International Economics
THEORY & POLICY

Seventh Edition

Paul R. Krugman   Maurice Obstfeld

Chapter 13

Exchange Rates
and the Foreign
Exchange Market:
An Asset
Approach

PEARSON
Addison
Wesley

Slides prepared by Thomas Bishop

Preview

- The basics of exchange rates

- Exchange rates and the prices of goods

- The foreign exchange markets

- The demand for currency and other assets

- A model of foreign exchange markets

  ♦ role of interest rates on currency deposits

  ♦ role of expectations about exchange rates

Definitions of Exchange Rates

- Exchange rates are quoted as foreign currency per unit of domestic currency or domestic currency per unit of foreign currency.

  - How much can be exchanged for one dollar? ¥102/$1
  - How much can be exchanged for one yen? $0.0098/¥1

- Exchange rate allow us to express the cost or price of a good or service in a common currency.

  - How much does a Honda cost? ¥3,000,000
  - Or, ¥3,000,000 x $0.0098/¥1 = $29,400

Depreciation and Appreciation

- **Depreciation** is a *decrease* in the value of a currency relative to another currency.

  ♦ A depreciated currency is *less valuable* (less expensive) and therefore can be exchanged for (can buy) a smaller amount of foreign currency.

  ♦ $1/€1 → $1.20/€1 means that the dollar has depreciated against the euro. It now takes $1.20 to buy one euro, so that the dollar is less valuable.

  ♦ At the same time, the euro has appreciated against the dollar: it is now more valuable.

Depreciation and Appreciation (cont.)

- **Appreciation** is an *increase* in the value of a currency relative to another currency.

  - An appreciated currency is *more valuable* (more expensive) and therefore can be exchanged for (can buy) a larger amount of foreign currency.

  - $1/€1 → $0.90/€1 means that the dollar has appreciated against the euro. It now takes only $0.90 to buy one euro, so that the dollar is relatively more valuable.

  - The euro has depreciated against the dollar: it is now relatively less valuable.

Depreciation and Appreciation (cont.)

- A depreciated currency is less valuable, and therefore it can buy fewer foreign-produced goods with prices that are quoted in foreign currency terms.
  - How many yen does a Japanese Honda cost? ¥3,000,000
  - ¥3,000,000 x $0.0098/¥1 = $29,400
  - ¥3,000,000 x $0.0100/¥1 = $30,000

- A depreciated currency means that *imports* are more expensive and domestically produced goods and *exports* are less expensive.

- A depreciated currency lowers the price of exports relative to the price of imports.

Depreciation and Appreciation (cont.)

- An appreciated currency is more valuable, and therefore it can buy more foreign produced goods that are denominated in foreign currency.

  - How much does a Honda cost? ¥3,000,000

  - ¥3,000,000 x $0.0098/¥1 = $29,400

  - ¥3,000,000 x $0.0090/¥1 = $27,000

- An appreciated currency means that *imports* are less expensive and domestically produced goods and *exports* are more expensive.

- An appreciated currency raises the price of exports relative to the price of imports.

TABLE 13-1 Exchange Rate Quotations

FOREIGN EXCHANGE

WEDNESDAY, NOVEMBER 3, 2004

Currency	Foreign Currency in Dollars Wed.	Tue.	Dollars in Foreign Currency Wed.	Tue.	Currency	Foreign Currency in Dollars Wed.	Tue.	Dollars in Foreign Currency Wed.	Tue.
Argentina (Peso)	.3401	.3401	2.9400	2.9400	Kuwait (Dinar)	3.3944	3.3944	.2946	.2946
Australia (Dollar)	.7544	.7454	1.3256	1.3416	Lebanon (Pound)	.000660	.000660	1514.46	1514.46
Bahrain (Dinar)	2.6525	2.6525	.3770	.3770	Malaysia (Ringgit)	.2632	.2632	3.7998	3.7998
Brazil (Real)	.3531	.3507	2.8320	2.8515	Mexico (Peso)	.087474	.087367	11.4320	11.4460
Britain (Pound)	1.8474	1.8362	.5413	.5446	N. Zealand (Dollar)	.6880	.6838	1.4535	1.4624
30-day fwd	1.8419	1.8327	.5429	.5456	Norway (Krone)	.1561	.1554	6.4048	6.4341
60-day fwd	1.8379	1.8289	.5441	.5468	Pakistan (Rupee)	.0166	.0164	60.42	61.01
90-day fwd	1.8336	1.8248	.5454	.5480	Peru (New Sol)	.3013	.3008	3.319	3.325
Canada (Dollar)	.8275	.8151	1.2084	1.2268	Philpins (Peso)	.0177	.0178	56.37	56.32
30-day fwd	.8252	.8160	1.2119	1.2255	Poland (Zloty)	.2959	.2959	3.38	3.38
60-day fwd	.8249	.8157	1.2123	1.2260	a-Russia (Ruble)	.0348	.0347	28.7590	28.7840
90-day fwd	.8245	.8153	1.2129	1.2265	SDR (SDR)	1.49632	1.49615	.6683	.6684
Chile (Peso)	.001646	.001635	607.53	611.62	Saudi Arab (Riyal)	.2667	.2667	3.7501	3.7500
China (Yuan)	.1208	.1208	8.2781	8.2781	Singapore (Dollar)	.6004	.5999	1.6656	1.6670
Colombia (Peso)	.000390	.000390	2567.39	2567.39	SlovakRep (Koruna)	.0319	.0319	31.37	31.32
CzechRep (Koruna)	.0404	.0405	24.73	24.68	So. Africa (Rand)	.1651	.1632	6.0556	6.1260
Denmark (Krone)	.1720	.1711	5.8133	5.8457	So. Korea (Won)	.000896	.000897	1116.00	1114.80
Dominican (Peso)	.0323	.0323	31.00	31.00	Sweden (Krona)	.1411	.1400	7.0868	7.1430
Egypt (Pound)	.1605	.1605	6.2301	6.2301	Switzerlnd (Franc)	.8377	.8261	1.1938	1.2105
Europe (Euro)	1.2821	1.2674	.7800	.7890	30-day fwd	.8361	.8285	1.1961	1.2070
30-day fwd	1.2781	1.2692	.7824	.7879	60-day fwd	.8372	.8295	1.1945	1.2055
60-day fwd	1.2786	1.2692	.7821	.7879	90-day fwd	.8384	.8315	1.1927	1.2027
90-day fwd	1.2784	1.2691	.7822	.7880	Taiwan (Dollar)	.0301	.0299	33.25	33.48
Hong Kong (Dollar)	.1285	.1285	7.7804	7.7815	Thailand (Baht)	.02435	.02435	41.07	41.07
Hungary (Forint)	.0052	.0052	192.98	192.72	Turkey (Lira)	.000001	.000001	1470588	1470588
India (Rupee)	.0221	.0220	45.250	45.490	U.A.E. (Dirham)	.2723	.2723	3.6727	3.6728
Indnsia (Rupiah)	.000110	.000110	9120.00	9090.00	Uruguay (New Peso)	.0370	.0370	27.0270	27.0270
Israel (Shekel)	.2247	.2250	4.4504	4.4444	Venzuel (Bolivar)	.000522	.000522	1915.20	1915.20
Japan (Yen)	.009421	.009399	106.15	106.39					
30-day fwd	.009438	.009421	105.96	106.15					
60-day fwd	.009455	.009438	105.76	105.95					
90-day fwd	.009476	.009459	105.53	105.72					
Jordan (Dinar)	1.4104	1.4104	.70902	.70902					
Kenya (Shilling)	.0124	.0123	80.78	81.10					

a-Russian Central Bank rate.
c-commercial rate, d-free market rate, f-financial rate, y-official rate, z-floating rate.
Prices as of 3:00 p.m. Eastern Time from Moneyline Telerate and other sources.

Source: Data from "Foreign Exchange," *New York Times*, November 3, 2004. © 2005 The New York Times Co.

The Foreign Exchange Market

The main players:

- Commercial banks and other depository institutions: transactions involve buying/selling of bank deposits in different currencies for investment.

- Non-bank financial institutions (pension funds, insurance funds) may buy/sell foreign assets.

- Private firms: conduct foreign currency transactions to buy/sell goods, assets, or services.

- Central banks: conduct official international reserve transactions; foreign exchange intervention.

The Foreign Exchange Market (cont.)

- Buying and selling in the foreign exchange market are dominated by commercial banks.

    ♦ Inter-bank transactions of deposits in foreign currencies occur in amounts $1 million or more per transaction.

    ♦ Central banks sometimes intervene, but the direct effects of their transactions are usually small and transitory (unless they can have a major effect on *expectations* of future policies and exchange rates; see below).

The Foreign Exchange Market (cont.)

Characteristics of the market:

- Trading occurs mostly in major financial cities: London, New York, Tokyo, Frankfurt, Singapore.

- The volume of foreign exchange has grown:
    - in 1989 the daily volume of trading was $600 billion, in 2004 the daily volume of trading was $1.9 trillion.

- Nearly 90% of transactions in 2004 involved US dollars. Why? US dollar is the main *vehicle currency*.

The Foreign Exchange Market (cont.)

- Electronic information transmission (most recently internet) has helped to integrate regional FX markets since the 1860s.

- The integration of markets implies that there is no significant **arbitrage** between markets.

  - if dollars are cheaper in New York than in London, people will buy them in New York and stop buying them in London. The price of dollars in New York rises and the price of dollars in London falls, until the prices in the two markets are equal.

Spot Rates and Forward Rates

- **Spot rates** are exchange rates for currency exchanges "on the spot", or when trading is executed in the present.

- **Forward rates** are exchange rates for currency exchanges that will occur at a future ("forward") date.

  ♦ forward dates are typically 30, 90, 180 or 360 days in the future.

  ♦ rates are negotiated between individual institutions in the present, but the exchange occurs in the future.

Spot and Forward Rates
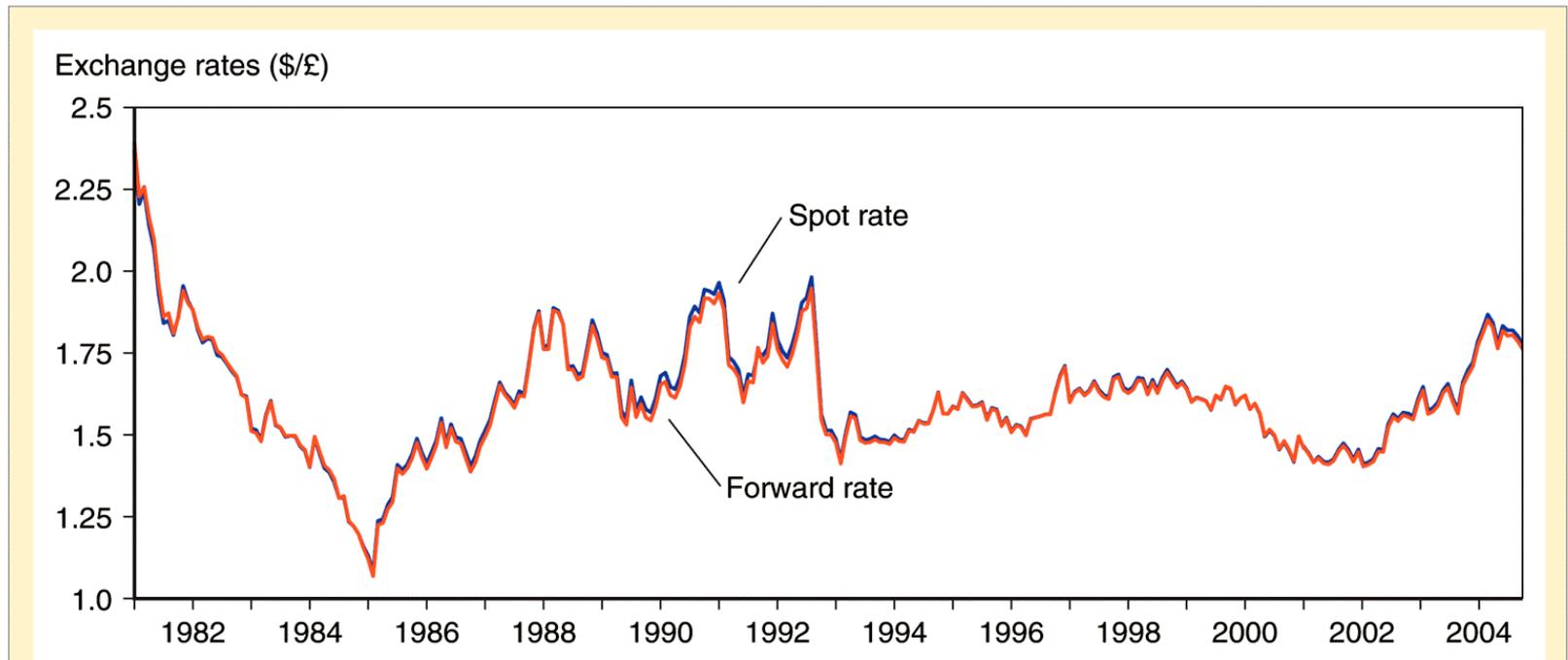
Exchange rates ($/£)

Figure 13-1

Dollar/Pound Spot and Forward Exchange Rates, 1981–2004

Spot and forward exchange rates tend to move in a highly correlated fashion.

Source: *Datastream.* Rates shown are 90-day forward exchange rates and spot exchange rates, at end of month.

The Demand for Currency Deposits

- What influences the demand for (willingness to buy) deposits denominated in domestic or foreign currency?

- Factors that influence the return on assets determine the demand for those assets.

The Demand for Currency Deposits (cont.)

- **Rate of return**: the percentage change in value that an asset offers during a time period.

  - The annual total return for $100 savings account with an annual interest rate of 2% is $100 x 1.02 = $102, so that the *rate* of return = ($102 - $100)/$100 = 2% per year.

- **Real rate of return**: inflation-adjusted rate of return.

  - stated in terms of real purchasing power: the amount of real goods & services that can be purchased with the asset.

  - the *real* rate of return for the savings account when annual inflation is 1.5%: 2% – 1.5% = 0.5%. The asset can purchase only 0.5% more goods and services after 1 year.

The Demand for Currency Deposits (cont.)

- If prices are given (fixed) at some level, inflation is 0% and then (nominal) rates of return = real rates of return. But this is not usually true over longer periods of time.

- For bank deposits in different currencies, we often assume that prices are given at some level. (A reasonable *short-run* assumption.)

The Demand for Currency Deposits (cont.)

- **Risk** of holding assets also influences decisions about whether to buy them.

- **Liquidity** of an asset, or ease of using the asset to buy goods and services, also influences the willingness to buy assets.

- But we assume for now that risk and liquidity of bank deposits in the foreign exchange market are the same, regardless of their currency denomination.

  ♦ we will discuss FX risk more carefully in Chapter 17

  ♦ it is related, in general, to the *covariance* of exchange rates with the uncertain returns on other forms of wealth

The Demand for Currency Deposits (cont.)

- We assume that investors are primarily concerned about the rates of return on bank deposits. Rates of return are determined by

  ♦ interest rates that the assets earn

  ♦ expectations about appreciation or depreciation of the currency in which the deposit is denominated

  ♦ our assumptions mean that *investors always prefer the asset offering the highest expected return*, regardless of risk or liquidity characteristics: assumption of **perfect asset substitutability** of interest-bearing assets denominated in different currencies
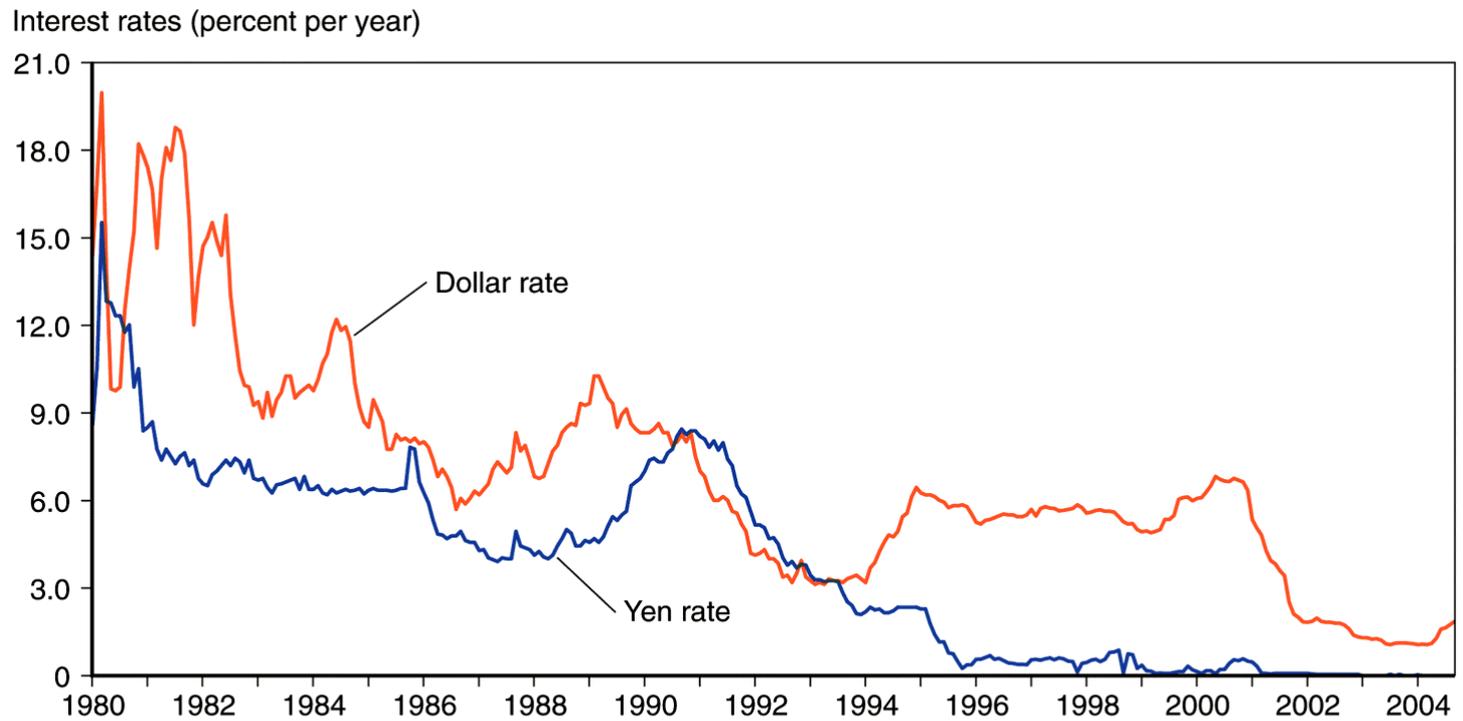
Figure 13-2

Interest Rates on Dollar and Yen Deposits, 1980–2004

Since dollar and yen interest rates are not measured in comparable terms, they can move quite differently over time.

Source: *Datastream.* Three-month interest rates are shown.

The Demand for Currency Deposits (cont.)

- A currency's **interest rate** is the amount of a currency an individual can earn by lending a unit of the currency for a year.

- The rate of return for a deposit in domestic currency is the interest rate that the bank deposit earns.

- To compare the rate of return on a deposit in domestic currency with one in foreign currency, we need to consider 2 factors:
  - ♦ (i) the interest rate for the foreign currency deposit
  - ♦ (ii) the expected rate of appreciation or depreciation of the foreign currency against the domestic currency.

The Demand for Currency Deposits (cont.)

- Suppose the interest rate on a dollar deposit is 2%.

- Suppose the interest rate on a euro deposit is 4%.

- Does a euro deposit yield a higher expected rate of return? It depends …

  ♦ Suppose today the exchange rate is $1/€1, and the expected rate 1 year in the future is $0.97/€1.

  ♦ $100 can be exchanged today for €100.

  ♦ These €100 will yield €104 after 1 year.

  ♦ These €104 are expected to be worth $0.97/€1 x €104 = $100.88.

The Demand for Currency Deposits (cont.)

- The rate of return in terms of dollars from investing in euro deposits is ($100.88-$100)/$100 = 0.88%.

- Let's compare this rate of return with the rate of return from a dollar deposit.
  - ♦ rate of return is simply the interest rate
  - ♦ After 1 year the $100 is expected to yield $102: ($102-$100)/$100 = 2%

- The euro deposit has a lower expected rate of return: *all* investors will prefer dollar deposits and *none* are willing to hold euro deposits.

The Demand for Currency Deposits (cont.)

- Note that the expected rate of appreciation of the euro is ($0.97- $1)/$1 = -0.03 = -3%.

- We simplify the analysis by saying that the dollar rate of return on euro deposits approximately equals
    - ♦ the interest rate on euro deposits
    - ♦ plus the expected rate of appreciation on euro deposits
    - ♦ 4% + -3% = 1% ≈ 0.88%

- $R_\epsilon + (E^e_{\$/\epsilon} - E_{\$/\epsilon})/E_{\$/\epsilon} \approx$ dollar return on euros

The Demand for Currency Deposits (cont.)

- The difference in the rate of return on dollar deposits and euro deposits is

- $R_\$ - (R_€ + (E^e_{\$/€} - E_{\$/€})/E_{\$/€}) =$

$$R_\$ \qquad\qquad - R_€ \qquad - (E^e_{\$/€} - E_{\$/€})/E_{\$/€}$$

| expected rate of return = interest rate on dollar deposits | interest rate on euro deposits | expected exchange rate | current exchange rate |

expected rate of appreciation of the euro

expected rate of return on euro deposits
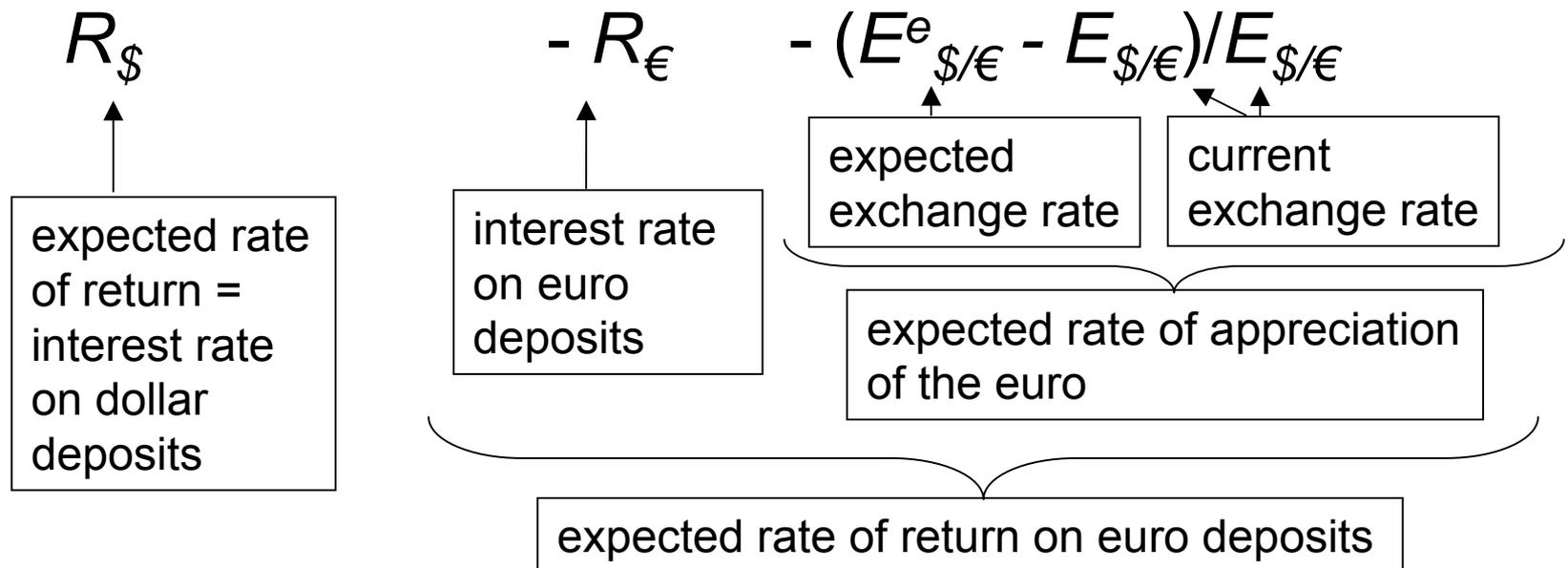
The Demand for Currency Assets

TABLE 13-3 Comparing Dollar Rates of Return on Dollar and Euro Deposits

Case	Dollar Interest Rate $R_\$$	Euro Interest Rate $R_\text{€}$	Expected Rate of Dollar Depreciation Against Euro $\dfrac{E^e_{\$/\text{€}} - E_{\$/\text{€}}}{E_{\$/\text{€}}}$	Rate of Return Difference Between Dollar and Euro Deposits $R_\$ - R_\text{€} - \dfrac{(E^e_{\$/\text{€}} - E_{\$/\text{€}})}{E_{\$/\text{€}}}$
1	0.10	0.06	0.00	0.04
2	0.10	0.06	0.04	0.00
3	0.10	0.06	0.08	−0.04
4	0.10	0.12	−0.04	0.02

The Market for Foreign Exchange

- We use the
  - demand for (rate of return on) dollar denominated deposits
  - and the demand for (rate of return on) foreign currency denominated deposits to construct a model of the foreign exchange market.

- The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return: **interest parity**.
  - interest parity implies that deposits in all currencies are deemed equally desirable assets if they offer the same expected rate of return.

The Market for Foreign Exchange (cont.)

- Interest parity says:

$$R_\$ = R_\euro + (E^e_{\$/\euro} - E_{\$/\euro})/E_{\$/\euro}$$

- Why should this condition hold? Suppose it didn't.

  - ♦ Suppose $R_\$ > R_\euro + (E^e_{\$/\euro} - E_{\$/\euro})/E_{\$/\euro}$.

  - ♦ Then no investor would want to hold euro deposits, driving down the demand for and relative price of euros.

  - ♦ Then all investors would want to hold dollar deposits, driving up the demand for and relative price of dollars.

  - ♦ The dollar would appreciate and the euro would depreciate today, increasing the right side (*given* the expected future exchange rate $E^e_{\$/\euro}$) until equality was achieved.

The Market for Foreign Exchange (cont.)

- How do changes in the current exchange rate affect expected returns in foreign currency?

- Very important: In asking this question now, we are hypothetically holding the *expected future* exchange rate $E^e_{\$/€}$ *constant.*

- (We will talk later on about how expectations are determined.)

The Market for Foreign Exchange (cont.)

- Depreciation of the domestic currency today *lowers* the expected return on deposits in foreign currency.

    ♦ A current depreciation of domestic currency will raise the initial cost of investing in foreign currency, thereby lowering the expected return in foreign currency. (Alt: it lowers the expected future depreciation rate of domestic currency.)

- Appreciation of the domestic currency today *raises* the expected return of deposits in foreign currency.

    ♦ A current appreciation of the domestic currency will lower the initial cost of investing in foreign currency, thereby raising the expected return in foreign currency. (Alt: it raises the expected future depreciation rate of domestic currency.)

Expected Returns on Euro Deposits when Expectation of $E^e_{\$/€}$ = $1.05 per Euro is *Given*

Current exchange rate	Interest rate on euro deposits	Expected rate of dollar depreciation	Expected dollar return on euro deposits
$E_{\$/€}$	$R_€$	$(1.05 - E_{\$/€})/E_{\$/€}$	$R_€ + (1.05 - E_{\$/€})/E_{\$/€}$
1.07	0.05	-0.019	0.031
1.05	0.05	0.000	0.050
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.050	0.100

The Current Exchange Rate and the Expected Dollar Return on Euro Deposits

Figure 13-3

The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits

Given $E^e_{\$/\euro} = 1.05$ and $R_\euro = 0.05$, an appreciation of the dollar against the euro raises the expected return on euro deposits, measured in terms of dollars.

Today's dollar/euro exchange rate, $E_{\$/\euro}$

Expected dollar return on euro deposits, $R_\euro + \dfrac{E^e_{\$/\euro} - E_{\$/\euro}}{E_{\$/\euro}}$

13-32

The Current Exchange Rate and the Expected Dollar Return on Euro Deposits

Current exchange rate, $E_{\$/€}$

Expected dollar return on dollar deposits, $R_\$$
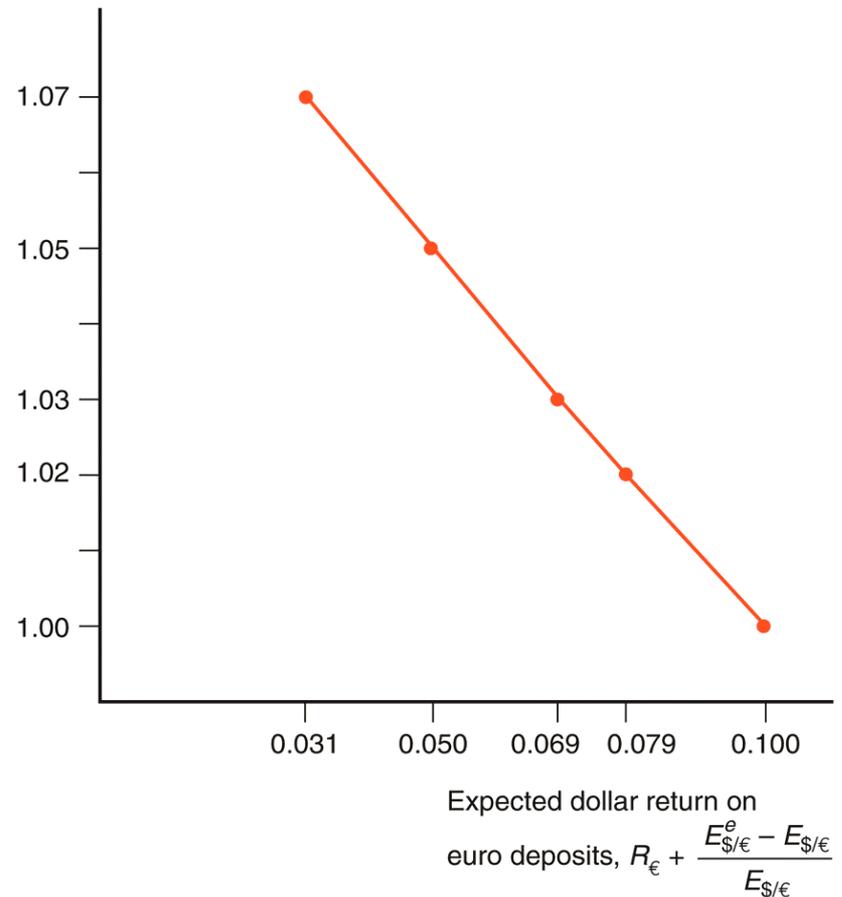
(y-axis values: 1.07, 1.05, 1.03, 1.02, 1.00)

(x-axis values: 0.031, 0.050, 0.069, 0.079, 0.100)

$\overline{R_\$}$
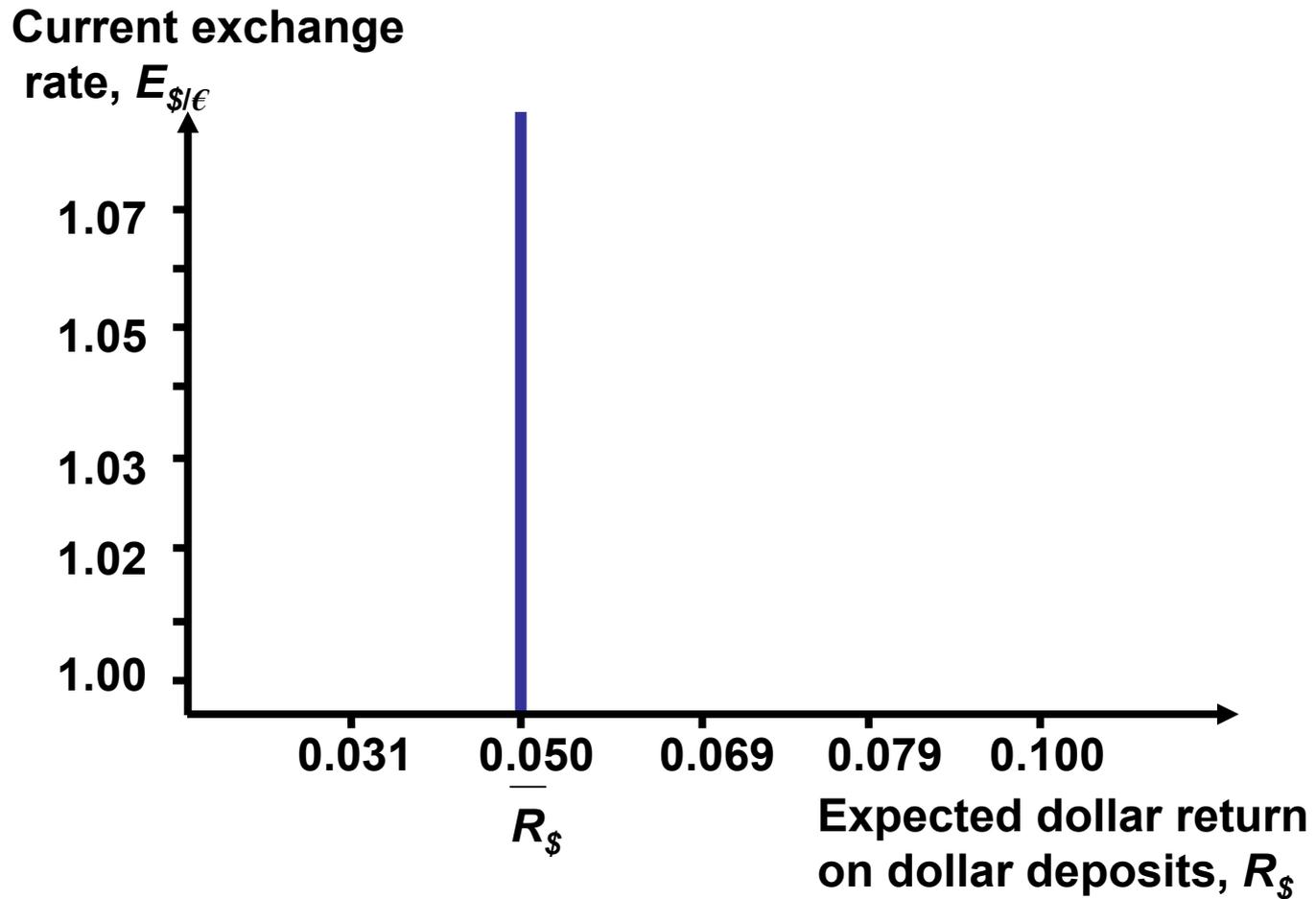
Determination of the Equilibrium Exchange Rate

Figure 13-4

Determination of the Equilibrium Dollar/Euro Exchange Rate

Equilibrium in the foreign exchange market is at point 1, where the expected dollar returns on dollar and euro deposits are equal.

Exchange rate, $E_{\$/€}$

Return on dollar deposits

No one is willing to hold euro deposits

No one is willing to hold dollar deposits

$E^2_{\$/€}$

$E^1_{\$/€}$

$E^3_{\$/€}$

Expected return on euro deposits

$R_{\$}$

Rates of return (in dollar terms)
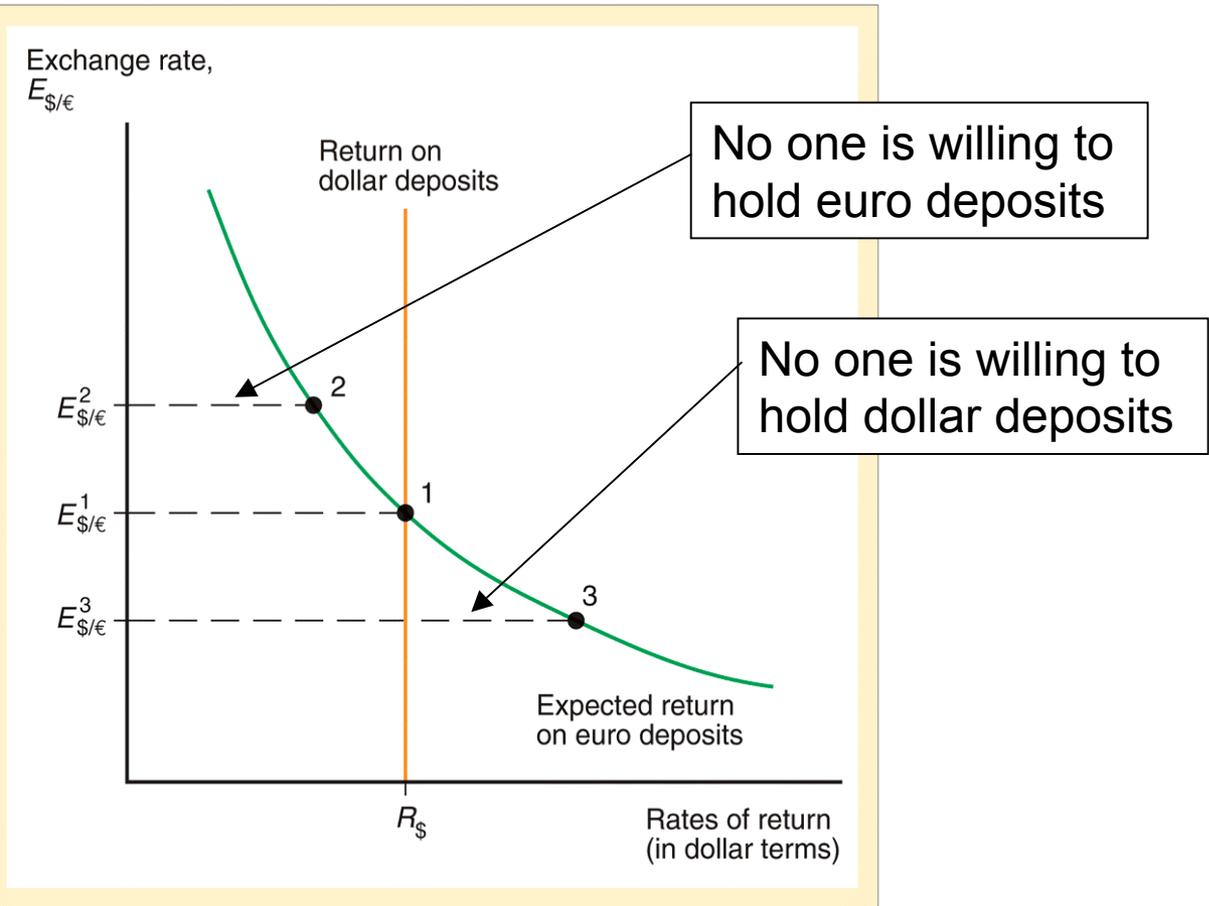
The Market for Foreign Exchange

- The effects of changing interest rates:

  - ♦ an increase in the interest rate paid on deposits denominated in a particular currency will increase the rate of return on those deposits.

  - ♦ This leads to an appreciation of the currency.

  - ♦ A rise in dollar interest rates causes the dollar to appreciate.

  - ♦ A rise in euro interest rates causes the dollar to depreciate.

The Effect of a Rise in the Dollar Interest Rate

Figure 13-5

Effect of a Rise in the Dollar Interest Rate

A rise in the interest rate offered by dollar deposits from $R_\$^1$ to $R_\$^2$ causes the dollar to appreciate from $E_{\$/€}^1$ (point 1) to $E_{\$/€}^2$ (point 2).

An appreciation of the dollar is a depreciation of the euro.

Exchange rate, $E_{\$/€}$

Dollar return

1
1'

$E_{\$/€}^1$

$E_{\$/€}^2$

2

Expected euro return

$R_\$^1$
$R_\$^2$

Rates of return (in dollar terms)
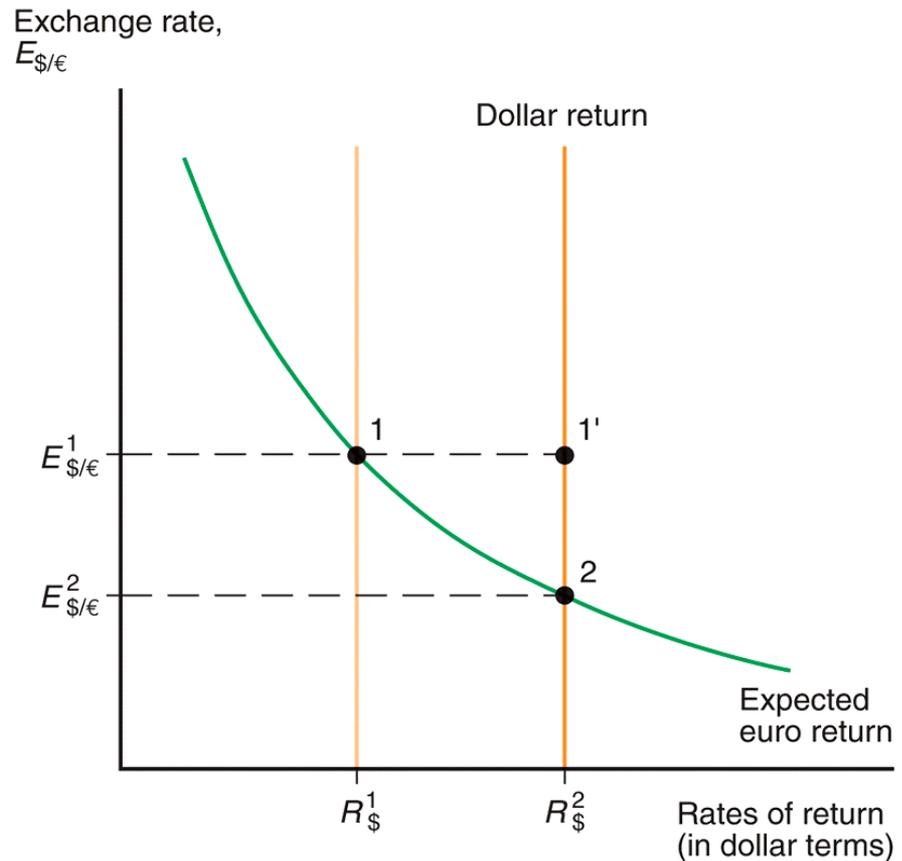
The Effect of a Rise in the Euro Interest Rate

Figure 13-6

Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from $E^1_{\$/€}$ (point 1) to $E^2_{\$/€}$ (point 2). (This figure also describes the effect of a rise in the expected future $/€ exchange rate.)
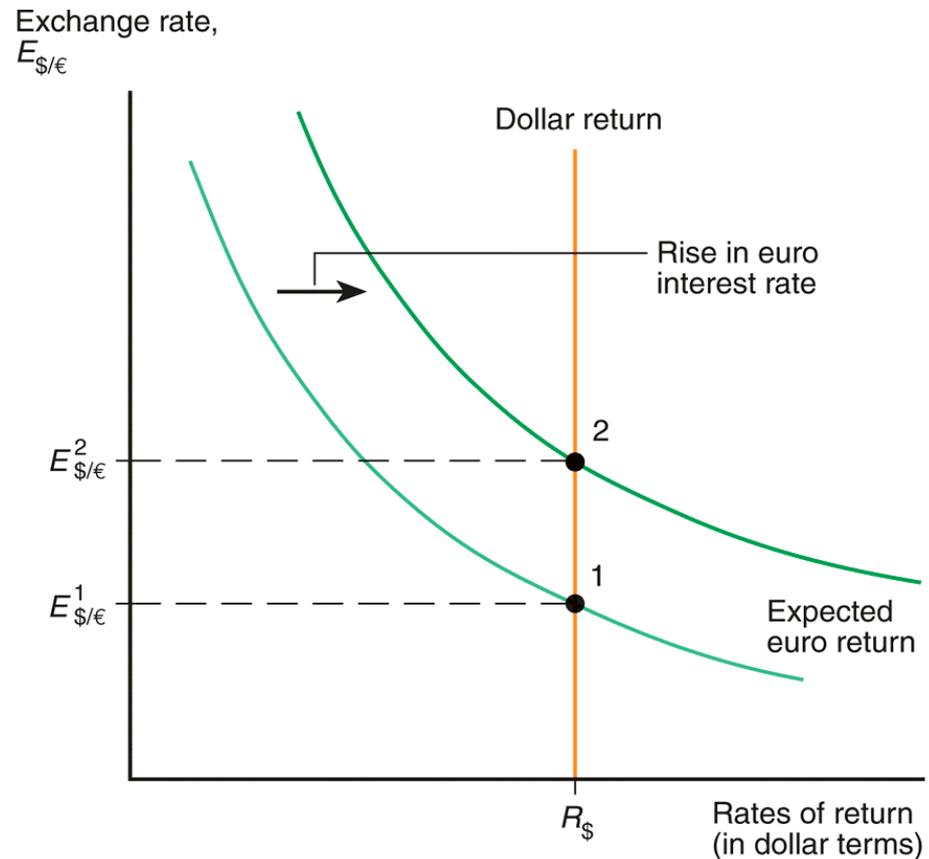
The Effect of a Rise in the Expected Future $/Euro Exchange Rate

Figure 13-6

Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from $E^1_{\$/€}$ (point 1) to $E^2_{\$/€}$ (point 2). (This figure also describes the effect of a rise in the expected future $/€ exchange rate.)

People now expect the euro to appreciate

Exchange rate, $E_{\$/€}$

Dollar return

$E^2_{\$/€}$ — 2

$E^1_{\$/€}$ — 1

Expected euro return
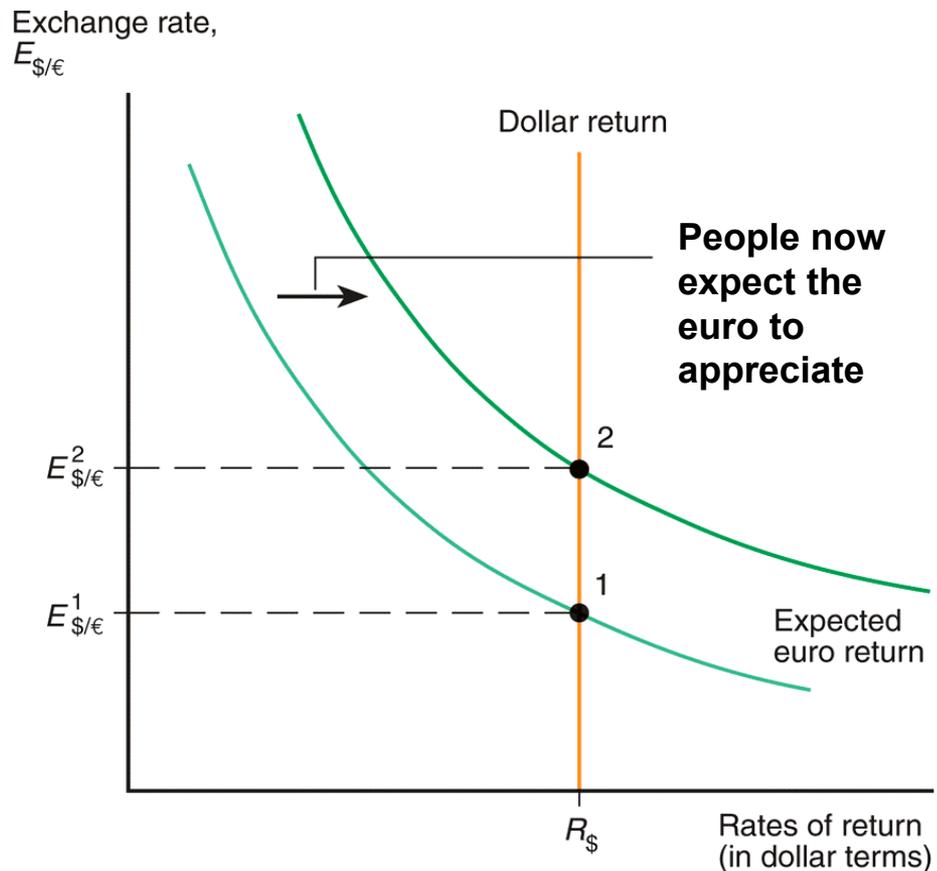
$R_\$$

Rates of return (in dollar terms)

The Effect of a Rise in the Expected Future $/Euro Exchange Rate (cont.)

- If people expect a higher value for the $/euro rate in the future than they did previously, then euro investments will pay off later in a more valuable ("stronger") euro, so that these future euros will be able to buy more dollars and more dollar-denominated goods.

  ♦ the expected return on euro deposits therefore increases.

  ♦ an expected future appreciation of a currency leads to a current appreciation; an expected future depreciation of a currency leads to a current depreciation

Covered Interest Parity

- Covered interest parity relates interest rates across countries and the rate of change between forward exchange rates and the spot exchange rate:

$$R_{\$} = R_{\text{€}} + (F_{\$/\text{€}} - E_{\$/\text{€}})/E_{\$/\text{€}}$$

where $F_{\$/\text{€}}$ is the forward exchange rate.

- It says that rates of return on dollar deposits and "covered" foreign currency deposits are the same.

  ♦ How could you make easy, risk-free money in the foreign exchange markets if covered interest parity did not hold?

  ♦ Covered positions using the forward rate involve little risk.

Summary

- Exchange rates are prices of foreign currencies in terms of domestic currencies, or vice versa.

- Depreciation of a country's currency means that it is less expensive (valuable) and goods denominated in it are less expensive: exports are cheaper and imports more expensive.

  - A depreciation will hurt consumers of imports but help producers of exports.

Summary (cont.)

- Appreciation of a country's currency means that it is more expensive (valuable) and goods denominated in it are more expensive: exports are more expensive and imports cheaper.

  ♦ An appreciation will help consumers of imports but hurt producers of exports.

- Commercial banks that invest in deposits of different currencies dominate the foreign exchange market.

  ♦ Expected rates of return are most important in determining the market demands for these deposits.

Summary (cont.)

- Returns on bank deposits in the foreign exchange market are influenced by interest rates and expected exchange rates.

- Equilibrium in the foreign exchange market occurs when expected returns on deposits in domestic currency and in foreign currency are equal: *interest rate parity*.

- An increase in the interest rate on a currency's deposit leads to an increase in the rate of return and to an appreciation of the currency.

Summary (cont.)

- A higher expected appreciation of a currency (for example) leads to an increase in the expected rate of return for that currency, and leads to an actual appreciation.

- Covered interest parity says that rates of return on domestic currency deposits and "covered" foreign currency deposits using the forward exchange rate are the same. (This is true regardless of uncertainty, etc.-- it is a pure arbitrage relation.)