Chapter 14

Exchange Rates and the Foreign Exchange Market:

An Asset Approach

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Learning Objectives

14.1 Relate exchange rate changes to changes in the relative prices of countries' exports.

14.2 Describe the structure and functions of the foreign exchange market.

14.3 Use exchange rates to calculate and compare returns on assets denominated in different currencies.

14.4 Apply the interest parity condition to find equilibrium exchange rates.

14.5 Find the effects of interest rates and expectation shifts on exchange rates.

Preview

- The basics of exchange rates
- Exchange rates and international relative prices
- Demand and equilibrium in the foreign exchange market
- The demand of currency and other assets
- A model of foreign exchange markets
  - role of interest rates on currency deposits/bonds
  - role of expectations of exchange rates
  - forward exchange rates and covered interest parity

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?
  - How much can be exchanged for one yen? $\frac{\$0.01027}{¥}$
- Exchange rates allow us to denominate the cost or price of a good or service in a common currency.
  - How much does a Nissan cost? ¥2,500,000
  - Or, $\frac{¥2{,}500{,}000 \times \$0.01027}{¥} = \$25{,}672.50$

Table 14.1 Exchange Rate Quotations (1 of 5)

Currencies

Jun 3	Currency	DOLLAR Closing Mid	DOLLAR Day's Change	EURO Closing Mid	EURO Day's Change	POUND Closing Mid	POUND Day's Change
Argentina	Argentine Peso	68.8026	0.0953	77.1927	0.3569	86.6673	0.3917
Australia	Australian Dollar	1.4423	−0.0088	1.6181	−0.0046	1.8168	−0.0053
Bahrain	Bahraini Dinar	0.3772	0.0000	0.4231	0.0013	0.4751	0.0014
Bolivia	Bolivian Boliviano	6.9100		7.7526	0.0251	8.7042	0.0273
Brazil	Brazilian Real	5.0281	−0.1935	5.6412	−0.1981	6.3336	−0.2231
Canada	Canadian Dollar	1.3489	0.0001	1.5138	0.0050	1.6991	0.0055
Chile	Chilean Peso	764.9900	−15.2950	858.2761	−14.3210	963.6213	−16.1809
China	Chinese Yuan	7.1099	−0.0006	7.9769	0.0252	8.9560	0.0274
Colombia	Colombian Peso	3579.3300	−46.9050	4015.8094	−39.4294	4508.7106	−44.7456
Costa Rica	Costa Rican Colon	577.1050	1.7850	647.4796	4.0960	726.9515	4.5235
Czech Republic	Czech Koruna	23.7213	0.0004	26.6139	0.0868	29.8805	0.0943
Denmark	Danish Krone	6.6449	−0.0199	7.4552	0.0019	8.3702	0.0012
Egypt	Egyptian Pound	16.0836	0.1097	18.0449	0.1812	20.2598	0.2014
Hong Kong	Hong Kong Dollar	7.7503	−0.0002	8.6953	0.0279	9.7626	0.0303

Table 14.1 Exchange Rate Quotations (2 of 5)

Jun 3	Currency	DOLLAR Closing Mid	DOLLAR Day's Change	EURO Closing Mid	EURO Day's Change	POUND Closing Mid	POUND Day's Change
Hungary	Hungarian Forint	306.7205	– 2.1010	344.1232	– 1.2335	386.3611	– 1.4253
India	Indian Rupee	75.4700	0.1075	84.6731	0.3948	95.0659	0.4334
Indonesia	Indonesian Rupiah	14110.0000	– 322.5000	15830.6500	– 309.3157	17773.7017	– 349.1678
Israel	Israeli Shekel	3.4763	0.0030	3.9002	0.0161	4.3789	0.0176
Japan	Japanese Yen	108.8250	0.2400	122.0956	0.6644	137.0816	0.7317
..One Month		108.8249	0.2399	122.0958	0.6644	137.0816	0.7316
..Three Month		108.8248	0.2397	122.0956	0.6645	137.0815	0.7314
..One Year		108.8242	0.2384	122.0957	0.6647	137.0816	0.7309
Kenya	Kenyan Shilling	106.1000	– 0.3500	119.0383	– 0.0054	133.6491	– 0.0199
Kuwait	Kuwaiti Dinar	0.3081	– 0.0002	0.3457	0.0010	0.3881	0.0010
Malaysia	Malaysian Ringgit	4.2625	– 0.0150	4.7823	– 0.0013	5.3693	– 0.0020
Mexico	Mexican Peso	21.5950	– 0.0380	24.2284	0.0361	27.2022	0.0377
New Zealand	New Zealand	1.5570	– 0.0139	1.7469	– 0.0099	1.9613	– 0.0113
Nigeria	Nigerian Naira	388.1800	1.4300	435.5163	3.0116	488.9718	3.3307
Norway	Norwegian Krone	9.4775	– 0.0501	10.6332	– 0.0215	11.9384	– 0.0254

Table 14.1 Exchange Rate Quotations (3 of 5)

Jun 3	Currency	DOLLAR Closing Mid	DOLLAR Day's Change	EURO Closing Mid	EURO Day's Change	POUND Closing Mid	POUND Day's Change
Pakistan	Pakistani Rupee	164.2000	– 0.3500	184.1232	– 0.3434	206.3849	– 0.4180
Peru	Peruvian Nuevo Sol	3.3860	– 0.0145	3.7989	– 0.0039	4.2652	– 0.0048
Philippines	Philippine Peso	50.1200	– 0.3250	56.2318	– 0.0693	63.1338	– 0.0843
Poland	Polish Zloty	3.9347	0.0150	4.4145	0.0311	4.9564	0.0345
Romania	Romanian Leu	4.3079	– 0.0185	4.8333	– 0.0050	5.4265	– 0.0062
Russia	Russian Ruble	68.6488	– 0.1112	77.0201	0.1254	86.4735	0.1318
Saudi Arabia	Saudi Riyal	3.7550	0.0015	4.2128	0.0053	4.7299	0.0167
Singapore	Singapore Dollar	1.3970	– 0.0026	1.5674	0.0022	1.7597	0.0023
South Africa	South African Rand	16.9163	– 0.1885	18.9791	– 0.1492	21.3086	– 0.1698
South Korea	South Korean Won	1216.6500	– 8.7500	1365.0135	– 5.3583	1532.5558	– 6.1763
Sweden	Swedish Krona	9.2891	– 0.0357	10.4219	– 0.0062	11.7011	– 0.0082
Switzerland	Swiss Franc	0.9621	0.0015	1.0794	0.0051	1.2118	0.0056
Taiwan	New Taiwan Dollar	29.8745	– 0.0800	33.5175	0.0192	37.6315	0.0177
Thailand	Thai Baht	31.5525	-	35.4001	0.1148	39.7452	0.1248
Tunisia	Tunisian Dinar	2.8531	– 0.0050	3.2010	0.0048	3.5939	0.0051

Table 14.1 Exchange Rate Quotations (4 of 5)

Jun 3	Currency	DOLLAR Closing Mid	DOLLAR Closing Mid	EURO Closing Mid	EURO Day's Change	POUND Closing Mid	POUND Day's Change
Turkey	Turkish Lira	6.7498	–0.0028	7.3504	0.0274	8.4701	0.0232
United Arab Emirates	UAE Dirham	3.6732	-	4.1211	0.0134	4.6269	0.0145
United Kingdom	Pound Sterling	0.7939	–0.0025	0.8907	0.0001	-	-
..One Month		0.7939	–0.0025	0.8906	0.0001	-	-
..Three Month		0.7939	–0.0025	0.8905	0.0001	-	-
..One Year		0.7941	–0.0025	0.8901	0.0001	-	-
United States	United States Dollar	-	–1.1219	-	0.0036	1.2597	0.0040
..One Month		-	–1.1219	-	–0.1338	1.2597	0.0040
..Three Month		-	–1.1217	-	–0.1338	1.2597	0.0040
..One Year		-	-	1.1210	–0.1338	1.2599	0.0040
Venezuela	Venezuelan Bolivar Fuerte	-	-	-	-	-	-
Vietnam	Vietnamese Dong	23262.0000	5.5000	26098.6896	90.7520	29302.0544	98.8350

Table 14.1 Exchange Rate Quotations (5 of 5)

Jun 3	Currency	DOLLAR Closing Mid	DOLLAR Day's Change	EURO Closing Mid	EURO Day's Change	POUND Closing Mid	POUND Day's Change
European Union	Euro	0.8913	– 0.0029			1.1227	– 0.0001
..One Month		0.8912	– 0.0029			1.1227	– 0.0001
..Three Month		0.8911	– 0.0029			1.1226	– 0.0001
..One Year		0.8903	– 0.0029			1.1221	– 0.0001

Rates are derived from WM Reuters Spot Rates and MorningStar (latest rates at time of production). Some values are rounded. Currency redenominated by 1000. The exchange rates printed in this table are also available at www.FT.com/marketsdata.

Depreciation and Appreciation (1 of 5)

- **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.
  - $\$1/€ \rightarrow \$1.20/€$ means that the dollar has depreciated relative to the euro. It now takes $1.20 to buy one euro, so that the dollar is less valuable.
  - The euro has **appreciated** relative to the dollar: it is now more valuable.

Depreciation and Appreciation (2 of 5)

- **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.
  - $\$1/€ \rightarrow \$0.90/€$ means that the dollar has appreciated relative to the euro. It now takes only $0.90 to buy one euro, so that the dollar is more valuable.
  - The euro has **depreciated** relative to the dollar: it is now less valuable.

Depreciation and Appreciation (3 of 5)

- A depreciated currency is less valuable, and therefore it can buy fewer foreign produced goods that are denominated in foreign currency.
  - A Nissan costs $\frac{¥2{,}500{,}000 \times \$0.01027}{¥} = \$25{,}672.50$
  - Less expensive than $27,962.50 at $\frac{\$0.011185}{¥}$
- 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 (4 of 5)

- An appreciated currency is more valuable, and therefore it can buy more foreign produced goods that are denominated in foreign currency.
  - A Nissan costs ¥2,500,000 = $27,962.50 at $0.011185/¥
  - becomes less expensive $25,000 at $0.010/¥
- 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.

Depreciation and Appreciation (5 of 5)

- Table 14.2 shows the relative prices implied by exchange rates of $1.25 per pound, $1.50 per pound, and $1.75 per pound.
- If the good's money prices do not change, an appreciation of the dollar against the pound makes sweaters more expensive in terms of jeans (each pair of jeans buys fewer sweaters).
- **All else equal, an appreciation of a country's currency raises the relative price of its exports to its imports, while a depreciation lowers the relative price of its exports to its imports**.

Table 14.2 $/£ Exchange Rates and the Relative Price of American Designer Jeans and British Sweaters

Exchange rate $/£	1.25	1.50	1.75
Relative price of sweater in terms of pairs of jeans	1.39	1.67	1.94

Note: The above calculations assume unchanged money prices of $45 per pair of jeans and £50 per sweater.

Foreign Exchange Markets (1 of 4)

- The set of markets where foreign currencies and other assets are exchanged for domestic ones
  - Institutions buy and sell deposits of currencies or other assets for investment purposes.
- The **daily** volume of foreign exchange transactions was $6.6 trillion in April 2019
  - up substantially from $500 billion in 1989.
- Most transactions exchange foreign currencies for U.S. dollars.

Foreign Exchange Markets (2 of 4)

The participants:

1. Commercial banks and other depository institutions: transactions involve buying/selling of deposits in different currencies for investment purposes.
2. Corporations (non-financial businesses) conduct foreign currency transactions to buy/sell goods, services and assets.
3. Non-bank financial institutions (mutual funds, hedge funds, securities firms, insurance companies, pension funds) may buy/sell foreign assets for investment.
4. Central banks: conduct official international reserves transactions.

Foreign Exchange Markets (3 of 4)

- Buying and selling in the foreign exchange market are dominated by commercial and investment 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 small and transitory in many countries.

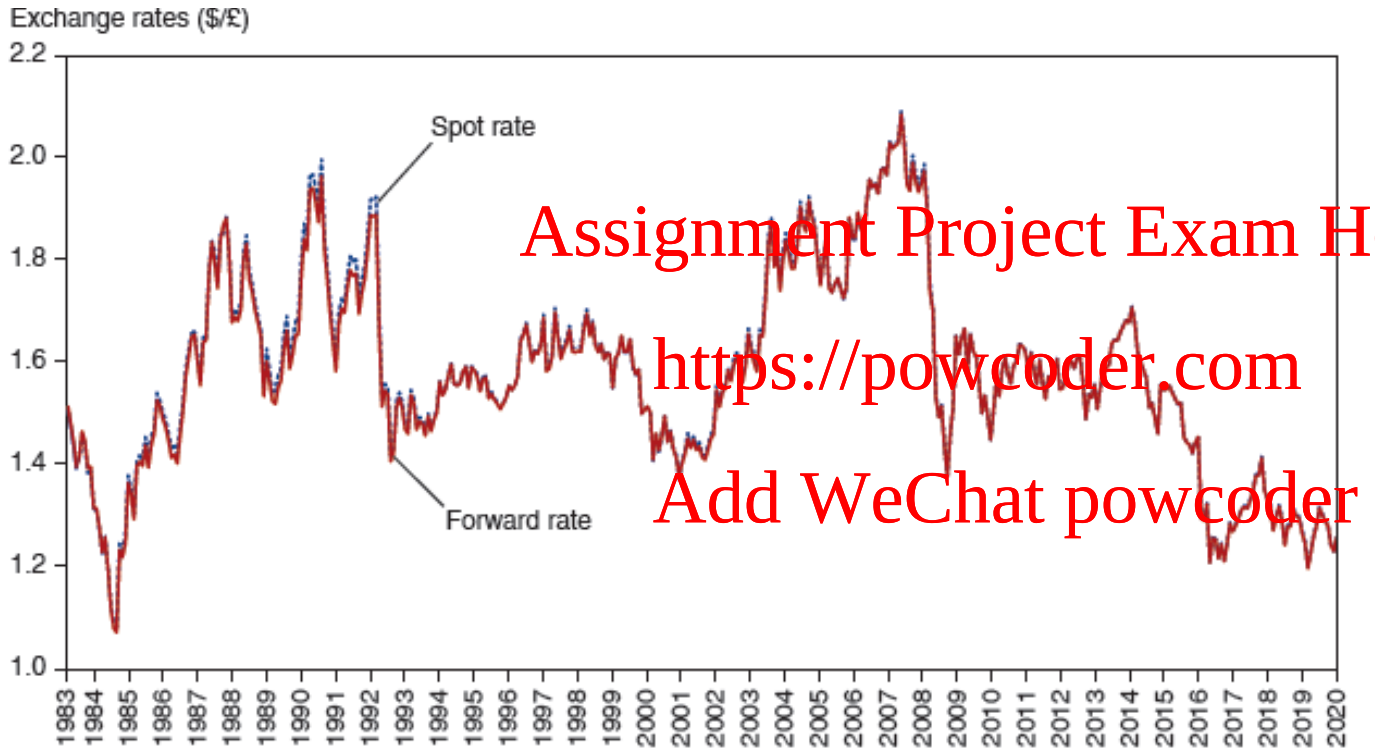
Foreign Exchange Markets (4 of 4)

- Computer and telecommunications technology transmit information rapidly and have integrated markets.
- The integration of financial markets implies that there can be no significant differences in exchange rates across locations.
  - Arbitrage: buy at low price and sell at higher price for a profit.
  - If the euro were to sell for $1.1 in New York and $1.2 in London, could buy euros in New York (where cheaper) and sell them in London at a profit.

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 two parties in the present, but the exchange occurs in the future.

Figure 14.1 Dollar/Pound Spot and Forward Exchange Rates, 1983–2020



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.

Other Methods of Currency Exchange (1 of 3)

- **Foreign exchange swaps**: a combination of a spot sale with a forward repurchase.
- Swaps allow parties to meet each other's needs for a temporary amount of time and often cost less in fees than separate transactions.
  - For example, suppose Toyota receives $1 million from American sales, plans to use it to pay its California suppliers in three months, but wants to invest the money in euro bonds in the meantime.

Other Methods of Currency Exchange (2 of 3)

- **Futures contracts**: a contract designed by a **third party** for a **standard** amount of foreign currency delivered/received on a **standard** date.
  - Contracts can be bought and sold in markets, and only the current owner is obliged to fulfill the contract.

Other Methods of Currency Exchange (3 of 3)

- **Options contracts**: a contract designed by a third party for a standard amount of foreign currency delivered/received on or before a standard date.
  - Contracts can be bought and sold in markets.
  - A contract gives the owner the option, but not obligation, of buying or selling currency if the need arises.
  - A **call option** gives the owner the right to buy, while a **put option** gives the right to sell, a specified amount of foreign currency at a specified price at any time prior to the specified expiration date.

The Demand of Currency Deposits (1 of 12)

- What influences the demand of (willingness to buy) deposits denominated in domestic or foreign currency?
- Factors that influence the return on assets determine the demand of those assets.

The Demand of Currency Deposits (2 of 12)

- **Rate of return**: the percentage change in value that an asset offers during a time period.
  - The annual return for $100 savings deposit with an interest rate of 2% is $100 × 1.02 = $102, so that the

$$\text{rate of return} = \frac{(\$102 - \$100)}{\$100} = 2\%$$

The Demand of Currency Deposits (3 of 12)

- **Real rate of return**: inflation-adjusted rate of return, which represents the additional amount of goods and services that can be purchased with earnings from the asset.
  - The real rate of return for the above savings deposit when inflation is 1.5% is 2% – 1.5% = 0.5%. After accounting for the rise in the prices of goods and services, the asset can purchase 0.5% more goods and services after 1 year.

The Demand of Currency Deposits (4 of 12)

- If prices are fixed, the inflation rate is 0% and (nominal) rates of return = real rates of return.
- Because trading of deposits in different currencies occurs on a daily basis, we often assume that prices do not change from day to day.
  - A good assumption to make for the short run.

The Demand of Currency Deposits (5 of 12)

- **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.

The Demand of Currency Deposits (6 of 12)

- But we assume that risk and liquidity of currency deposits in foreign exchange markets are essentially the same, regardless of their currency denomination.
  - Risk and liquidity are only of secondary importance when deciding to buy or sell currency deposits.
  - Importers and exporters may be concerned about risk and liquidity, but they make up a small fraction of the market.

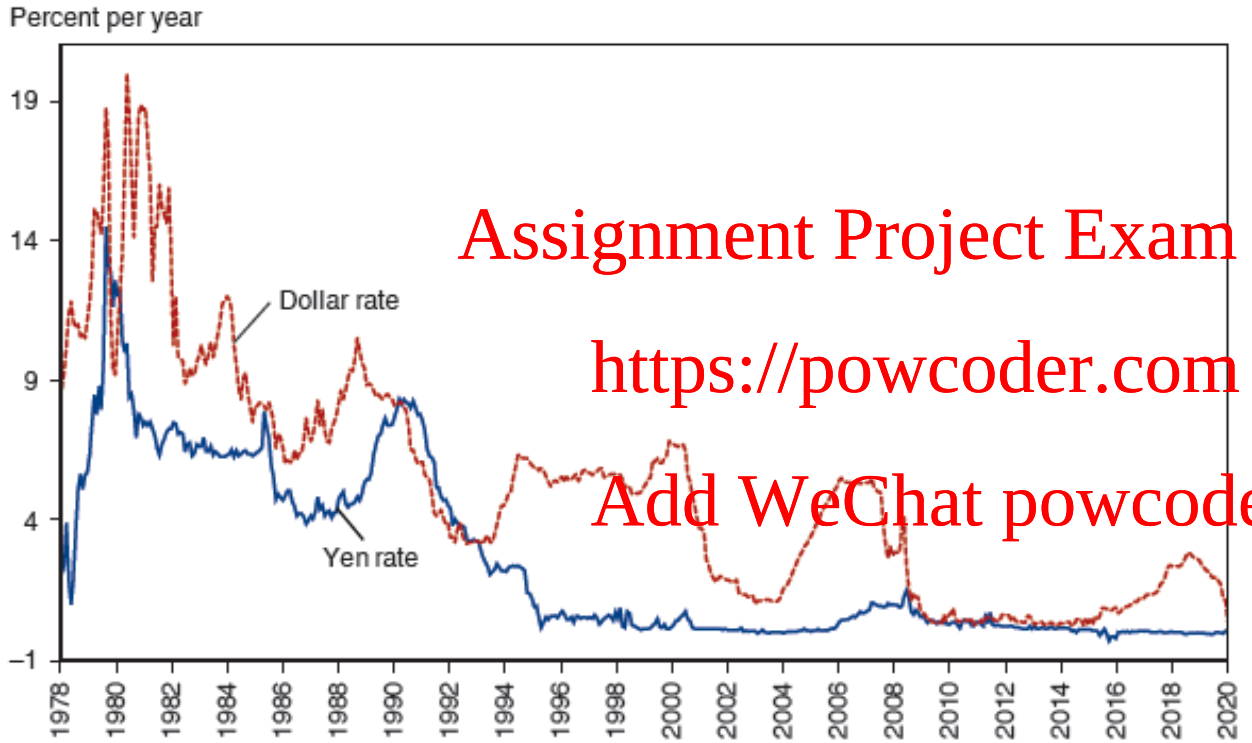
The Demand of Currency Deposits (7 of 12)

- We therefore say that investors are primarily concerned about the rates of return on currency deposits.
- Rates of return that investors expect to earn are determined by
  - interest rates that the assets will earn
  - expectations about appreciation or depreciation

The Demand of Currency Deposits (8 of 12)

- A currency deposit's **interest rate** is the amount of a currency that an individual or institution 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 deposit earns.
- To compare the rate of return on a deposit in domestic currency with one in foreign currency, consider
  - the interest rate for the foreign currency deposit
  - the expected rate of appreciation or depreciation of the foreign currency relative to the domestic currency.

Figure 14.2 Interest Rates on Dollar and Yen Deposits, 1978–2020



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

Source: Datastream. The figure shows three-month interest rates.

The Demand of Currency Deposits (9 of 12)

- 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?
  - Suppose today the exchange rate is \$1/€1, and the expected rate one 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×€104** = \$100.88 in 1 year.

The Demand of Currency Deposits (10 of 12)

- The rate of return in terms of dollars from investing in euro deposits is

$$\frac{(\$100.88 - \$100)}{\$100} = 0.88\%.$$

- Let's compare this rate of return with the rate of return from a dollar deposit.
  - The rate of return is simply the interest rate.
  - After 1 year the $100 is expected to yield $102:

$$\frac{(\$102 - \$100)}{\$100} = 2\%$$

- The euro deposit has a lower expected rate of return: thus, **all** investors should be willing to dollar deposits and **none** should be willing to hold euro deposits.

The Demand of Currency Deposits (11 of 12)

- Note that the expected rate of appreciation of the euro was

$$\frac{\$0.97 - \$1}{\$1} = -0.03 = -3\%.$$

- 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 of euro deposits

  - $4\% + -3\% = 1\% \approx 0.88\%$
  - $R_{€} + \frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$

The Demand of Currency Deposits (12 of 12)

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

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

$R_\$$ — expected rate of return = interest rate on dollar deposits

$-R_€$ — interest rate on euro deposits

$-(E^e_{\$/€} - E_{\$/€})/E_{\$/€}$ — expected rate of appreciation of the euro

expected exchange rate; current exchange rate

expected rate of return on euro deposits

Model of Foreign Exchange Markets (1 of 6)

- Construct model of foreign exchange markets using:
  - the demand of (rate of return on) dollar-denominated deposits
  - and the demand of (rate of return on) foreign currency– denominated deposits

Table 14.3 Comparing Dollar Rates of Return on Dollar and Euro Deposits

	Dollar Interest Rate	Euro Interest Rate	Expected Rate of Dollar Depreciation Against Euro	Rate of Return Difference between Dollar and Euro Deposits
Case	$R_{\$}$	$R_{€}$	$\frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$	$R_{\$} - R_{€} - \frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$
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

Model of Foreign Exchange Markets (2 of 6)

- Model 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 equally desirable assets.
  - Interest parity implies that arbitrage in the foreign exchange market is not possible.
- Interest parity says:

$$R_{\$} = R_{€} + \frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$$

Model of Foreign Exchange Markets (3 of 6)

- Why should the interest parity condition hold?
  - Suppose it did not. Suppose

$$R_{\$} > R_{€} + \frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$$

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

  - Then all investors would want to hold dollar deposits, driving up the demand and price of dollars.
  - The dollar would appreciate and the euro would depreciate, increasing the right side until equality was achieved.

Model of Foreign Exchange Markets (4 of 6)

- How do changes in the current exchange rate affect the expected rate of return of foreign currency deposits?
- Depreciation of the domestic currency today lowers the expected rate of return on foreign currency deposits.
  - When the domestic currency depreciates, the initial cost of investing in foreign currency deposits increases, thereby lowering the expected rate of return of foreign currency deposits.

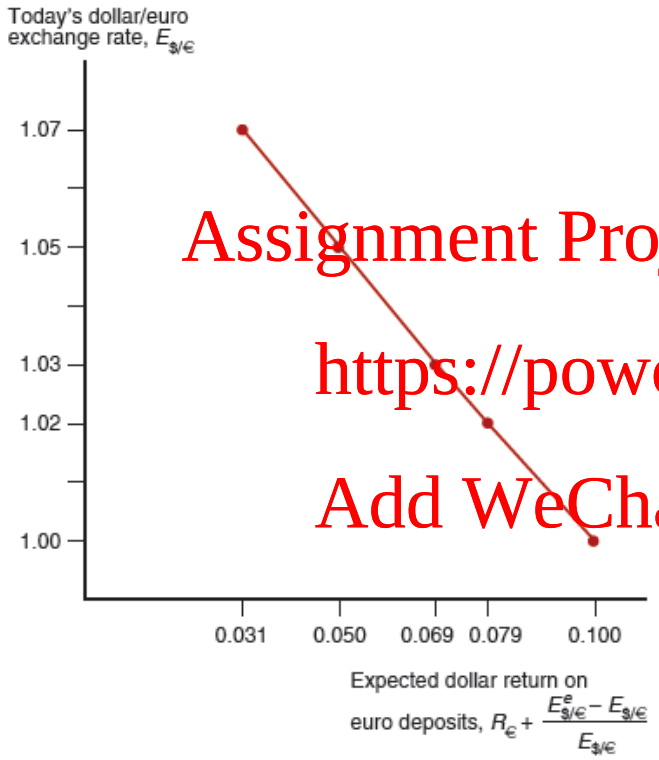
Model of Foreign Exchange Markets (5 of 6)

- Appreciation of the domestic currency today raises the expected return of deposits on foreign currency deposits.
  - When the domestic currency appreciates, the initial cost of investing in foreign currency deposits decreases, thereby increasing the expected rate of return of foreign currency deposits.

Table 14.4 Today's Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits When $E^e_{\$/€} = \$1.05$ per Euro

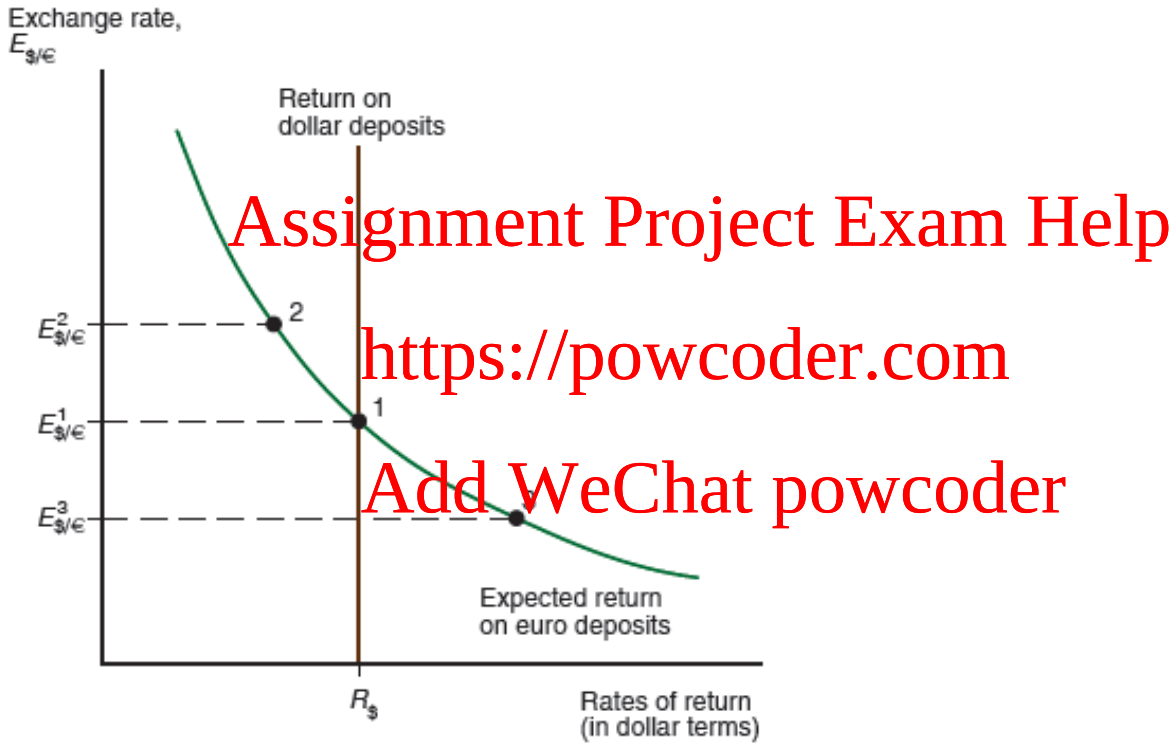
Today's Dollar/Euro Exchange Rate	Interest Rate on Euro	Expected Dollar Depreciation Rate against Euro	Expected Dollar Return on Euro Deposits
$E_{\$/€}$	$R_€$	$\frac{1.05 - E_{\$/€}}{E_{\$/€}} \times 100$	$R_€ + \frac{1.05 - E_{\$/€}}{E_{\$/€}}$
1.07	0.05	–0.019	0.031
1.05	0.05	0.00	0.05
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.05	0.10

Figure 14.3 The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits



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

Figure 14.4 Determination of the Equilibrium Dollar/Euro Exchange Rate

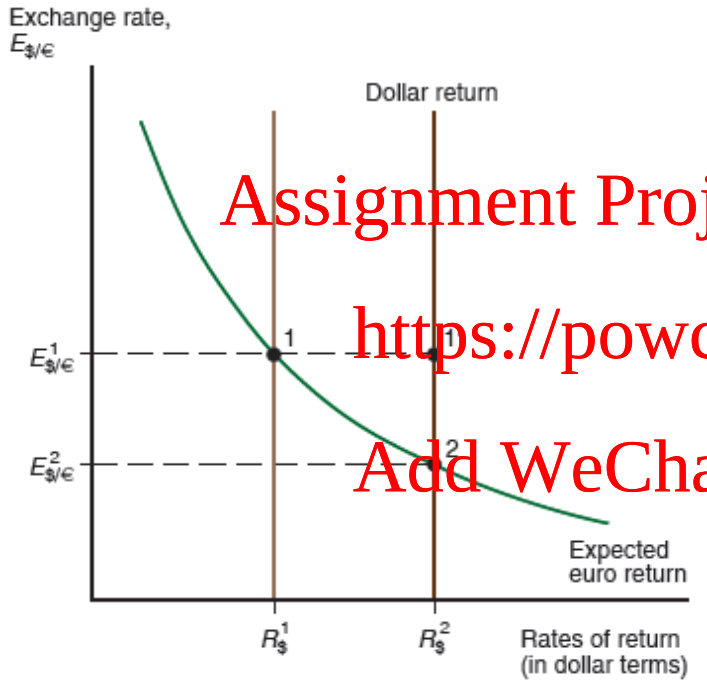


Equilibrium in the foreign exchange market is at point 1, where the expected dollar returns on dollar and euro deposits are equal.

Model of Foreign Exchange Markets (6 of 6)

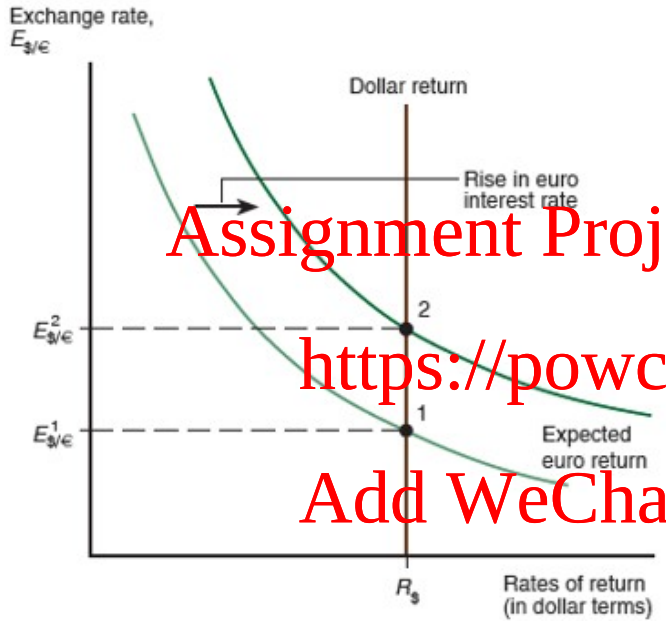
- The effects of changing interest rates:
  - An increase in the interest rate paid on deposits denominated in a particular currency will increase the rate of return on those deposits.
  - This leads to an appreciation of the currency.
  - Higher interest rates on dollar-denominated assets cause the dollar to appreciate.
  - Higher interest rates on euro-denominated assets cause the dollar to depreciate.

Figure 14.5 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).

Figure 14.6 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.)

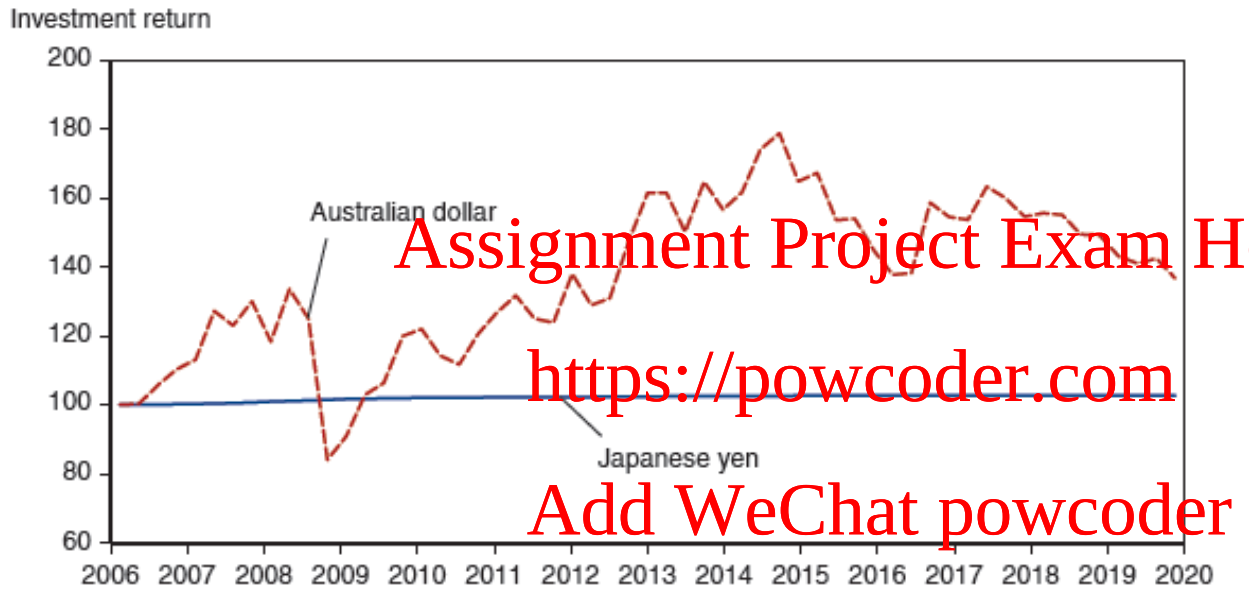
The Effect of Changing Expectations on the Current Exchange Rate

- If people expect the euro to appreciate in the future, then euro-denominated assets will pay in valuable euros, so that these future euros will be able to buy many dollars and many dollar-denominated goods.
  - The expected rate of return on euros therefore increases.
  - An expected appreciation of a currency leads to an actual appreciation (a self-fulfilling prophecy).
  - An expected depreciation of a currency leads to an actual depreciation (a self-fulfilling prophecy).

What Explains Carry Trade?

- International investors frequently borrow low-interest currencies and buy high-interest currencies, with results that can be profitable over long periods—this activity is called carry trade.
- The extent of carry trade positions can become very large when sizable international interest differentials open up. Is the prevalence of the carry trade evidence that interest parity is wrong?
- While interest parity does not hold exactly in practice, in part because of the risk and liquidity factors mentioned earlier, economists are still trying to understand if the carry trade requires additional explanation.
  - The high-interest currencies that carry traders target may experience abrupt crashes.

Figure 14.7 Cumulative Total Investment Return in Australian Dollars Compared with Japanese Yen, 2006–2020



The Australian dollar-yen carry trade has been profitable on average but is subject to sudden large reversals, as in 2008.

Source: Quarterly Japanese yen/Australian dollar exchange rate, 90-day Australia bank bill rate, and 90-day Japan certificate of deposit rate from FRED database. The chart compares the cumulative value over time of a **¥100** investment in Japanese interest-bearing 90-day bonds, rolled over every quarter, with the same yen investment converted into Australian dollars, invested in 90-day Australian bonds and rolled over every quarter, and then converted back into yen at the end of the investment period.

Forward Exchange Rates and Covered Interest Parity (1 of 5)

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

$$R_{\$} = R_{€} + \frac{F_{\$/€} - E_{\$/€}}{E_{\$/€}}$$

where $F_{\$/€}$ 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 earn a risk-free return in the foreign exchange markets if covered interest parity did not hold?
  - Covered positions using the forward rate involve little risk.

Forward Exchange Rates and Covered Interest Parity (2 of 5)

- For example, suppose the 1-year forward price of euros in terms of dollars is $F_{\$/€} = \$1.113$ and the spot exchange rate is $E_{\$/€} = \$1.05$ per euro.
- If $R_{€} = 0.04$, compare the rate of return on a covered euro deposit to a 10% rate of return on a dollar deposit $(R_{\$} = 0.10)$.
  - A €1 deposit costs $1.05 today and is worth €1.04 after 1 year.
  - Selling €1.04 forward today at the forward exchange rate $1.113 per euro yield a dollar value after 1 year of $(\$1.113 \text{ per euro}) \times (€1.04) = \$1.158$.
  - The rate of return on the covered purchase of a euro deposit is $(1.158 - 1.05)/1.05 = 0.103$, or 10.3%, is greater than a 10% rate of return on a dollar deposit and covered interest parity fails.

Forward Exchange Rates and Covered Interest Parity (3 of 5)

- The **forward premium** on euros against dollars (also called the forward discount on dollars against euros) is

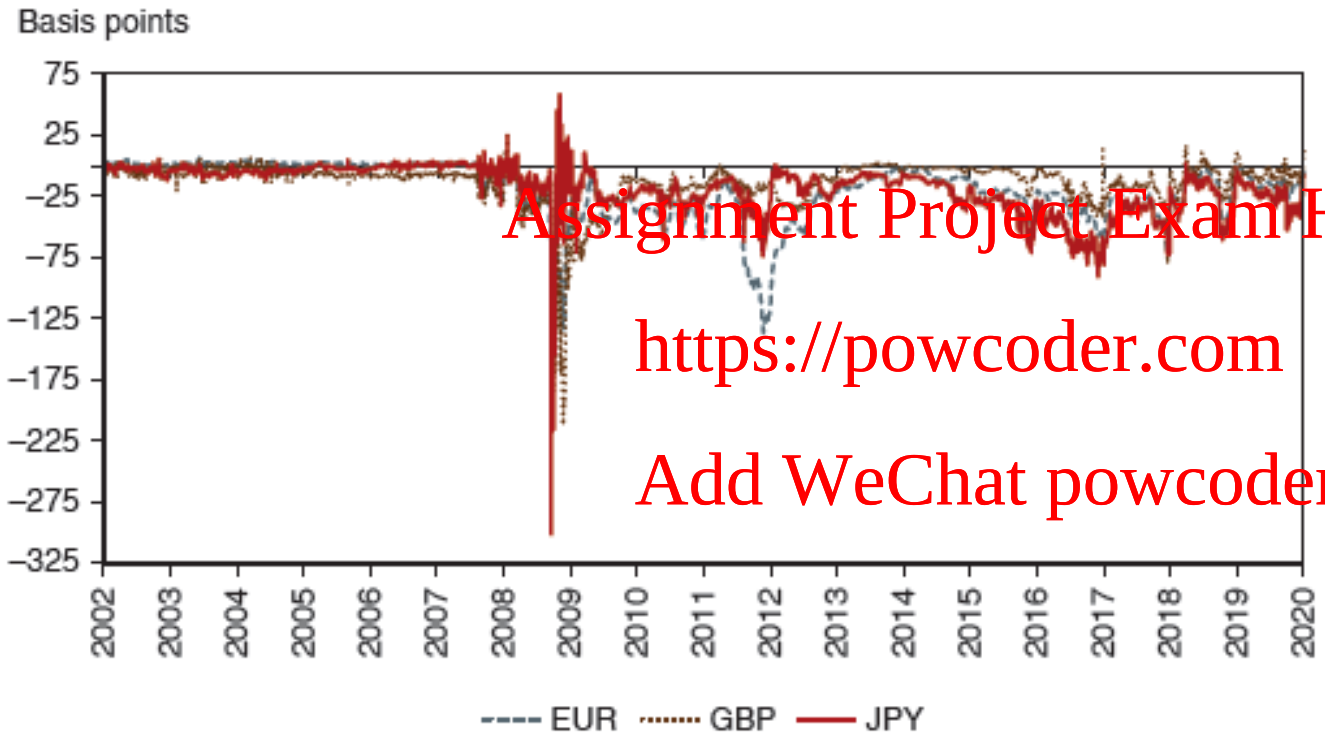
$$\frac{F_{\$/€} - E_{\$/€}}{E_{\$/€}}$$

- Using this terminology, the covered interest parity condition becomes:
  - The interest rate on dollar deposits equals the interest rate on euro deposits plus the forward premium on euros against dollars.

Forward Exchange Rates and Covered Interest Parity (4 of 5)

- Figure 14-8 graphs the difference between dollar interbank interest rates and the covered return to investing in three foreign interbank markets.
  - Big deviations from CIP emerged around the time of the worldwide banking crisis in 2007–2008. CIP did not reestablish itself after the crisis passed.
  - The deviations from CIP tend to be negative, implying that it would be profitable to arbitrage by borrowing dollars, selling them for foreign currencies, and then investing the proceeds in foreign money markets while selling the proceeds forward to complete the round trip out of dollars and back

Figure 14.8 U.S. Dollar Three-Month Interest Rate Less Covered Rate on Three-Month Foreign Bank Deposits



Covered interest parity held well up until the financial crisis that started in 2008, but it has not held closely since then. The three non-U.S. investment currencies shown are the euro, pound, and yen.

Forward Exchange Rates and Covered Interest Parity (5 of 5)

- By comparing the uncovered interest parity (UIP) condition,

$$R_{\$} = R_{€} + \frac{E^{e}_{\$/€} - E_{\$/€}}{E_{\$/€}}$$

with the covered interest parity condition, you will find that both conditions can be true at the same time only if the 1-year forward rate quoted today equals the spot exchange rate

people expect to materialize a year from today: $F_{\$/€} = E^{e}_{\$/€}$

- Covered transactions do not involve exchange rate risk, whereas uncovered transactions do.

Summary (1 of 4)

1. An **exchange rate** is the price of one country's currency in terms of another country's currency.
   - It enables us to translate different countries' prices into comparable terms.
2. **Depreciation of a currency** means that it becomes less valuable and goods denominated in it are less expensive: exports are cheaper and imports more expensive.
3. **Appreciation of a currency** means that it becomes more valuable and goods denominated in it are more expensive: exports are more expensive and imports cheaper.

Summary (2 of 4)

4. Commercial and investment banks that invest in deposits of different currencies dominate the foreign exchange market.
   - Expected rates of return are most important in determining the willingness to hold these deposits.
5. Rates of return on currency deposits in the foreign exchange market are influenced by interest rates and expected exchange rates.

Summary (3 of 4)

6. Equilibrium in the foreign exchange market occurs when rates of returns on deposits in domestic currency and in foreign currency are equal; **interest rate parity**.
7. An increase in the interest rate on a currency's deposit leads to an increase in its expected rate of return and to an appreciation of the currency.

Summary (4 of 4)

8. An expected appreciation of a currency leads to an increase in the expected rate of return for that currency, and thus leads to an actual appreciation.
9. 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.