per dollar) exchange rate given simultaneously on the phone by three banks:

Bank A 121.15–121.25
Bank B 121.30–121.35
Bank C 121.15–121.35

Are these quotes reasonable? Is there an arbitrage opportunity?

10. At a certain point in time, the euro is quoted as EUR:USD = 1.1610–1.1615, and the Swiss franc is quoted as USD:CHF = 1.4100–1.4120. What is the implicit EUR:CHF quotation?

11. At a certain point in time, a bank quoted the following exchange rates against the dollar for the Swiss franc and the Australian dollar:

$SF = 1.5960–70
$A$ = 1.8225–35

Simultaneously, an Australian firm asked the bank for a $A$:SF quote. What cross rate would the bank have quoted?

12. At a certain point in time, a bank quoted the following exchange rates against the dollar for the Swiss franc and the Australian dollar:

$SF = 1.5960–70
$A$ = 1.8225–35

Simultaneously, a Swiss firm asked the bank for an SF:A$ quote. What cross rate would the bank have quoted?

13. Based on historical Japanese yen and Canadian dollar quotes by a bank, the implicit yen per Canadian dollar cross rate quotation was ¥C$ = 82.50/1.00–82.00/30. What would be the implicit Canadian dollar per yen cross rate quotation, C$:¥?

14. Suppose that a quote for the dollar spot exchange rate of Danish kroner (symbol Dkk or code DKK) is DKK8.25 per dollar, and a quote for the dollar spot exchange rate of Swiss Franc is SFr1.65 per dollar.

a. What should be the quote for the SFr:Dkk cross rate so that there are no arbitrage opportunities (ignore transaction costs)?

b. Suppose a bank is offering a quote for the SFr:Dkk cross rate as DKK5.20 per SFr. In this quote, which currency is overvalued with respect to the other?
Problems

15. Suppose that at a point in time, Barclays bank was quoting a dollars per pound exchange rate of £/¥ = 1.4570, Industrial bank was quoting a Japanese yen per dollar exchange rate of ¥/$ = 126.17, and Midland bank was quoting a Japanese yen per pound cross rate of £¥ 183.
   a. Ignoring bid-ask spreads, was there an arbitrage opportunity here?
   b. If there was an arbitrage opportunity, what steps would you have taken to make an arbitrage profit, and how much would you have profited with $1 million available for this purpose?

16. Jim Waugh specializes in cross-rate arbitrage. At a point in time, he noticed the following quotes:
   U.S. dollar in Swiss francs = SFr1.5071 per $  
   U.S. dollar in Australian dollars = A$1.8215 per $  
   Swiss franc in Australian dollar = A$1.1450 per SFr
   Ignoring transaction costs, did Jim Waugh have an arbitrage opportunity based on these quotes? If there was an arbitrage opportunity, what steps would he have taken to make an arbitrage profit, and how much would he have profited with $1 million available for this purpose?

17. You notice the following hypothetical exchange rates in the newspaper.
   £/$ spot = 1.40  
   £/$ three-month forward = 1.42  
   $SFr$ spot = 1.60  
   $SFr$ three-month forward = 1.65
   In the language of currency traders, would the £ be considered strong or weak relative to the dollar? What about the Swiss franc?

18. Suppose that the spot pound in dollars exchange rate is £/$ = 1.4570-1.4576 and the six-month forward pound exchange rate is $/£ = 1.4408-1.4434.
   a. Is the pound trading at a discount or at a premium relative to the dollar in the forward market?
   b. Compute the annualized forward discount or premium on the pound relative to the dollar.

19. Suppose that the spot Swiss francs per dollar exchange rate is $SFr = 1.5960-70 and the three-month forward exchange rate is $SFr = 1.5932-62.
   a. Is the Swiss franc trading at a discount or at a premium relative to the dollar in the forward market?
   b. Compute the annualized forward discount or premium on the Swiss franc relative to the dollar.

20. On the Forex market, you observe the following hypothetical quotes.
   Spot ¥/$ = 110.00-110.10
   One-year interest rate $ = 4% - 4 1/4%
   One-year interest rate ¥ = 1% - 1 1/4%
   What should be the quote for the one-year forward exchange rate ¥/$?
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Currency Exchange Rates

1. Since the value of the British pound in U.S. dollars has gone down, it has depreciated with respect to the U.S. dollar. Therefore, the British will have to spend more British pounds to purchase U.S. goods. Accordingly, the correct answer is (c).

2. Since the number of Australian dollars needed to purchase one U.S. dollar has decreased from 1.60 to 1.50, the Australian dollar has appreciated with respect to the U.S. dollar. Therefore, the Australians will have to spend fewer Australian dollars to purchase U.S. goods. Accordingly, the correct answer is (a).

3. The value of the dollar in Swiss francs has gone up from about 1.20 to about 1.60. Therefore, the dollar has appreciated relative to the Swiss franc, and the dollars needed by Americans to purchase Swiss goods have decreased. Thus, the statement is correct.

4. a. One baht was worth 1/25 or 0.04 dollars earlier. It is worth 1/30 or 0.0333 dollars now. Thus, the baht has depreciated with respect to the dollar. Percentage change in the dollar value of the baht = \((0.0333 - 0.04)/0.04)100\% = -16.7\%\).
b. One dollar was worth 25 bahts earlier and is worth 30 bahts now. Percentage change in the value of the dollar = \(((30 - 25)/25)100\% = 20.0\%\).

5. The increase in £:$ 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 × 1.45 = $7,250,000
- Bank’s liability in dollars now is 5,000,000 × 1.51 = $7,550,000

Thus, the bank’s liability has increased by $300,000.

6. Three cross-exchange rates need to be computed: SFr/€, ¥/€, SFr/¥.

   a. €:SFr = $:SFr × €:$ = SFr 1.5971 per $ × $ 0.9119 per € = 1.4564
   b. €:¥ = $:¥ × €:$ = ¥ 128.17 per $ × $ 0.9119 per € = 116.88
   c. ¥:SFr = $:SFr × ¥:$ = ($:SFr ) ÷ ($:¥) = (SFr 1.5971 per $)/(¥ 128.17 per $) = 0.0125

7. These quotations mean that Bank A is willing to buy one euro for 1.1210 dollars (bid rate) or to sell one for 1.1215 dollars (ask rate). Bank B’s €:$ bid rate is 1.1212; its ask rate is 1.1217. That is, Bank B is willing to buy one euro for 1.1212 dollars or to sell one for 1.1217 dollars.

8. The percentage spread is considerably higher for the Polish zloty than for the British pound. The market for the Polish zloty is much less liquid than the market for the British pound. There is a lot more competition between market makers for the British pound than for the Polish zloty. Consequently, the percentage spread is considerably higher for the Polish zloty than for the British pound.
9. These quotes are unreasonable because they deviate from Bank A to Bank B by more than the spread; for example, Bank A’s ask rate (121.25) is smaller than Bank B’s bid rate (121.30). There is, therefore, an arbitrage opportunity. One can buy Bank A’s dollars for 121.25 yen per dollar, sell these dollars to Bank B for 121.30 yen per dollar, and thereby make a profit of 0.05 yen per dollar traded. This is a riskless, instantaneous operation that requires no initial investment.

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

The €:SFr bid price is the number of Swiss francs that a trader is willing to pay for one euro. This transaction (buy euro–sell Swiss francs) is equivalent to selling Swiss francs to buy dollars (at a bid rate of 1.4100), and then selling those dollars to buy euros (at a bid rate of 1.1610). Mathematically, the transaction is as follows:

\[(\text{bid } $:SFr) \times (\text{bid } €:$) = 1.4100 \times 1.1610 = 1.6370\]

The €:SFr ask price is the number of Swiss francs that a trader is asking for one euro. This transaction (sell euros–buy Swiss francs) is equivalent to buying Swiss francs with dollars (at an ask rate of 1.4120) and simultaneously purchasing these dollars against euros (at an ask rate of 1.1615). Mathematically, this can be expressed as follows:

\[(\text{ask } $:SFr) \times (\text{ask } €:$) = 1.4120 \times 1.1615 = 1.6400\]

So the resulting quotation by the trader is

\[€:SFr = 1.6370 – 1.6400\]

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

The A$:SFr bid price is the number of SFr the bank is willing to pay to buy one A$. This transaction (buy A$–sell SFr) is equivalent to selling SFr to buy dollars (at a bid rate of 1.5960) and then selling those dollars to buy A$ (at an ask rate of 1.8235). Mathematically, the transaction is as follows:

\[\text{bid A$:SFr} = (\text{bid } $:SFr) ÷ (\text{ask } $:A$) = 1.5960/1.8235 = 0.8752\]

The A$:SFr ask price is the number of SFr that the bank is asking for one A$. This transaction (sell A$–buy SFr) is equivalent to buying SFr with dollars (at an ask rate of 1.5970) and simultaneously purchasing these dollars against A$ (at a bid rate of 1.8225). This may be expressed as follows:

\[\text{ask A$:SFr} = (\text{ask } $:SFr) ÷ (\text{bid } $:A$) = 1.5970/1.8225 = 0.8763\]

The resulting quotation by the bank is

\[A$:SFr = 0.8752 – 0.8763\]
12. The SFr:A$ quotation is obtained as follows. In obtaining this quotation, we keep in mind that SFr:A$ = ($:A$ ÷ ($:SFr), 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 A$ the bank is willing to pay to buy one SFr. This transaction (buy SFr – sell A$) is equivalent to selling A$ to buy dollars (at a bid rate of 1.8225) and then selling those dollars to buy SFr (at an ask rate of 1.5970). Mathematically, the transaction is as follows:

\[
\text{Bid SFr:A$} = \frac{\text{bid }$:A$}{\text{ask }$:SFr} = \frac{1.8225}{1.5970} = 1.1412
\]

The SFr:A$ ask price is the number of A$ that the bank is asking for one SFr. This transaction (sell SFr – buy A$) is equivalent to buying A$ with dollars (at an ask rate of 1.8235) and simultaneously purchasing these dollars against SFr (at a bid rate of 1.5960). This may be expressed as follows:

\[
\text{Ask SFr:A$} = \frac{\text{ask }$:A$}{\text{bid }$:SFr} = \frac{1.8235}{1.5960} = 1.1425
\]

The resulting quotation by the bank is

\[
\text{SFr:A$} = 1.1412 - 1.1425
\]

13. The bid ¥:C$ rate would be the inverse of the ask C$:¥ rate, and the ask ¥:C$ rate would be the inverse of the bid C$:¥ rate. Therefore,

\[
\begin{align*}
\text{bid ¥:C$} &= \frac{1}{\text{ask C$:¥}} = \frac{1}{82.5750} = 0.01211 \\
\text{ask ¥:C$} &= \frac{1}{\text{bid C$:¥}} = \frac{1}{82.5150} = 0.01212
\end{align*}
\]

Thus, the quote is ¥:C$ = 0.01211 – 0.01212.

14. a. There would be no arbitrage opportunities if cross rate SFr:DKr = $:DKr × SFr:$. Because $:SFr = 1.65, SFr:$ = 1/1.65 = 0.6061.

So, there would be no arbitrage opportunities if the cross rate SFr:DKr = 8.25 × 0.6061 = DKr 5 per SFr.

b. In the DKr 5.20 per SFr cross rate, one SFr is worth DKr 5.20. The implicit rate computed in part (a) above indicates that one SFr should be worth DKr 5. Therefore, the SFr is overvalued with respect to the DKr at the exchange rate of DKr 5.20 per SFr.

15. The implicit cross rate between yen and pound is £:¥ = ¥:£ × ¥:$. The cross rate based on the direct rates implies that one pound is worth 186.74 yen. Thus, pound is undervalued relative to the yen in the cross rate quoted by Midland, and your strategy for triangular arbitrage should be based on using yen to buy pounds from Midland. Accordingly, the steps you would take for an arbitrage profit are as follows:

a. Sell dollars to get yen: Sell $1,000,000 to get $1,000,000 × ¥128.17 per $ = ¥128,170,000.

b. Use yen to buy pounds: Sell ¥128,170,000 to buy ¥128,170,000/(¥183 per £) = £700,382.51.

c. Sell pounds for dollars: Sell £700,382.51 for £700,382.51 × (¥1.4570 per £) = $1,020,457.32.

Thus, your arbitrage profit is $1,020,457.32 – $1,000,000 = $20,457.32.
16.  a. The implicit cross rate between Australian dollars and Swiss francs is \( \text{SFr: A$} = \frac{\text{A$}}{\text{SFr}} \times \frac{\text{SFr}}{\text{A$}} = \frac{\text{A$}}{\text{SFr}} + \frac{\text{SFr}}{\text{A$}} = 1.8215 \times 1.5971 = 1.1405 \). However, the quoted cross rate is higher at \( \text{A$1.1450 per SFr} \). So, triangular arbitrage is possible.

b. In the quoted cross rate of \( \text{A$1.1450 per SFr} \), one Swiss franc is worth \( \text{A$1.1450} \), whereas the cross rate based on the direct rates implies that one Swiss franc is worth \( \text{A$1.1405} \). Thus, the Swiss franc is overvalued relative to the A$ in the quoted cross rate, and Jim Waugh’s strategy for triangular arbitrage should be based on selling Swiss francs to buy A$ as per the quoted cross rate. Accordingly, the steps Jim Waugh would take for an arbitrage profit are as follows:

   i. Sell dollars to get Swiss francs: Sell \( \text{A$1,000,000} \) to get \( \text{A$1,000,000 \times \text{SFr1.5971 per A$}} = \text{SFr1,597,100} \).

   ii. Sell Swiss francs to buy Australian dollars: Sell \( \text{SFr1,597,100} \) to buy \( \text{SFr1,597,100 \times \text{A$1.1450 per SFr}} = \text{A$1,828,679.50} \).

   iii. Sell Australian dollars for dollars: Sell \( \text{A$1,828,679.50} \) for \( \frac{\text{A$1,828,679.50}}{\text{A$1.8215 per A$}} = \text{A$1,003,941.53} \).

Thus, your arbitrage profit is \( \text{A$1,003,941.53} - \text{A$1,000,000} = \text{A$3,941.53} \).

17. The value of the £ in $ is worth less three months forward than it is now. Thus, the £ is trading at a forward discount relative to the $. Therefore, the £ is “weak” relative to the $. Because a $ is worth SFr 1.60 now but worth SFr 1.65 three months forward, the $ is “strong” relative to the SFr. That is, the SFr is “weak” relative to the $.

18. The midpoint of the spot dollar to pound exchange rate is £:$ = 1.4573. The midpoint of the six-month forward dollar to pound exchange rate is £:$ = 1.4421.

   a. Based on the midpoints, the dollar value of a pound is 1.4573 now and only 1.4421 six months forward. Thus, the pound is worth less six months forward than now. That is, the pound is trading at a discount relative to the dollar in the forward market.

   b. Difference between midpoints of the forward and spot rates = 0.0152.

\[
\text{Annualized discount} = \left( \frac{\text{Difference between forward and spot rates}}{\text{Spot rate}} \right) \left( \frac{12}{\text{No. months forward}} \right) 100% = \left( \frac{0.0152}{1.4573} \right) \left( \frac{12}{6} \right) 100% = 2.09%
\]

19. The midpoint of the spot Swiss franc to dollar exchange rate is $:SFr = 1.5965. The midpoint of the three-month forward Swiss franc to dollar exchange rate is $:SFr = 1.5947.

   a. Based on the midpoints, a dollar is worth SFr 1.5965 now and only 1.5947 three months forward. So, the dollar is trading at a discount relative to the SFr in the forward market. That is, the SFr is trading at a premium relative to the dollar in the forward market.

   b. Difference between midpoints of the forward and spot rates = 0.0018.

\[
\text{Annualized premium} = \left( \frac{\text{Difference between forward and spot rates}}{\text{Spot rate}} \right) \left( \frac{12}{\text{No. months forward}} \right) 100% = \left( \frac{0.0018}{1.5965} \right) \left( \frac{12}{3} \right) 100% = 0.45%
\]
20. Let’s first make sure we calculate the forward rate in the proper direction. The one-year forward rate $:¥ is given by Equation (1.3), where the dollar is the quoted currency (a) measured in yen (currency b):

\[
\text{Forward exchange rate} = \text{Spot exchange rate} \times \frac{1 + r_d}{1 + r_y}
\]

A bank will quote bid – ask forward rates, where the bid is lower than the ask. The ask forward rate (ask forward $:¥), is the ¥ price at which an investor can buy dollars forward and the bid forward rate is the ¥ price that an investor can obtain for dollars. Buying dollars forward (paying the ask forward) is equivalent to:

- Borrowing yen (and hence having to pay the ask interest rate: ask $r_y$,
- Using these yen to buy dollars spot (and hence having to pay the ask exchange rate: ask §:¥,
- Lending those dollars (and hence receiving the bid interest rate: bid $r_d$.

The resulting ask-forward exchange rate ($:¥$) is

\[
\text{Ask forward ($:¥$)} = 110.10 \cdot \frac{1 + 1.25\%}{1 + 4.00\%} = 107.19
\]

The bid-forward exchange rate ($:¥$) is

\[
\text{Bid forward ($:¥$)} = 110.10 \cdot \frac{1 + 1.00\%}{1 + 4.25\%} = 106.57
\]

Thus, the one-year forward rate should be: $:¥r = 106.57–107.19.$
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- Combining all the parity relations indicates that the expected return on default-free bills should be the same in all countries, and exchange risk reduces to inflation uncertainty because there is no real foreign currency risk.
- Deviations from purchasing power parity should be corrected in the long run.
- The elements in the balance of payments are the current account, the capital account, the financial account, and the official reserves account; without central bank intervention, a current account deficit must be balanced by a financial account surplus. Exchange rate adjustments can be needed to restore balance of payments equilibrium.
- The asset market approach to pricing exchange rate expectations claims that the exchange rate is the relative price of two currencies, determined by investors' expectations about these currencies.
- The long-run exchange rate effect of a sudden and unexpected increase in the money supply is a depreciation of the currency so that purchasing power parity is maintained as the percentage increase in the price level matches the percentage increase in the money supply. Given sticky-pulled prices, the short-run exchange rate effect is an immediate drop in the real interest rate and more depreciation of the currency than the depreciation implied by purchasing power parity.

Problems

1. Consider two countries, A and B, whose currencies are α and β, respectively. The interest rate in A is greater than the interest rate in B. Which of the following is true according to the expected exchange rate movement relationship and interest rate parity, respectively?
   a. α is expected to appreciate relative to β, and α trades with a forward discount.
   b. α is expected to depreciate relative to β, and α trades with a forward premium.
   c. α is expected to appreciate relative to β, and α trades with a forward discount.
   d. α is expected to depreciate relative to β, and α trades with a forward premium.

2. Suppose that the spot ε: $ is equal to 1.1795. The annual one-year interest rates on the Eurocurrency market are 4 percent in euros and 5 percent in U.S. dollars. The annualized one-month interest rates are 5 percent in euros and 3 percent in U.S. dollars.
   a. What is the one-year forward exchange rate?
   b. What is the one-month forward exchange rate?

3. You are given the following hypothetical quotes.
   Spot exchange rates:
   €: $ 1.1865–1.1870
   $: ¥ 108.10–108.20
Three-month interest rates (percent per year):

in $ 5–5\frac{1}{4}

in € 3\frac{1}{4}–3\frac{3}{5}

in ¥ 1\frac{3}{4}–1\frac{1}{2}

What should the quotes be for the following?

a. ¥ spot exchange rate.
b. £ $ three-month forward ask exchange rate. Hint: Buying euros forward is equivalent to borrowing dollars to buy euros spot and investing the euros.
c. $ $ three-month forward bid exchange rate.
d. $ ¥ three-month forward bid and ask exchange rate.

4. Jason Smith is a foreign exchange trader. At a point in time, he noticed the following quotes.

<table>
<thead>
<tr>
<th>Spot exchange rate</th>
<th>$SFr – 1.6627</th>
</tr>
</thead>
<tbody>
<tr>
<td>Six-month forward exchange rate</td>
<td>$SFr – 1.0538</td>
</tr>
<tr>
<td>Six-month $ interest rate</td>
<td>3.5% per year</td>
</tr>
<tr>
<td>Six-month SF interest rate</td>
<td>3.0% per year</td>
</tr>
</tbody>
</table>

a. Ignoring transaction costs, was the interest rate parity holding?
b. Was there an arbitrage possibility? If yes, what steps would have been needed to make an arbitrage profit? Assuming that Jason Smith was authorized to work with $1 million for this purpose, how much would the arbitrage profit have been in dollars?

5. At a point in time, foreign exchange arbitrageur noticed that the Japanese yen to U.S. dollar spot exchange rate was ¥/$ = 108 and the three-month forward exchange rate was ¥/$ = 107.30. The three-month $ interest rate was 5.20 percent per annum and the three-month ¥ interest rate was 1.20 percent per annum.

a. Was interest rate parity holding?
b. Was there an arbitrage possibility? If yes, what steps would have been needed to make an arbitrage profit? Assuming that the arbitrageur was authorized to work with $1 million for this purpose, how much would the arbitrage profit have been in dollars?

6. Suppose the following chart illustrates the domestic prices of three items (shoes, watches, and electric motors) of similar quality in the United States and Mexico.

<table>
<thead>
<tr>
<th>Items</th>
<th>United States (dollars)</th>
<th>Mexico (pesos)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoes</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Watches</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>Electric motors</td>
<td>50</td>
<td>500</td>
</tr>
</tbody>
</table>

If one dollar exchanges for five Mexican pesos and transportation costs are zero, Mexico will import

a. shoes and watches, and the United States will import electric motors.
b. shoes, and the United States will import watches and electric motors.
c. all three goods from the United States.
d. electric motors, and the United States will import shoes and watches.
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7. A group of countries decides to introduce a common currency. What do you think would happen to the inflation rates of these countries after the introduction of the common currency?

8. Suppose that the current Swiss franc to U.S. dollar spot exchange rate is $:SFr = 1.60. The expected inflation over the coming year is 2 percent in Switzerland and 5 percent in the United States. According to purchasing power parity, what is the expected value of the Swiss franc to U.S. dollar spot exchange rate a year from now?

9. Let us consider a utopian world in which there are only three goods: sake, beer, and TV sets.
   - Japanese consume only a locally produced food, called sake, and an industrially produced and traded good, called TV sets.
   - Americans consume only a locally produced food, called beer, and an industrially produced and traded good, called TV sets.

   TV sets are produced in both countries and are traded; their local prices follow the law of one price. Foods are produced only locally and are not traded. The consumption basket of a Japanese individual consists of two-thirds sake and one-third TV sets. The consumption basket of an American consists of one-half beer and one-half TV sets. Prices of beer and TV sets in the United States are constant over time in U.S. dollars. Japanese are very competitive and export a lot of TV sets. Japanese farmers want to share in the increased national wealth, and the price of sake is rising at a rate of 10 percent per year in yen. Assume that the yen/dollar exchange rate stays constant.
   a. What is the consumer price index inflation in Japan?
   b. Does relative PPP hold between Japan and the United States?

10. a. Explain the following three concepts of purchasing power parity:
    i. The law of one price
    ii. Absolute PPP
    iii. Relative PPP

   b. Evaluate the usefulness of relative PPP in predicting movements in foreign exchange rates on a
      i. short-term basis (e.g., three months).
      ii. long-term basis (e.g., six years).

11. A French company is importing some equipment from Switzerland and will need to pay 10 million Swiss francs three months from now. Suppose that the current spot exchange rate is €:SFr = 1.5345. The treasurer of the company expects the franc to appreciate in the next few weeks and is concerned about it. The three-month forward rate is €:SFr = 1.5329.
    a. Given the treasurer’s expectation, what action can she take using the forward contract?
    b. Three months later, the spot exchange rate turns out to be €:SFr = 1.5101. Did the company benefit because of the treasurer’s action?

12. Suppose the international parity conditions hold. Does that mean that the nominal interest rates would be equal among countries? Why or why not?

13. Suppose that you are given the following information about Australia, Switzerland, and the United States. The Australian dollar is expected to depreciate relative to the United States dollar. The nominal interest rate in the United States is greater than that in
Problems 73

Switzerland. Can you say whether the Australian dollar is expected to depreciate or appreciate relative to the Swiss Franc?

14. Suppose that there were some statistics about the Swedish krona and the dollar:

<table>
<thead>
<tr>
<th></th>
<th>SEK</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation (annual rate)</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>One-year interest rate</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td>Spot exchange rate (SEK/$)</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Expected exchange rate in one year (SEK/$)</td>
<td>0</td>
<td>?</td>
</tr>
<tr>
<td>One-year forward exchange rate (SEK/$)</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Based on the linear approximations of the international parity conditions, replace the question marks with appropriate answers.

15. Suppose that the one-year interest rate is 12 percent in the United Kingdom. The expected annual rate of inflation for the coming year is 10 percent for the United Kingdom and 4 percent for Switzerland. The current spot exchange rate is $1 = SEK 8.5. Using the precise form of the international parity relation, compute the one-year interest rate in Switzerland, the expected Swiss franc to pound exchange rate in one year, and the one-year forward exchange rate.

16. Following are some statistics for Malaysia, the Philippines, and the United States.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>4.49</td>
<td>4.69</td>
<td>3.57</td>
<td>3.71</td>
<td>5.28</td>
<td>3.56</td>
</tr>
<tr>
<td>Philippines</td>
<td>18.70</td>
<td>8.93</td>
<td>7.58</td>
<td>9.06</td>
<td>8.11</td>
<td>8.41</td>
</tr>
<tr>
<td>United States</td>
<td>4.23</td>
<td>3.03</td>
<td>3.00</td>
<td>2.61</td>
<td>2.61</td>
<td>2.34</td>
</tr>
</tbody>
</table>

In 1997, Malaysia and the Philippines suffered a severe currency crisis. Use the numbers in the preceding tables to provide a partial explanation.

17. Paf is a small country whose currency is the pib. Twenty years ago, the exchange rate with the U.S. dollar was 2 pib per dollar, and the inflation indexes were equal to 100 in both the United States and Paf. Now, the exchange rate is 8.9 pib per dollar, and the inflation indexes are equal to 400 in the United States and 200 in Paf.
   a. What should the current exchange rate be if PPP prevailed?
   b. Is the process of under valued according to PPP?

18. Paf is a small country. Its currency is the pib, and the exchange rate with the United States dollar is 8.9 pib per dollar. Following are some of the transactions affecting Paf's balance of payments during the quarter:
   - Paf exports 10 million pib of local products.
   - Paf investors buy foreign companies for a total cost of $3 million.
   - Paf investors receive $0.1 million of dividends on their foreign shares.
   - Many tourists visit Paf and spend $0.5 million.
   - Paf pays 1 million pib as interest on Paf bonds currently held by foreigners.
Chapter 2. Foreign Exchange Parity Relations

- Paf imports $7 million of foreign goods.
- Paf receives $0.3 million as foreign aid.

Illustrate how the preceding transactions would affect Paf’s balance of payments for the quarter, including the current account, the financial account, and the official reserves account.

19. The domestic economy seems to be overheating, with rapid economic growth and low unemployment. News has just been released that the monthly activity level is even higher than expected (as measured by new orders to factories and unemployment figures). This news leads to renewed fears of inflationary pressures and likely action by the monetary authorities to raise interest rates to slow the economy down.
   a. Based on the traditional flow market approach, discuss whether this news is good or bad for the exchange rate.
   b. Based on the asset market approach, discuss whether this news is good or bad for the exchange rate.

20. Even though the investment community generally believes that Country M’s recent budget deficit reduction is “credible, sustainable, and large,” analysts disagree about how it will affect Country M’s foreign exchange rate. Juan Da Silva, CFA, states, “The reduced budget deficit will lower interest rates, which will immediately weaken Country M’s foreign exchange rate.”
   a. Discuss the direct (short-term) effects of a reduction in Country M’s budget deficit on
      i. demand for loanable funds.
      ii. nominal interest rates.
      iii. exchange rates.
   b. Helga Wu, CFA, states, “Country M’s foreign exchange rate will strengthen over time as a result of changes in expectations in the private sector in country M.” Support Wu’s position that Country M’s foreign exchange rate will strengthen because of the changes a budget deficit reduction will cause in
      i. expected inflation rates.
      ii. expected rates of return on domestic securities.

Bibliography

Chapter 2
Foreign Exchange Parity Relations

1. Because the interest rate in A is greater than the interest rate in B, $\alpha$ is expected to depreciate relative to $\beta$, and should trade with a forward discount. Accordingly, the correct answer is (c).

2. Because the exchange rate is given in $\欧元:$/ terms, the appropriate expression for the interest rate parity relation is

\[
\frac{F}{S} = \frac{1 + r_s}{1 + r_e}
\]

($r_s$ is a part of the numerator and $r_e$ is a part of the denominator).

a. The one-year $\欧元:$/ forward rate is given by

\[
\欧元:$/ = 1.1795 \frac{1.05}{1.04} = 1.1908
\]

b. The one-month $\欧元:$/ forward rate is given by

\[
\欧元:$/ = 1.1795 \frac{1 + (0.04/12)}{1 + (0.03/12)} = 1.1805
\]

Of course, these are central rates, and bid-ask rates could also be determined on the basis of bid-ask rates for the spot exchange and interest rates.

3. a. bid $\欧元:¥ = (bid ¥:¥) \times (bid \欧元:$/) = 108.10 \times 1.1865 = 128.2607.$

ask $\欧元:¥ = (ask ¥:¥) \times (ask \欧元:$/) = 108.20 \times 1.1870 = 128.4334.$

b. Because the exchange rate is in $\欧元:$/ terms, the appropriate expression for the interest rate parity relation is $F/S = (1 + r_s)/(1 + r_e)$.

\[
\欧元:$/3\text{-month ask} = (\text{spot ask } \欧元:$/) \frac{1 + (\text{ask } r_s)}{1 + (\text{bid } r_e)} = 1.1870 \frac{1 + (0.0525/4)}{1 + (0.0325/4)}
\]

= 1.1929

Thus, the $\欧元:$/3-month forward ask exchange rate is: 1.1929.

c. bid $$/\欧元 = 1/\text{ask } \欧元:$/ = 1 / 1.1929 = 0.8383.$

Thus, the 3-month forward bid exchange rate is $$/\欧元 = 0.8383.$
d. Because the exchange rate is in $:¥ terms, the appropriate expression for the interest rate parity relation is
\[ \frac{F}{S} = \frac{1 + r_¥}{1 + r_s}. \]

Thus, the $:¥ 3-month forward exchange rate is: 107.03 – 107.26.

**Note:** The interest rates one uses in all such computations are those that result in a lower forward bid (so, bid interest rates in the numerator and ask rates in the denominator) and a higher forward ask (so, ask interest rates in the numerator and bid rates in the denominator).

4. a. For six months, \( r_{SFr} = 1.50\% \) and \( r_s = 1.75\% \). Because the exchange rate is in $:SFr terms, the appropriate expression for the interest rate parity relation is
\[ \frac{F}{S} = \frac{1 + r_{SFr}}{1 + r_s}, \quad \text{or} \quad \frac{F}{S} (1 + r_s) = (1 + r_{SFr}). \]

The left side of this expression is
\[ \frac{F}{S} (1 + r_s) = \frac{1.6558}{1.6627} (1 + 0.0175) = 1.0133 \]

The right side of the expression is: \( 1 + r_{SFr} = 1.0150 \). Because the left and right sides are not equal, IRP is not holding.

b. Because IRP is not holding, there is an arbitrage possibility: Because \( 1.0133 < 1.0150 \), we can say that the SFr interest rate quote is more than what it should be as per the quotes for the other three variables. Equivalently, we can also say that the $ interest rate quote is less than what it should be as per the quotes for the other three variables. Therefore, the arbitrage strategy should be based on borrowing in the $ market and lending in the SFr market. The steps would be as follows:
- Borrow $1,000,000 for six months at 3.5% per year. Need to pay back $1,000,000 \times (1 + 0.0175) = $1,017,500 six months later.
- Convert $1,000,000 to SFr at the spot rate to get SFr 1,662,700.
- Lend SFr 1,662,700 for six months at 3% per year. Will get back SFr 1,662,700 \times (1 + 0.0150) = SFr 1,687,641 six months later.
- Sell SFr 1,687,641 six months forward. The transaction will be contracted as of the current date but delivery and settlement will only take place six months later. So, six months later, exchange SFr 1,687,641 for SFr 1,687,641/SFr 1.6558/$ = $1,019,230.

The arbitrage profit six months later is $1,019,230 – $1,017,500 = $1,730.

5. a. For three months, \( r_s = 1.30\% \) and \( r_s = 0.30\% \). Because the exchange rate is in $:¥ terms, the appropriate expression for the interest rate parity relation is
\[ \frac{F}{S} = \frac{1 + r_s}{1 + r_s}, \quad \text{or} \quad \frac{F}{S} (1 + r_s) = (1 + r_s). \]
The left side of this expression is

\[ \frac{F}{S} (1 + r_s) = \frac{107.30}{108.00} (1 + 0.0130) = 1.0064. \]

The right side of this expression is: \( 1 + r_y = 1.0030 \). Because the left and right sides are not equal, IRP is not holding.

b. Because IRP is not holding, there is an arbitrage possibility. Because 1.0064 > 1.0030, we can say that the $ interest rate quote is more than what it should be as per the quotes for the other three variables. Equivalently, we can also say that the ¥ interest rate quote is less than what it should be as per the quotes for the other three variables. Therefore, the arbitrage strategy should be based on lending in the $ market and borrowing in the ¥ market. The steps would be as follows:

- Borrow the yen equivalent of $1,000,000. Because the spot rate is ¥108 per $, borrow $1,000,000 \times ¥108/$ = ¥108,000,000. Need to pay back ¥108,000,000 \times (1 + 0.0030) = ¥108,324,000 three months later.
- Exchange ¥108,000,000 for $1,000,000 at the spot exchange rate.
- Lend $1,000,000 for three months at 5.20% per year. Will get back $1,000,000 \times (1 + 0.0130) = $1,013,000 three months later.
- Buy ¥108,324,000 three months forward. The transaction will be contracted as of the current date, but delivery and settlement will only take place three months later. So, three months later, get ¥108,324,000 for ¥108,324,000 / (¥107.30 per $) = $1,009,543.

The arbitrage profit three months later is $1,013,000 – $1,009,543 = $3,457.

6. At the given exchange rate of 5 pesos/$, the cost in Mexico in dollar terms is $16 for shoes, $36 for watches, and $120 for electric motors. Thus, compared with the United States, shoes and watches are cheaper in Mexico, and electric motors are more expensive in Mexico. Therefore, Mexico will import electric motors from the United States, and the United States will import shoes and watches from Mexico. Accordingly, the correct answer is (d).

7. Consider two countries, A and B. Based on relative PPP,

\[ \frac{S_1}{S_0} = \frac{1 + I_A}{1 + I_B} \]

where \( S_1 \) and \( S_0 \) are the expected and the current exchange rates between the currencies of A and B, and \( I_A \) and \( I_B \) are the inflation rates in A and B. If A and B belong to the group of countries that introduces the same currency, then one could think of both \( S_1 \) and \( S_0 \) being one. Then, \( I_A \) and \( I_B \) should both be equal for relative PPP to hold. Thus, introduction of a common currency by a group of countries would result in the convergence of the inflation rates among these countries. A similar argument could be applied to inflation among the various states of the United States.

8. Based on relative PPP,

\[ \frac{S_1}{S_0} = \frac{1 + I_{\text{Switzerland}}}{1 + I_{\text{US}}} \]
where $S_i$ is the expected $\$:SFr exchange rate one year from now, $S_0$ is the current $\$:SFr exchange rate, and $I_{\text{Switzerland}}$ and $I_{\text{US}}$ are the expected annual inflation rates in Switzerland and the United States, respectively. So,
\[
\frac{S_i}{1.60} = \frac{1 + 0.02}{1 + 0.05} \quad \text{and} \quad S_i = 1.60 \left( \frac{1.02}{1.05} \right) = \text{SFr 1.55/\$}.
\]

9. a. A Japanese consumption basket consists of two-thirds sake and one-third TV sets. The price of sake in yen is rising at a rate of 10% per year. The price of TV sets is constant. The Japanese consumer price index inflation is therefore equal to
\[
\frac{2}{3}(10\%) + \frac{1}{3}(0\%) = 6.67\%
\]

b. Relative PPP states that
\[
\frac{S_i}{S_0} = \frac{1 + I_{\text{FC}}}{1 + I_{\text{DC}}}
\]

Because the exchange rate is given to be constant, we have $S_0 = S_i$, which implies $S_i/S_0 = 1$. As a result, in our example, PPP would hold if $1 + I_{\text{FC}} = 1 + I_{\text{DC}}$ (i.e., $I_{\text{FC}} = I_{\text{DC}}$). Because the Japanese inflation rate is 6.67% and the American inflation rate is 0%, we do not have $I_{\text{FC}} = I_{\text{DC}}$, and PPP does not hold.

10. a. i. The law of one price is that, assuming competitive markets and no transportation costs or tariffs, the same goods should have the same real prices in all countries after converting prices to a common currency.

ii. Absolute PPP, focusing on baskets of goods and services, states that the same basket of goods should have the same price in all countries after conversion to a common currency. Under absolute PPP, the equilibrium exchange rate between two currencies would be the rate that equalizes the prices of a basket of goods between the two countries. This rate would correspond to the ratio of average price levels in the countries. Absolute PPP assumes no impediments to trade and identical price indexes that do not create measurement problems.

iii. Relative PPP holds that exchange rate movements reflect differences in price changes (inflation rates) between countries. A country with a relatively high inflation rate will experience a proportionate depreciation of its currency’s value vis-à-vis that of a country with a lower rate of inflation. Movements in currencies provide a means for maintaining equivalent purchasing power levels among currencies in the presence of differing inflation rates.

Relative PPP assumes that prices adjust quickly and price indexes properly measure inflation rates. Because relative PPP focuses on changes and not absolute levels, relative PPP is more likely to be satisfied than the law of one price or absolute PPP.

b. i. Relative PPP is not consistently useful in the short run because of the following:

(1) Relationships between month-to-month movements in market exchange rates and PPP are not consistently strong, according to empirical research. Deviations between the rates can persist for extended periods. (2) Exchange rates fluctuate by minute because they are set in the financial markets. Price levels, in contrast, are sticky and adjust slowly. (3) Many other factors can influence exchange rate movements rather than just inflation.

ii. Research suggests that over the long term, a tendency exists for market and PPP rates to move together, with market rates eventually moving toward levels implied by PPP.
11. a. If the treasurer is worried that the franc might appreciate in the next three months, she could hedge her foreign exchange exposure by trading this risk against the premium included in the forward exchange rate. She could buy 10 million Swiss francs on the three-month forward market at the rate of SFr 1.5320 per €. The transaction will be contracted as of the current date, but delivery and settlement will only take place three months later.

b. Three months later, the company received the 10 million Swiss francs at the forward rate of SFr 1.5320 per € agreed on earlier. Thus, the company needed (SFr 10,000,000)/(SFr 1.5320 per €), or €6,527,415. If the company had not entered into a forward contract, the company would have received the 10 million Swiss francs at the spot rate of SFr 1.5101 per €. Thus, the company would have needed (SFr 10,000,000) / (SFr 1.5101 per €), or €6,622,078. Therefore, the company benefited by the treasurer’s action, because €6,622,078 – €6,527,415 = €94,663 were saved.

12. The nominal interest rate is approximately the sum of the real interest rate and the expected inflation rate over the term of the interest rate. Even if the international Fisher relation holds, and the real interest rates are equal among countries, the expected inflation can be very different from one country to another. Therefore, there is no reason why nominal interest rates should be equal among countries.

13. Because the Australian dollar is expected to depreciate relative to the dollar, we know from the combination of international Fisher relation and relative PPP that the nominal interest rate in Australia is greater than the nominal interest rate in the United States. Further, the nominal interest rate in the United States is greater than that in Switzerland. Thus, the nominal interest rate in Australia has to be greater than the nominal interest rate in Switzerland. Therefore, we can say from the combination of international Fisher relation and relative PPP that the Australian dollar is expected to depreciate relative to the Swiss franc.

14. According to the approximate version of the international Fisher relation, \( r_{Sweden} - r_{US} = I_{Sweden} - I_{US} \). So, \( 8 - 7 = 6 - I_{US} \), which means that \( I_{US} = 5\% \).

According to the approximate version of relative PPP,

\[
\frac{S_1 - S_0}{S_0} = I_{Sweden} - I_{US}
\]

where, \( S_1 \) and \( S_0 \) are in $:SKr terms. \( I_{Sweden} - I_{US} = 6 - 5 = 1\% \), or 0.01. So, \( (6 - S_0)/S_0 \) = 0.01. Solving for \( S_0 \), we get \( S_0 = SKr 5.94 \) per $.

According to the approximate version of IRP,

\[
\frac{F - S_0}{S_0} = r_{Sweden} - r_{US}
\]

where, \( F \) and \( S_0 \) are in $:SKr terms. \( r_{Sweden} - r_{US} = 8 - 7 = 1\% \), or 0.01. So, \( (F - 5.94)/5.94 = 0.01 \). Solving for \( F \), we get \( F = SKr 6 \) per $.

Because we are given the expected exchange rate, we could also have arrived at this answer by using the foreign exchange expectations relation.
15. According to the international Fisher relation,

\[
\frac{1 + r_{\text{Switzerland}}}{1 + r_{\text{UK}}} = \frac{1 + I_{\text{Switzerland}}}{1 + I_{\text{UK}}}
\]

So,

\[
\frac{1 + r_{\text{Switzerland}}}{1 + 0.12} = \frac{1 + 0.04}{1 + 0.10}
\]

therefore, \( r_{\text{Switzerland}} = 0.0589 \), or 5.89%.

According to relative PPP,

\[
\frac{S_1}{S_0} = \frac{1 + I_{\text{Switzerland}}}{1 + I_{\text{UK}}}
\]

where, \( S_1 \) and \( S_0 \) are in £:SFr terms.

So,

\[
\frac{S_1}{3} = \frac{1 + 0.04}{1 + 0.10}
\]

Solving for \( S_1 \) we get \( S_1 = \text{SFr 2.8364 per £} \).

According to IRP,

\[
\frac{F}{S_0} = \frac{1 + r_{\text{Switzerland}}}{1 + r_{\text{UK}}}
\]

where, \( F \) and \( S_0 \) are in £:SFr terms.

So,

\[
\frac{F}{3} = \frac{1 + 0.0589}{1 + 0.12}
\]

Solving for \( F \) we get \( F = \text{SFr 2.8363 per £} \). This is the same as the expected exchange rate in one year, with the slight difference due to rounding.

16. During the 1991–1996 period, the cumulative inflation rates were about 25 percent in Malaysia, 61 percent in the Philippines, and 18 percent in the United States. Over this period, based on relative PPP, one would have expected the Malaysian ringgit to depreciate by about 7 percent relative to the United States dollar (the inflation differential). In reality, the Malaysian ringgit appreciated by about 8 percent. Similarly, in view of the very high inflation differential between the Philippines and the United States, one would have expected the Philippine peso to depreciate considerably relative to the dollar. But it did not. Thus, according to PPP, both currencies had become strongly overvalued.
17. a. According to PPP, the current exchange rate should be

$$S_1 = S_0 = \frac{PI_1^{PI}}{PI_0^{PI} \cdot S}$$

where subscript 1 refers to the value now, subscript 0 refers to the value 20 years ago, $PI$ refers to price index, and $S$ is the $:\text{pif}$ exchange rate. Thus, the current exchange rate based on PPP should be

$$S_1 = 2 \left( \frac{200/100}{400/100} \right) = \text{pif 1 per $}.$$

b. As per PPP, the pif is overvalued at the prevailing exchange rate of pif 0.9 per $.

18. Exports equal 10 million pifs and imports equal $7 million (6.3 million pifs). Accordingly, the trade balance is $10 - 6.3 = 3.7$ million pifs.

- Balance of services includes the $0.5 million spent by tourists (0.45 million pifs).
- Net income includes $0.1 million or 0.09 million pifs received by Paf investors as dividends, minus 1 million pifs paid out by Paf as interest on Paf bonds (−0.91 million pifs).
- Unrequited transfers include $0.3 million (0.27 million pifs) received by Paf as foreign aid.
- Portfolio investment includes the $3 million or 2.7 million pifs spent by Paf investors to buy foreign firms. So, portfolio investment = −2.7 million pifs.

Based on the preceding,

- Current account = 3.24 (= 3.70 + 0.45 − 0.91)
- Capital account = 0.27
- Financial account = −2.7

The sum of current account, capital account, and financial account is 0.81. By definition of balance of payments, the sum of the current account, the capital account, the financial account, and the change in official reserves must be equal to zero. Therefore, official reserve account = −0.81.

The following summarizes the effect of the transactions on the balance of payments.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current account</td>
<td>3.24</td>
</tr>
<tr>
<td>Trade balance</td>
<td>3.70</td>
</tr>
<tr>
<td>Balance of services</td>
<td>0.45</td>
</tr>
<tr>
<td>Net income</td>
<td>−0.91</td>
</tr>
<tr>
<td>Capital account</td>
<td>0.27</td>
</tr>
<tr>
<td>Unrequited transfers</td>
<td>0.27</td>
</tr>
<tr>
<td>Financial account</td>
<td>−2.70</td>
</tr>
<tr>
<td>Portfolio investment</td>
<td>−2.70</td>
</tr>
<tr>
<td>Official reserve account</td>
<td>−0.81</td>
</tr>
</tbody>
</table>

19. a. A traditional flow market approach would suggest that the home currency should depreciate because of increased inflation. An increase in domestic consumption could also lead to increased imports and a deficit in the balance of trade. This deficit should lead to a weakening of the home currency in the short run.

b. The asset market approach claims that this scenario is good for the home currency. Foreign capital investment is attracted by the high returns caused by economic growth and high interest rates. This capital inflow leads to an appreciation of the home currency.
20. a. i. The immediate effect of reducing the budget deficit is to reduce the demand for loanable funds because the government needs to borrow less to bridge the gap between spending and taxes.
   ii. The reduced public-sector demand for loanable funds has the direct effect of lowering nominal interest rates, because lower demand leads to lower cost of borrowing,
   iii. The direct effect of the budget deficit reduction is a depreciation of the domestic currency and the exchange rate. As investors sell lower yielding Country M securities to buy the securities of other countries, Country M’s currency will come under pressure and Country M’s currency will depreciate.

b. i. In the case of a credible, sustainable, and large reduction in the budget deficit, reduced inflationary expectations are likely because the central bank is less likely to monetize the debt by increasing the money supply. Purchasing power parity and international Fisher relationships suggest that a currency should strengthen against other currencies when expected inflation declines.
   ii. A reduction in government spending would tend to shift resources into private-sector investments, in which productivity is higher. The effect would be to increase the expected return on domestic securities.