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Introduction to Exchange Rates and the Foreign Exchange Market

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

	Today June 25, 2010		One Year Ago June 25, 2009	
Country	**Per $**	**Per £**	**Per €**	**Per $**
Australia	1.152	1.721	1.417	1.225
Canada	1.037	1.559	1.283	1.084
Denmark	6.036	9.045	7.443	5.238
Euro	0.811	1.215	1.000	0.703
Hong Kong	7.779	11.643	9.583	7.750
India	46.360	69.476	57.179	48.160
Japan	89.350	134.048	110.308	94.860
Mexico	12.697	18.993	15.631	13.220
Sweden	7.740	11.632	9.577	7.460
United Kingdom	0.667	1.000	0.822	0.609
United States	1.000	1.496	1.232	1.000

Source: U.S. Federal Reserve Board of Governors, H.10 release: Foreign Exchange Rates.

a. Compute the U.S. dollar–yen exchange rate, $E_{\$/¥}$, and the U.S. dollar–Canadian dollar exchange rate, $E_{\$/C\$}$, on June 25, 2010, and June 25, 2009

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:

$\%\Delta E_{\$/¥} = (\$0.0112 - \$0.0105) / \$0.0105 = 6.17\%$
$\%\Delta E_{\$/¥} = (\$0.9643 - \$0.9225) / \$0.9225 = 4.53\%$

c. Using the information in the table for June 25, 2010, compute the Danish krone–Canadian dollar exchange rate, $E_{krone/C\$}$.

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

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:

Country (currency)	Share of trade	$ per FX in 2009	Dollar per FX in 2010
Canada (dollar)	36%	0.9225	0.9643
Mexico (peso)	28%	0.0756	0.0788
China (yuan)	20%	0.1464	0.1473
Japan (yen)	16%	0.0105	0.0112

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:
$\%\Delta E_{\$/C\$} = (0.9643 - 0.9225) / 0.9225 = 4.53\%$
$\%\Delta E_{\$/pesos} = (0.0788 - 0.0756) / 0.0756 = 4.23\%$
$\%\Delta E_{\$/yuan} = (0.1473 - 0.1464) / 0.1464 = 0.61\%$
$\%\Delta E_{\$/¥} = (0.0112 - 0.0105 / 0.0105 = 6.67\%$

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:
$\%\Delta E = 0.36(\%\Delta E_{\$/C\$}) + 0.28(\%\Delta E_{\$/pesos}) + 0.20(\%\Delta E_{\$/yuan}) + 0.16(\%\Delta E_{\$/¥})$
$\%\Delta E = 0.36(4.53\%) + 0.28(4.23\%) + 0.20(0.61\%) + 0.16(6.67\%) = 4.01\%$

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:

a. Canada (dollar), 1980–2009
b. China (yuan), 1999–2005 and 2005–2009
c. Mexico (peso), 1993–1995 and 1995–2009
d. Thailand (baht), 1986–1997 and 1997–2009
b. Venezuela (bolivar), 2003–2009

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

b. China (yuan), 1999–2005 and 2005–2009

Answer: 1999–2005: Fixed exchange rate. 2005–2009: Gradual appreciation vis-à-vis the dollar.

c. Mexico (peso), 1993–1995 and 1995–2006

Answer: 1993–1995: crawl; 1995–2006: floating (with some evidence of a managed float)

d. Thailand (baht), 1986–1997 and 1997–2006

Answer: 1986–1997: fixed exchange rate; 1997–2006: floating

e. Venezuela (bolivar), 2003–2006

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, $E_{\$/€}$, 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 Toyko, 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 €1,071 (= €1,000 × (1.575 / 1.5) × (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% (= (1.575 / 1.5) × (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: $F_{€/£} = E_{€/£}\,(1 + i_€) / (1 + i_£) = 1.5 \times 1.0404 / 1.02 =$ €1.53 per £.

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 = $(F_{€/£} / E_{€/£} - 1) = (1.53 / 1.50) - 1 = 0.03 =$ 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, $\Delta E^e_{£/€} / E_{£/€} = i_£ - i_€ = 2.04\%$. 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: $\Delta E^e_{£/€} = E_{£/€} \times (1 + i_£) / (1 + i_€) = (1 / 1.5) \times (1 + 0.02) / (1 + 0.0404) =$ £0.654 per €. 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: $E^e_{£/€} = E_{£/€} \times (1 + i_€) / (1 + i_£) = 1.5 \times 1.0404 / 1.02 =$ (€1.53 per £. Using the approximation, $E_{£/€}$ decreases by 2.04% from 0.667 to 0.653. This implies the new spot rate, $E_{€/£} = 1.53$.

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 ($E_{\$/¥} = 0.0100$). 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 (= ¥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 ($E_{\$/¥} = 0.00909$)?

Answer: The firm would receive $363,636 (= ¥40,000,000 / 110).

c. Describe how you could use an options contract to hedge against the risk of losses associated with the potential appreciation in the U.S. dollar.

Answer: The firm could buy ¥40 million in call options on dollars at a rate of 105 ¥ per dollar. This would ensure the firm's yen receipts will sell for at least this rate (between the current 100 and future 110 rate).

8. Consider how transactions costs affect foreign currency exchange. Rank each of the following foreign exchanges according to their probable spread (between the "buy at" and "sell for" bilateral exchange rates) and justify your ranking.

a. An American returning from a trip to Turkey wants to exchange his Turkish lira for U.S. dollars at the airport.

b. Citigroup and HSBC, both large commercial banks located in the United States and the United Kingdom, respectively, need to clear several large checks drawn on accounts held by each bank.

c. Honda Motor Company needs to exchange yen for U.S. dollars to pay American workers at its Ohio manufacturing plant.

d. A Canadian tourist in Germany pays for her hotel room using a credit card.

Answer: Ranking (highest spread first): (a), (d), (c), (b). Both (a) and (d) involve small transactions that will involve a go-between who will charge a premium to convert the currency. (d) involves a credit card company (a commercial bank or nonbank financial institution) that likely is involved in large volumes of transactions each day. (c) involves a corporation that can negotiate a better rate (versus an individual) because it will likely engage in a large currency exchange, or Honda could simply enter the market without going through a broker. Finally, (b) involves two large commercial banks that regularly engage in large-volume foreign exchange trading.