Introduction to Exchange Rates and the Foreign Exchange Market

1. Refer to the exchange rates given in the following table.

<table>
<thead>
<tr>
<th>Country</th>
<th>Today</th>
<th>One Year Ago</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June 25, 2010</td>
<td>June 25, 2009</td>
</tr>
<tr>
<td></td>
<td>Per $</td>
<td>Per £</td>
</tr>
<tr>
<td>Australia</td>
<td>1.152</td>
<td>1.721</td>
</tr>
<tr>
<td>Canada</td>
<td>1.037</td>
<td>1.559</td>
</tr>
<tr>
<td>Denmark</td>
<td>6.036</td>
<td>9.045</td>
</tr>
<tr>
<td>Euro</td>
<td>0.811</td>
<td>1.215</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>7.779</td>
<td>11.643</td>
</tr>
<tr>
<td>India</td>
<td>46.360</td>
<td>69.476</td>
</tr>
<tr>
<td>Japan</td>
<td>89.350</td>
<td>134.048</td>
</tr>
<tr>
<td>Mexico</td>
<td>12.697</td>
<td>18.993</td>
</tr>
<tr>
<td>Sweden</td>
<td>7.740</td>
<td>11.632</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.667</td>
<td>1.000</td>
</tr>
<tr>
<td>United States</td>
<td>1.000</td>
<td>1.496</td>
</tr>
</tbody>
</table>


Answer:
June 25, 2009: $E_{\$/¥} = 1 / (94.86) = $0.0105/¥$
June 25, 2010: $E_{\$/¥} = 1 / (89.35) = $0.0112/¥$
June 25, 2009: $E_{\$/C} = 1 / (1.084) = $0.9225/C$
June 25, 2010: $E_{\$/C} = 1 / (1.037) = $0.9643/C$

b. What happened to the value of the U.S. dollar relative to the Japanese yen and Canadian dollar between June 25, 2009 and June 25, 2010? Compute the percentage change in the value of the U.S. dollar relative to each currency using the U.S. dollar–foreign currency exchange rates you computed in (a).

Answer: Between June 25, 2009 and 2010, both the Canadian dollar and the Japanese yen appreciated relative to the U.S. dollar. The percentage appreciation in the foreign currency relative to the U.S. dollar is:

$\% \Delta E_{\$/¥} = \frac{($0.0112 - $0.0105)}{$0.0105} = 6.17\%$

$\% \Delta E_{\$/C} = \frac{($0.9643 - 0.9225)}{0.9225} = 4.53\%$
c. Using the information in the table for June 25, 2010, compute the Danish krone–Canadian dollar exchange rate, \( E_{\text{krona/C$}} \).

**Answer:** \( E_{\text{krona/C$}} = \frac{6.036 \text{ kr/}$}{1.037 \text{ C$/}$} = 5.8206 \text{ kr/C$} \).

d. Visit the Web site of the Board of governors of the Federal Reserve System at http://www.federalreserve.gov/. Click on “Economic Research and Data” and then “Statistics: Releases and Historical Data.” Download the H.10 release Foreign Exchange Rates (weekly data available). What has happened to the value of the U.S. dollar relative to the Canadian dollar, Japanese yen, and Danish krone since June 25, 2010?

**Answer:** Answers will vary.

e. Using the information from (d), what has happened to the value of the U.S. dollar relative to the British pound and the euro? Note: the H.10 release quotes these exchange rates as U.S. dollars per unit of foreign currency in line with long-standing market conventions.

**Answer:** Answers will vary.

2. Consider the United States and the countries it trades with the most (measured in trade volume): Canada, Mexico, China, and Japan. For simplicity, assume these are the only four countries with which the United States trades. Trade shares and exchange rates for these four countries are as follows:

<table>
<thead>
<tr>
<th>Country (currency)</th>
<th>Share of trade</th>
<th>$ per FX in 2009</th>
<th>Dollar per FX in 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada (dollar)</td>
<td>36%</td>
<td>0.9225</td>
<td>0.9643</td>
</tr>
<tr>
<td>Mexico (peso)</td>
<td>28%</td>
<td>0.0756</td>
<td>0.0788</td>
</tr>
<tr>
<td>China (yuan)</td>
<td>20%</td>
<td>0.1464</td>
<td>0.1473</td>
</tr>
<tr>
<td>Japan (yen)</td>
<td>16%</td>
<td>0.0105</td>
<td>0.0112</td>
</tr>
</tbody>
</table>

a. Compute the percentage change from 2009 to 2010 in the four U.S. bilateral exchange rates (defined as U.S. dollars per units of foreign exchange, or FX) in the table provided.

**Answer:**
\[
\% \Delta E_{\text{C$/}} = \frac{(0.9643 - 0.9225)}{0.9225} = 4.53% \\
\% \Delta E_{\text{pesos}} = \frac{(0.0788 - 0.0756)}{0.0756} = 4.23% \\
\% \Delta E_{\text{yuan}} = \frac{(0.1473 - 0.1464)}{0.1464} = 0.61% \\
\% \Delta E_{\text{yen}} = \frac{(0.0112 - 0.0105)}{0.0105} = 6.67% \\
\]

b. Use the trade shares as weights to compute the percentage change in the nominal effective exchange rate for the United States between 2009 and 2010 (in U.S. dollars per foreign currency basket).

**Answer:** The trade-weighted percentage change in the exchange rate is:
\[
\% \Delta E = 0.36(\% \Delta E_{\text{C$/}}) + 0.28(\% \Delta E_{\text{pesos}}) + 0.20(\% \Delta E_{\text{yuan}}) + 0.16(\% \Delta E_{\text{yen}}) \\
% \Delta E = 0.36(4.53%) + 0.28(4.23%) + 0.20(0.61%) + 0.16(6.67%) = 4.01% \\
\]

c. Based on your answer to (b), what happened to the value of the U.S. dollar against this basket between 2009 and 2010? How does this compare with the change in the value of the U.S. dollar relative to the Mexican peso? Explain your answer.

**Answer:** The dollar depreciated by 4.01% against the basket of currencies. Vis-à-vis the peso, the dollar depreciated by 4.23%.

3. Go to the Web site for Federal Reserve Economic Data (FRED): http://research.stlouisfed.org/fred2/. Locate the monthly exchange rate data for the following:
Look at the graphs and make a judgment as to whether each currency was fixed (peg or band), crawling (peg or band), or floating relative to the U.S. dollar during each time frame given:

a. Canada (dollar), 1980–2009
   Answer: Floating exchange rate


e. Venezuela (bolivar), 2003–2009
   Answer: Fixed exchange rate (with occasional adjustments)

4. Describe the different ways in which the government may intervene in the foreign exchange market. Why does the government have the ability to intervene in this way whereas private actors do not?
   Answer: The government may participate in the forex market in a number of ways: capital controls, official market (with fixed rates), and intervention. The government has the ability to intervene in a way that private actors do not because (1) it can impose regulations on the foreign exchange market, and (2) it can implement large-scale transactions that influence exchange rates.

5. Suppose quotes for the dollar–euro exchange rate, $E_{\text{$/€}}$, are as follows: in New York, $1.50 per euro; and in Tokyo, $1.55 per euro. Describe how investors use arbitrage to take advantage of the difference in exchange rates. Explain how this process will affect the dollar price of the euro in New York and Tokyo.
   Answer: Investors will buy euros in New York at a price of $1.50 each because this is relatively cheaper than the price in Tokyo. They will then sell these euros in Tokyo at a price of $1.55, earning a $0.05 profit on each euro. With the influx of buyers in New York, the price of euros in New York will increase. With the influx of traders selling euros in Tokyo, the price of euros in Tokyo will decrease. This price adjustment continues until the exchange rates are equal in both markets.

6. Consider a Dutch investor with 1,000 euros to place in a bank deposit in either the Netherlands or Great Britain. The (one-year) interest rate on bank deposits is 2% in Britain and 4.04% in the Netherlands. The (one-year) forward euro–pound exchange rate is 1.575 euros per pound and the spot rate is 1.5 euros per pound. Answer the following questions, using the exact equations for UIP and CIP as necessary.
   a. What is the euro-denominated return on Dutch deposits for this investor?
      Answer: The investor's return on euro-denominated Dutch deposits is equal to €1,040.04 (= €1,000 × (1 + 0.0404)).
b. What is the (riskless) euro-denominated return on British deposits for this investor using forward cover?

**Answer:** The euro-denominated return on British deposits using forward cover is equal to \( \frac{\varepsilon 1,071}{\varepsilon 1,000} \times \frac{1.575}{1.5} \times (1 + 0.02) \).

c. Is there an arbitrage opportunity here? Explain why or why not. Is this an equilibrium in the forward exchange rate market?

**Answer:** Yes, there is an arbitrage opportunity. The euro-denominated return on British deposits is higher than that on Dutch deposits. The net return on each euro deposit in a Dutch bank is equal to 4.04% versus 7.1% \( (\frac{1.575}{1.5}) \times (1 + 0.02) \) on a British deposit (using forward cover). This is not an equilibrium in the forward exchange market. The actions of traders seeking to exploit the arbitrage opportunity will cause the spot and forward rates to change.

d. If the spot rate is 1.5 euros per pound, and interest rates are as stated previously, what is the equilibrium forward rate, according to CIP?

**Answer:** CIP implies:

\[
\frac{\varepsilon}{\varepsilon} = \frac{\varepsilon}{\varepsilon} \times (1 + i_\varepsilon) \times \frac{1}{1 + i_\varepsilon} = 1.5 \times 1.0404 / 1.02 = \varepsilon 1.53 per \varepsilon.
\]

e. Suppose the forward rate takes the value given by your answer to (d). Calculate the forward premium on the British pound for the Dutch investor (where exchange rates are in euros per pound). Is it positive or negative? Why do investors require this premium/discount in equilibrium?

**Answer:** Forward premium = \( (\frac{\varepsilon}{\varepsilon} / \varepsilon - 1) = (1.53 / 1.50) - 1 = 0.03 = 3\% \). The existence of a positive forward premium would imply that investors expect the euro to depreciate relative to the British pound. Therefore, when establishing forward contracts, the forward rate is higher than the current spot rate.

f. If UIP holds, what is the expected depreciation of the euro against the pound over one year?

**Answer:** According to the UIP approximation, \( \frac{\Delta E_e / E_e}{\Delta E_p} = \frac{1}{1 + i_e} = 1.03 \) = 2.04%. Therefore, the euro is expected to depreciate by 2.04%. Using the exact UIP condition, we first need to convert the exchange rates into pound–euro terms to calculate the depreciation in the euro. From UIP:

\[
\frac{\Delta E_e}{E_e} = \frac{E_p}{E_e} \times (1 + i_e) / (1 + i_p) = \frac{1}{1.5} \times (1 + 0.02) / (1 + 0.0404) = 0.654 per \varepsilon.
\]

Therefore, the depreciation in the euro is equal to 1.95% (0.654 / 0.667 / 0.667).

g. Based on your answer to (f), what is the expected euro–pound exchange rate one year ahead?

**Answer:** Using the exact UIP (not the approximation), we know that the following is true:

\[
\frac{E_p}{E_e} = \frac{E_p}{E_e} \times (1 + i_e) / (1 + i_p) = 1.5 \times 1.0404 / 1.02 = (\varepsilon 1.53 per \varepsilon).
\]

This implies the new spot rate, \( \frac{\varepsilon}{\varepsilon} = 1.53. \)

7. You are a financial adviser to a U.S. corporation that expects to receive a payment of 40 million Japanese yen in 180 days for goods exported to Japan. The current spot rate is 100 yen per U.S. dollar \( (E_{yen} = 0.0100) \). You are concerned that the U.S. dollar is going to appreciate against the yen over the next six months.

a. Assuming that the exchange rate remains unchanged, how much does your firm expect to receive in U.S. dollars?

**Answer:** The firm expects to receive \$400,000 \( (= \varepsilon 40,000,000 / 100) \).

b. How much would your firm receive (in U.S. dollars) if the dollar appreciated to 110 yen per U.S. dollar \( (E_{yen} = 0.00909) \)?

**Answer:** The firm would receive \$363,636 \( (= \varepsilon 40,000,000 / 110) \).
Exchange Rates I: The Monetary Approach in the Long Run

1. Suppose that two countries, Vietnam and Côte d’Ivoire, produce coffee. The currency unit used in Vietnam is the dong (VND). Côte d’Ivoire is a member of Communauté Financière Africaine (CFA), a currency union of West African countries that use the CFA franc (XOF). In Vietnam, coffee sells for 5,000 dong (VND) per pound of coffee. The exchange rate is 30 VND per 1 CFA franc, \( E_{\text{VND/XOF}} = 30 \).

   a. If the law of one price holds, what is the price of coffee in Côte d’Ivoire, measured in CFA francs?

      **Answer:** According to LOOP, the price of coffee should be the same in both markets:
      \[
      P_{\text{coffee}}^{\text{VND}} = \frac{P_{\text{coffee}}^{\text{US}}}{E_{\text{VND/XOF}}} = \frac{5,000}{30} = 166.7
      \]

   b. Assume the price of coffee in Côte d’Ivoire is actually 160 CFA francs per pound of coffee. Calculate the relative price of coffee in Côte d’Ivoire versus Vietnam. Where will coffee traders buy coffee? Where will they sell coffee? How will these transactions affect the price of coffee in Vietnam? In Côte d’Ivoire?

      **Answer:** The relative price of coffee in these two markets is:
      \[
      q_{\text{coffee}} = \frac{E_{\text{VND/XOF}} \times P_{\text{coffee}}^{\text{US}}}{P_{\text{coffee}}^{\text{VND}}} = \frac{30 \times 160}{5000} = 0.96 < 1
      \]

      Traders will buy coffee in Côte d’Ivoire because it is cheaper there. Traders will sell coffee in Vietnam. This will lead to an increase in the price of coffee in Côte d’Ivoire and a decrease in the price in Vietnam.

2. Consider each of the following goods and services. For each, identify whether the law of one price will hold, and state whether the relative price, \( q_{\text{US/F oreign}} \), is greater than, less than, or equal to 1. Explain your answer in terms of the assumptions we make when using the law of one price.

   a. Rice traded freely in the United States and Canada

      **Answer:** \( q_{\text{US/F oreign}} = 1 \)

      LOOP should hold in this case because its assumptions are met.

   b. Sugar traded in the United States and Mexico; the U.S. government imposes a quota on sugar imports into the United States

      **Answer:** \( q_{\text{US/F oreign}} > 1 \)
If the U.S. government imposes a quota on sugar, this will lead to an increase in the relative price of sugar in the United States through restricting competition.

\[ q_{US/FOREIGN} = 1 \]

e. The McDonald’s Big Mac sold in the United States and Japan

\[ q_{US/FOREIGN} = 1 \]

The McDonald’s Big Mac sold in the United States may sell for a different price compared with Japan because there are nontradable elements in the production of the Big Mac, such as labor and rent.

d. Haircuts in the United States and the United Kingdom

\[ q_{US/FOREIGN} = 1 \]

Because haircuts cannot be traded across the United States and the United Kingdom, consumers will not arbitrage away differences in the prices of haircuts in these two regions.

3. Use the table that follows to answer this question. Treat the country listed as the home country and the United States as the foreign country. Suppose the cost of the market basket in the United States is \( P_{US} = \$190 \). Check to see whether purchasing power parity (PPP) holds for each of the countries listed and determine whether we should expect a real appreciation or real depreciation for each country (relative to the United States) in the long run.

<table>
<thead>
<tr>
<th>Country (currency measured in FX units)</th>
<th>Price of U.S. basket (in FX)</th>
<th>Real exchange rate ( q_{country/us} )</th>
<th>Does PPP hold? (yes/no)</th>
<th>Is FX currency overvalued or undervalued?</th>
<th>Is FX currency expected to have Real appreciation or depreciation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil (real)</td>
<td>2.1893</td>
<td>520</td>
<td>415.97</td>
<td>0.80</td>
<td>No Real overvalued Real exchange rate will depreciate</td>
</tr>
<tr>
<td>India (rupee)</td>
<td>46.6672</td>
<td>12,000</td>
<td>8,766.77</td>
<td>0.74</td>
<td>No Rupee overvalued Real exchange rate will depreciate</td>
</tr>
<tr>
<td>Mexico (peso)</td>
<td>11.0131</td>
<td>1,800</td>
<td>2,092.49</td>
<td>1.16</td>
<td>No Peso undervalued Real exchange rate will appreciate</td>
</tr>
<tr>
<td>South Africa (rand)</td>
<td>6.9294</td>
<td>800</td>
<td>1,316.59</td>
<td>1.65</td>
<td>No Rand undervalued Real exchange rate will appreciate</td>
</tr>
<tr>
<td>Zimbabwe (Z$)</td>
<td>101,347</td>
<td>4,000,000</td>
<td>19,225,930.00</td>
<td>4.81</td>
<td>No ZWS undervalued Real exchange rate will appreciate</td>
</tr>
</tbody>
</table>

\[ q_{country/us} = P_{US}/P_{country} \]
In the previous table:

- PPP holds only when the real exchange rate $q_{US/F} = 1$. This implies that the baskets in the home country and the United States have the same price in a common currency.
- If $q_{US/F} > 1$, then the basket in the United States is more expensive than the basket in the home country. This implies the U.S. dollar is overvalued and the Home currency is undervalued. According to PPP, the Home country will experience a real appreciation (Mexico, South Africa, and Zimbabwe).
- If $q_{US/F} < 1$, then the basket in the home country is more expensive than the basket in the United States. This implies the U.S. dollar is undervalued and the Home currency is overvalued. According to PPP, the Home country will experience a real depreciation (Brazil and India).

4. Table 3-1 in the text shows the percentage undervaluation or overvaluation in the Big Mac, based on exchange rates in July 2009. Suppose purchasing power parity holds in the long run, so that these deviations would be expected to disappear. Suppose the local currency prices of the Big Mac remained unchanged. Exchange rates in January 4, 2010, were as follows (source: IMF):

<table>
<thead>
<tr>
<th>Country</th>
<th>Per-U.S.-$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia (A$)</td>
<td>0.90</td>
</tr>
<tr>
<td>Brazil (real)</td>
<td>1.74</td>
</tr>
<tr>
<td>Canada (C$)</td>
<td>1.04</td>
</tr>
<tr>
<td>Denmark (krone)</td>
<td>5.17</td>
</tr>
<tr>
<td>Eurozone (euro)</td>
<td>0.69</td>
</tr>
<tr>
<td>India (rupee)</td>
<td>46.51</td>
</tr>
<tr>
<td>Japan (yen)</td>
<td>93.05</td>
</tr>
<tr>
<td>Mexico (peso)</td>
<td>12.92</td>
</tr>
<tr>
<td>Sweden (krona)</td>
<td>7.14</td>
</tr>
</tbody>
</table>

Based on these data and Table 3-1, calculate the change in the exchange rate from July to January, and state whether the direction of change was consistent with the PPP-implied exchange rate using the Big Mac Index. How might you explain the failure of the Big Mac Index to correctly predict the change in the nominal exchange rate between July 2009 and January 2010?
Answer: (The complete table is included in the Excel workbook for this chapter in the solutions manual.)

<table>
<thead>
<tr>
<th>Big-Mac-prices</th>
<th>(local-currency per-U.S.-dollar)</th>
<th>Exchange rate</th>
<th>Percent change</th>
<th>PPP-correct or-not?</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>$ 3.57</td>
<td>3.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>A$ 4.34</td>
<td>3.3643</td>
<td>1.2157</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>Correct direction, but depreciation was way more than predicted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>R$ 8.03</td>
<td>4.0150</td>
<td>2.2493</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>PPP-predicted depreciation, but currency actually appreciated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>C$ 3.89</td>
<td>3.3534</td>
<td>1.0896</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>Correct direction, but appreciation was way more than PPP predicted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>Kr 29.50</td>
<td>5.5243</td>
<td>8.2633</td>
<td>5.34</td>
</tr>
<tr>
<td></td>
<td>PPP-predicted depreciation, but currency actually appreciated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euro-area</td>
<td>€ 2.31</td>
<td>4.5073</td>
<td>0.9270</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>PPP-predicted depreciation, but currency actually appreciated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>¥ 320.00</td>
<td>3.4557</td>
<td>89.6359</td>
<td>92.6</td>
</tr>
<tr>
<td></td>
<td>PPP-predicted appreciation, but currency actually depreciated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>Peso 33.00</td>
<td>2.3013</td>
<td>9.2437</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>Correct direction, but appreciation was way less than PPP predicted.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>kr 38.00</td>
<td>4.9367</td>
<td>10.0244</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>PPP-predicted depreciation, but currency actually appreciated.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We can see from the table that during this time, PPP correctly predicted the direction exchange rate movements for only three of these countries. The Big Mac Index may fail to predict exchange rate movements because there are nontradable inputs used in the production of Big Macs, such as labor and rent.

5. You are given the following information. The current dollar–pound exchange rate is $2 per British pound. A U.S. basket that costs $100 would cost $120 in the United Kingdom. For the next year, the Fed is predicted to keep U.S. inflation at 2% and the Bank of England is predicted to keep U.K. inflation at 3%. The speed of convergence to absolute PPP is 15% per year.

a. What is the expected U.S. minus U.K. inflation differential for the coming year?

Answer: The inflation differential is equal to \(-1\% = (2\% - 3\%).\)

b. What is the current U.S. real exchange rate, \(q_{US/UK}\), with the United Kingdom?

Answer: The current real exchange rate is:

\[ q_{US/UK} = \frac{(E_{P_{UK}}/P_{US})}{P_{US}} = \frac{120/100}{1} = 1.2. \]

c. How much is the dollar overvalued/undervalued?

Answer: The British pound is undervalued by 20% and the U.S. dollar is overvalued by 20% \(= \frac{1.2 - 1}{1}\).

d. What do you predict the U.S. real exchange rate with the United Kingdom will be in one year’s time?

Answer: We can use the information on convergence to compute the implied change in the U.S. real exchange rate. We know the speed of convergence to absolute PPP is 15%; that is, each year the exchange rate will adjust by 15% of what is needed to achieve the real exchange rate equal to 1 (assuming prices in each country remain unchanged). Today, the real exchange rate is equal to 1.2, implying a 0.2 decrease is needed to satisfy absolute PPP. Over the next year, 15% of this adjustment will occur, so the real exchange rate will decrease by 0.03. Therefore, after one year, the U.S. real exchange rate, \(q_{US/UK}\), will equal 1.17.

e. What is the expected rate of real depreciation for the United States (versus the United Kingdom)?

Answer: From (d), the real exchange rate will decrease by 0.03. Therefore, the rate of real depreciation is equal to \(-2.5\% = -0.03/1.20\). This implies a real appreciation in the United States relative to the United Kingdom.

f. What is the expected rate of nominal depreciation for the United States (versus the United Kingdom)?

Answer: The expected rate of nominal depreciation can be calculated based on the inflation differential plus the expected real depreciation from (e). In this case, the inflation differential is \(-1\%\) and the expected real appreciation is \(-2.5\%\), so the expected nominal depreciation is \(-3.5\%.\) That is, we expect a 3.5% appreciation in the U.S. dollar relative to the British pound.

g. What do you predict will be the dollar price of one pound a year from now?

Answer: The current nominal exchange rate is $2 per pound and we expect a 3.5% appreciation in the dollar (from [f]). Therefore, the expected exchange rate in one year is equal to $1.93 \(= 2 \times (1 - 0.035)\).

6. Describe how each of the following factors might explain why PPP is a better guide for exchange rate movements in the long run versus the short run: (1) transactions costs, (2) nontraded goods, (3) imperfect competition, and (4) price stickiness. As markets become increasingly integrated, do you suspect PPP will become a more useful guide in the future? Why or why not?
Answer: Each of these factors hinders trade more in the short run than in the long run. Specifically, each is a reason to expect that the condition of frictionless trade is not satisfied. For this reason, PPP is more likely to hold in the long run than in the short run.

(1) Transactions costs. Over longer periods of time, producers generally face decreasing average costs (as fixed costs become variable costs in the long run). Therefore, the average cost associated with a given transaction should decrease.

(2) Nontraded goods. Goods that are not traded among countries cannot be arbitrated. Since intercountry arbitrage is required for PPP, nontraded goods will prevent exchange rates from completely adjusting to PPP. Examples of nontraded goods include many services that require a physical presence on site to complete the work. There are many of these, ranging from plumbers to hairdressers.

(3) Imperfect competition. Imperfect competition implies that producers of differentiated products have the ability to influence prices. In the short run, these firms may either collude to prevent price adjustment, or they may engage in dramatic changes in price (e.g., price wars) designed to capture market share. These collusion agreements and price wars generally are not long-lasting.

(4) Price stickiness. In the short run, prices may be inflexible for several reasons. Firms may face menu costs, or fear that price adjustments will adversely affect market share. Firms also may have wage contracts that are set in nominal terms. However, in the long run, these costs associated with changing prices dissipate, either because menu costs decrease over time or because firms and workers renegotiate wage contracts in the long run.

As markets become more integrated, PPP should become a better predictor of exchange rate movements. For PPP to hold, we have to assume frictionless trade. The more integrated markets are, the closer they are to achieving frictionless trade.

7. Consider two countries, Japan and Korea. In 1996, Japan experienced relatively slow output growth (1%), whereas Korea had relatively robust output growth (6%). Suppose the Bank of Japan allowed the money supply to grow by 2% each year, whereas the Bank of Korea chose to maintain relatively high money growth of 12% per year. For the following questions, use the simple monetary model (where $L$ is constant). You will find it easiest to treat Korea as the home country and Japan as the foreign country.

a. What is the inflation rate in Korea? In Japan?

**Answer:**

\[ \pi_K = \mu_K - g_K \Rightarrow \pi_K = 12\% - 6\% = 6\% \]
\[ \pi_J = \mu_J - g_J \Rightarrow \pi_J = 2\% - 1\% = 1\% \]

b. What is the expected rate of depreciation in the Korean won relative to the Japanese yen?

**Answer:**

\[ \%\Delta\bar{E}_{won/y} = (\pi_K - \pi_J) = 6\% - 1\% = 5\% \]
You can check this by using the following expression from the monetary model:

\[ \%\Delta\bar{E}_{won/y} = (\mu_K - g_K) - (\mu_J - g_J) \]

If nothing in Japan changes, what is the new inflation rate in Korea?

**Answer:**

\[ \pi^{new}_K = \mu_K - g_K = 15\% - 6\% = 9\% \]
d. Using time series diagrams, illustrate how this increase in the money growth rate affects the money supply, \( M_K \); Korea’s interest rate; prices, \( P_K \); real money supply; and \( E_{won/¥} \) over time. (Plot each variable on the vertical axis and time on the horizontal axis.)

**Answer:** See the following diagrams.

- Bank of Korea increases money growth rate
  - \( M_K \)
  - \( P_K \)
  - \( M_K/P_K \)
  - \( E_{won/¥} \)

- Bank of Korea reduces the money growth rate to less than 7%
  - \( M_K \)
  - \( P_K \)
  - \( M_K/P_K \)
  - \( E_{won/¥} \)

Note that \( E \) actually falls here because the won appreciates.
e. Suppose the Bank of Korea wants to maintain an exchange rate peg with the Japanese yen. What money growth rate would the Bank of Korea have to choose to keep the value of the won fixed relative to the yen?

**Answer:** To keep the exchange rate constant, the Bank of Korea must lower its money growth rate. We can figure out exactly which money growth rate will keep the exchange rate fixed by using the fundamental equation for the simple monetary model (used above in [b]):

\[ \% \Delta E_{\text{won/¥}} = (\mu_K - g_K) - (\mu_J - g_J) \]

The objective is to set \( \% \Delta E_{\text{won/¥}} = 0 \):

\[ (\mu_K^* - g_K) = (\mu_J - g_J) \]

Plug in the values given in the question and solve for \( \mu_K^* \):

\[ (\mu_K^* - 6\%) = (2\% - 1\%) \]

Therefore, if the Bank of Korea sets its money growth rate to 7\%, its exchange rate with Japan will remain unchanged.

f. Suppose the Bank of Korea sought to implement policy that would cause the Korean won to appreciate relative to the Japanese yen. What ranges of the money growth rate (assuming positive values) would allow the Bank of Korea to achieve this objective?

**Answer:** Using the same reasoning as previously, the objective is for the won to appreciate: \( \% \Delta E_{\text{won/¥}} < 0 \)

This can be achieved if the Bank of Korea allows the money supply to grow by less than 7\% each year. The diagrams on the following page show how this would affect the variables in the model over time.

S. This question uses the general monetary model, in which \( L \) is no longer assumed constant and money demand is inversely related to the nominal interest rate. Consider the same scenario described in the beginning of the previous question. In addition, the bank deposits in Japan pay 3\% interest.

a. Compute the interest rate paid on Korean deposits.

**Answer:**

Fisher effect: \( i_K = \pi_K - \pi_J \)

Solve for \( i_K = (6\% - 1\%) + 3\% = 8\% \)

b. Using the definition of the real interest rate (nominal interest rate adjusted for inflation), show that the real interest rate in Korea is equal to the real interest rate in Japan. (Note that the inflation rates you calculated in the previous question will apply here.)

**Answer:**

\[ r_K = i_K - \pi_K = 2\% - 1\% = 1\% \]

\[ r_J = i_J - \pi_J = 8\% - 6\% = 2\% \]

Therefore, if the Bank of Korea increases the money growth rate from 12\% to 15\% and the inflation rate rises proportionately (one for one) with this increase. If the nominal interest rate in Japan remains unchanged, what happens to the interest rate paid on Korean deposits?

**Answer:** We know that the inflation rate in Korea will increase to 9\%. We also know that the real interest rate will remain unchanged. Therefore:

\[ i_{\text{won}} = i_{\text{won}} + \pi_K = 1\% + 9\% = 10\% \]
d. Using time series diagrams, illustrate how this increase in the money growth rate affects the money supply, $M_K$; Korea’s interest rate; prices, $P_K$; real money supply; and $E_{won/¥}$ over time. (Plot each variable on the vertical axis and time on the horizontal axis.)

**Answer:** See the following diagrams.

![Diagrams](image)

9. Both advanced economies and developing countries have experienced a decrease in inflation since the 1980s (see Table 3-2 in the text). This question considers how the choice of policy regime has influenced this global disinflation. Use the monetary model to answer this question.

a. The Swiss Central Bank currently targets its money growth rate to achieve policy objectives. Suppose Switzerland has output growth of 3% and money growth of 8% each year. What is Switzerland’s inflation rate in this case? Describe how the Swiss Central Bank could achieve an inflation rate of 2% in the long run through the use of a nominal anchor.

**Answer:** From the monetary approach: $\pi = \mu - \gamma = 8\% - 3\% = 5\%$. If the Swiss Central Bank wants to achieve an inflation target of 2%, it would need to reduce its money growth rate to 5%: $\mu^K = \pi + \gamma = 2\% + 3\% = 5\%$. 

Exchange Rates II: The Asset Approach in the Short Run

1. Use the money market and FX diagrams to answer the following questions about the relationship between the British pound (£) and the U.S. dollar ($). The exchange rate is in U.S. dollars per British pound, $E_{$/£}. We want to consider how a change in the U.S. money supply affects interest rates and exchange rates. On all graphs, label the initial equilibrium point $A$.

a. Illustrate how a temporary decrease in the U.S. money supply affects the money and FX markets. Label your short-run equilibrium point $B$ and your long-run equilibrium point $C$.

Answer: See the diagram below.
b. Using your diagram from (a), state how each of the following variables changes in the short run (increase/decrease/no change): U.S. interest rate, British interest rate, \( E_{$/£} \), \( E_{£/}$ \), and the U.S. price level.

**Answer:** The U.S. interest rate increases, the British interest rate does not change, \( E_{$/£} \) decreases, \( E_{£/}$ \) does not change, and the U.S. price level does not change.

c. Using your diagram from (a), state how each of the following variables changes in the long run (increase/decrease/no change relative to their initial values at point \( A \)): U.S. interest rate, British interest rate, \( E_{$/£} \), \( E_{£/}$ \), and U.S. price level.

**Answer:** All of the variables return to their initial values in the long run. This is because the shock is temporary, implying the central bank will increase the money supply from \( M^* \) to \( M^1 \) in the long run.

2. Use the money market and FX diagrams from (a) to answer the following questions. This question considers the relationship between the Indian rupees (Rs) and the U.S. dollar (S$). The exchange rate is in rupees per dollar, \( E_{Rs/S} \). On all graphs, label the initial equilibrium point \( A \).

a. Illustrate how a permanent increase in India’s money supply affects the money and FX markets. Label your short-run equilibrium point \( B \) and your long-run equilibrium point \( C \).

**Answer:** See the following diagram. Thick arrows indicate temporary movement while thinner ones indicate the movements in the long run. In the short run, prices are fixed. Therefore the real money supply changes from \( MS^1 \) to \( MS^2 \), thus temporarily lowering the domestic interest rate. In the long run, as prices rise, the real money supply and interest rate return to their original level. In the foreign exchange market, \( FR \) shifts to the right and stays there permanently because of an expected depreciation of rupees.
b. By plotting them on a chart with time on the horizontal axis, illustrate how each of the following variables changes over time (for India): nominal money supply $M_{n,\text{IN}}$, price level $P_{n,\text{IN}}$, real money supply $M_{n,\text{IN}}/P_{n,\text{IN}}$, India’s interest rate $i_{Rs}$, and the exchange rate $E_{Rs/\$}$. 

Answer: See the following diagrams.

![Diagrams showing changes over time](https://via.placeholder.com/150)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_{n,\text{IN}}$</td>
<td><img src="https://via.placeholder.com/150" alt="Chart" /></td>
</tr>
<tr>
<td>$P_{n,\text{IN}}$</td>
<td><img src="https://via.placeholder.com/150" alt="Chart" /></td>
</tr>
<tr>
<td>$M_{n,\text{IN}}/P_{n,\text{IN}}$</td>
<td><img src="https://via.placeholder.com/150" alt="Chart" /></td>
</tr>
<tr>
<td>$i_{Rs}$</td>
<td><img src="https://via.placeholder.com/150" alt="Chart" /></td>
</tr>
<tr>
<td>$E_{Rs/$}$</td>
<td><img src="https://via.placeholder.com/150" alt="Chart" /></td>
</tr>
</tbody>
</table>


c. Using your previous analysis, state how each of the following variables changes in the short run (increase/decrease/no change): India’s interest rate $i_{Rs}$, $E_{Rs/\$}$, and India’s price level $P_{n,\text{IN}}$. 

Answer: India’s interest rate decreases, the U.S. interest rate remains unchanged, $E_{Rs/\$}$ increases, $E_{Rs/\$}$ increases, and India’s price level remains unchanged.

d. Using your previous analysis, state how each of the following variables changes in the long run (increase/decrease/no change relative to their initial values at point A): India’s interest rate $i_{Rs}$, $E_{Rs/\$}$, India’s price level $P_{n,\text{IN}}$. 

Answer: India’s interest rate remains unchanged, the U.S. interest rate remains unchanged, $E_{Rs/\$}$ increases, $E_{Rs/\$}$ increases (remains unchanged in transition from short to long run), India’s price level increases.

e. Explain how overshooting applies to this situation.

Answer: The short-run exchange rate overshoots its long-run value, $E_{Rs/\$}$ as in the text Figure 4-13 (15-13). We can see this in the impulse response diagrams shown previously. The overshooting is caused by the investors’ adjustment of exchange rate expectations coupled with lower domestic interest rates. Since the rupees interest rate falls, investors must be compensated by a rupee appreciation for UIP with U.S. interest rate to hold. For a rupee appreciation to be possible, it must depreciate more in the short run than its longer-run value.
3. Is overshooting (in theory and in practice) consistent with purchasing power parity? Consider the reasons for the usefulness of PPP in the short run versus the long run and the assumption we’ve used in the asset approach (in the short run versus the long run). How does overshooting help to resolve the empirical behavior of exchange rates in the short run versus the long run?

**Answer:** Yes, overshooting is consistent with PPP. Investors forecast the expected exchange rate based on the theory of PPP. When there is some change in the market, the investors know the exchange rate will change to equate relative prices in the long run. This is why we observe overshooting in the short run—the investors incorporate this information into their short-run forecasts. Exchange rates are volatile in the short run. The theory’s implication that there is exchange rate overshooting (in response to permanent shocks) is one explanation for short-run volatility in exchange rates.

4. Use the money market and foreign exchange (FX) diagrams to answer the following questions. This question considers the relationship between the euro (€) and the U.S. dollar ($). The exchange rate is in U.S. dollars per euro, $E_{US}/€$. Suppose that with financial innovation in the United States, real money demand in the United States decreases. On all graphs, label the initial equilibrium point A.

a. Assume this change in U.S. real money demand is temporary. Using the FX and money market diagrams, illustrate how this change affects the money and FX markets. Label your short-run equilibrium point B and your long-run equilibrium point C.

**Answer:** See the following diagram. The long-run values are the same as the initial values because the shock is temporary. Also because the shock is temporary, we assume that the reversal of real money demand occurs before the price level adjusts—that is, MD returns from MD² to MD¹ before the price level changes.

b. Assume this change in U.S. real money demand is permanent. Using a new diagram, illustrate how this change affects the money and FX markets. Label your short-run equilibrium point B and your long-run equilibrium point C.

**Answer:** See the following diagram. In the long run, the price level will have to increase to adjust for the drop in real money demand (assuming the central bank does not change the money supply, M). That is, the nominal interest rate returns to its initial value in the long run. This requires that the price level increase to reduce real money supply. The drop in real money demand will have to be met one-for-one with a drop in real money supply (generated by an increase in the price level). In this case, the expected exchange rate changes because the shock is permanent. Therefore, FR schedule in the forex market also shifts upward.
c. Illustrate how each of the following variables changes over time in response to a permanent reduction in real money demand: nominal money supply $M_{US}$, price level $P_{US}$, real money supply $M_{US}/P_{US}$, U.S. interest rate $i_s$, and the exchange rate $E_{S/E}$.

**Answer:** See the following diagrams.
8. During the Great Depression, the United States remained on the international gold standard longer than other countries. This effectively meant that the United States was committed to maintaining a fixed exchange rate at the onset of the Great Depression. The U.S. dollar was pegged to the value of gold along with other major currencies, including the British pound, the French franc, and so on. Many researchers have blamed the severity of the Great Depression on the Federal Reserve and its failure to react to economic conditions in 1929 and 1930. Discuss how the policy trilemma applies to this situation.

**Answer:** The United States was committed to the fixed exchange rate with gold; consequently, policy makers had to sacrifice either monetary policy autonomy or capital mobility, just as the trilemma suggests. Based on the information given in the question, we can assume that the policy did not respond to the U.S. business cycle (policy makers did not exercise monetary policy autonomy). Thus, if we assume international capital mobility, the United States could not react to the business cycle with a monetary expansion until it abandoned the gold standard.

9. On June 20, 2007, John Authers, investment editor of the *Financial Times*, wrote the following in his column “The Short View”:

The Bank of England published minutes showing that only the narrowest possible margin, 5–4, voted down [an interest] rate hike last month. Nobody foresaw this . . . . The news took sterling back above $1.99, and to a 15-year high against the yen.

Can you explain the logic of this statement? Interest rates in the United Kingdom had remained unchanged in the weeks since the vote and were still unchanged after the minutes were released. What news was contained in the minutes that caused traders to react? Use the asset approach.

**Answer:** The news item indicates that investors did not expect the decision to leave interest rates unchanged would be divisive. They thought that any increases in interest rates would happen further in the future. Higher interest rates would lead to an appreciation in the pound sterling. When the minutes showed that interest rate increases were more likely than previously thought, investors came to expect an appreciation sooner rather than later. This caused an appreciation in the current spot exchange rate.

10. We can use the asset approach to both make predictions about how the market will react to current events and understand how important these events are to investors. Consider the behavior of the Union/Confederate exchange rate during the Civil War. How would each of the following events affect the exchange rate, defined as Confederate dollars per Union dollar, $E_{C/$}\?$

   a. The Confederacy increases the money supply by 2,900% between July and December of 1861.

   **Answer:** The Confederate money supply increases, the exchange rate increases, and the Confederate dollar depreciates.

   b. The Union Army suffers a defeat in Battle of Chickamauga in September 1863.

   **Answer:** Appreciation in the Confederate dollar is expected because a military victory means a stable economy and monetary policy, implying decreased uncertainty and risk, the exchange rate decreases, and the Confederate dollar appreciates.

   c. The Confederate Army suffers a major defeat with Sherman’s March in the autumn of 1864.

   **Answer:** Just the opposite of (b) above: depreciation in the Confederate dollar is expected because of military defeat increases economic and monetary uncertainty and risk; the exchange rate increases, and the Confederate dollar depreciates.