

Economics 100B: Macroeconomics

Exchange Rates and International Economic Policy: Part 1

October 28 & 30, 2020

Reading:

- Mishkin - Chapter 17
- Mishkin - Chapter 17 Appendix A and B (on bCourses).

Agenda:

- ① Foreign Exchange Rates and Markets.
- ② Exchange Rates in the Long-Run.
- ③ Exchange Rates in the Short-Run.

Overview:

Most countries have their own currencies.

- 1 International trade and/or financial transactions *require* the exchange of the different currencies.
- 2 *The exchange rate* is simply the price of one currency in terms of another currency.

Nominal and real exchange rates:

Most countries have their own currencies.

- The *nominal exchange rate*, E , is the relative price of one currency in terms of another currency.
- The *real exchange rate*, ϵ , is the relative price of goods in one country in terms of another country.
 - Also called *the terms of trade*.

Foreign Exchange Rates and Markets

Nominal and real exchange rates:

$$\underbrace{\frac{\text{USD}}{(\text{Mac Book Air})_{\text{US}}}}_{P_{\text{domestic}}} \times \underbrace{\frac{\text{JPY}}{\text{USD}}}_E \times \underbrace{\frac{(\text{Mac Book Air})_{\text{JP}}}{\text{JPY}}}_{\frac{1}{P_{\text{foreign}}}} = \underbrace{\frac{(\text{Mac Book Air})_{\text{JP}}}{(\text{Mac Book Air})_{\text{US}}}}_{\epsilon}$$

or

$$\epsilon = E \times \frac{P_{\text{domestic}}}{P_{\text{foreign}}}$$

where

$\epsilon \equiv$ the real exchange rate.

$E \equiv$ the nominal exchange rate.

$P_{\text{domestic}} \equiv$ the domestic general price level.

$P_{\text{foreign}} \equiv$ the foreign general price level.

Nominal and real exchange rates:

The real exchange rate indicates whether a currency is relatively cheap or expensive.

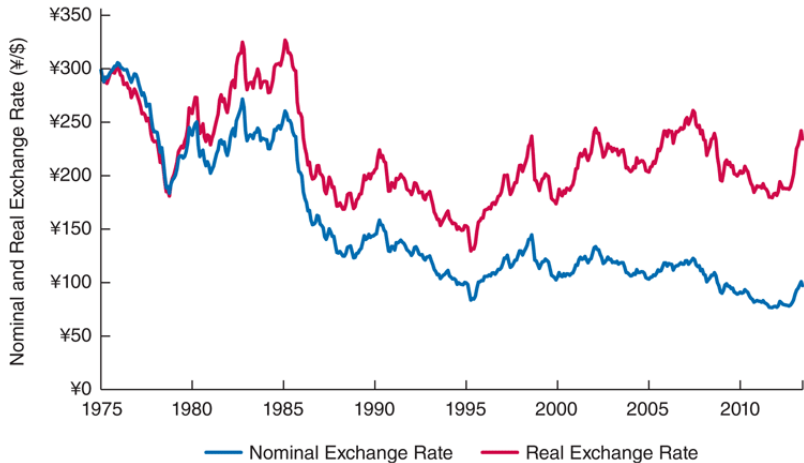
- When the real exchange rate is low (i.e., < 1), domestic goods are cheap relative to foreign goods.
- When the real exchange rate is high (i.e., > 1), domestic goods are expensive relative to foreign goods.

If prices are sticky, then nominal and real exchange rates should move together in the short run.

Foreign Exchange Rates and Markets

Nominal and real exchange rates:

Source: Mishkin, Figure 17.1



Quotes and markets:

Exchanges rates can be quoted two ways:

- ① The amount of foreign currency per unit of domestic currency, a *direct quote*.
 - For example, the number of yen per dollar.
- ② The amount of domestic currency per unit of foreign currency, an *indirect quote*.
 - For example, the number of dollars per euro.

Quotes and markets:

The *foreign exchange market* is where exchange rates are determined.

- 1 This is where currency trading takes place.
- 2 It is mostly an *over-the-counter market* of several hundred dealers (mostly banks) actively buying and selling bank deposits denominated in foreign currencies.

Quotes and markets:

Two types of foreign exchanges rates:

- ① The *spot exchange rate* is the exchange rate for spot transactions, which are immediate exchanges of bank deposits.
- ② The *forward exchange rate* is the exchange rate for forward transactions, which are exchanges of bank deposits at some specified future date.

Quotes and markets:

Changes in the foreign exchange rate:

- ① An *appreciation* occurs when a currency increases in value so that it is worth more in terms of another currency.
- ② A *depreciation* occurs when a currency decreases in value so that it is worth less in terms of another currency.

Changes in exchange rates affect the relative price of domestic versus foreign goods.

Quotes and markets:

If a country's currency appreciates when prices are sticky, then that country's:

- 1 Exported goods become more expensive to foreigners who buy fewer of them, and
- 2 Imported goods becomes less expensive to domestic residents who buy more of them.

The Law of One Price:

The law of one price says that if:

- ① Two countries produce an identical good and
- ② Transportation costs and trade barriers are low,

then

- ① The price of the good will be the same in both countries.
- ② *The exchange rate adjusts to make the price of the good equal in the two countries.*

Exchange Rates in the Long-Run

Purchasing power parity, or PPP:

- *Purchasing power parity, or PPP* says that the exchange rate between any two currencies will adjust to reflect changes in the price levels of the two countries.
- This is an application of the law of one price.

Purchasing power parity, or PPP:

If PPP holds, then the real exchange rate is equal to one, i.e., the purchasing power of the dollar is the same as the purchasing power of other currencies.

- PPP seems to hold in the very long run.
- PPP does not hold over short periods.

PPP in action: The Economist's Big Mac Index

- If PPP held exactly, then the real exchange rate would be 1 and all the prices in terms of dollars would be identical.
- The data show that is not the case and indicates which currencies are *overvalued* and which are *undervalued*.

Exchange Rates in the Long-Run

PPP in action: The Economist's Big Mac Index

Source: Mishkin, Table 17.1

THE ECONOMIST MAGAZINE'S BIG MAC INDEX, JULY 2013

Country	Big Mac Price		Exchange Rate (local currency/\$)	
	Local Currency	Dollars	Predicted	Actual
Norway	46.00	\$7.51	10.10	6.13
Switzerland	6.50	\$6.72	1.43	0.97
Canada	5.53	\$5.26	1.21	1.05
Euro Area	3.62	\$4.66	0.80	0.78
Australia	5.04	\$4.62	1.10	1.09
United States	4.56	\$4.56	1.00	1.00
Turkey	8.50	\$4.34	1.87	1.96
Britain	2.69	\$4.02	0.59	0.67
Hungary	860.00	\$3.76	188.79	228.46
South Korea	3900.00	\$3.43	855.89	1135.70
United Arab Emirates	12.00	\$3.27	2.63	3.67
Japan	320.00	\$3.20	70.23	100.11

Approaches to determination:

Three approaches to determining exchange rates in the short run.

- *The asset market approach* emphasizes the demand for the stock of domestic assets.
- An approach that emphasizes the *demand for flows of exports and imports* over short period of time.
- The *interest-parity condition*: a concept widely used in international finance.

"If by lending dollars in New York for one month the lender could earn interest at the rate of $5\frac{1}{2}\%$ per annum, whereas by lending sterling in London for one month he could only earn interest at the rate of 4% , then the preference observed above for holding funds in New York rather than in London is wholly explained. That is to say, forward quotations for the purchase of the currency of the dearer money market tend to be cheaper than spot quotations by a percentage per month equal to the excess of the interest which can be earned in a month in the dearer market over what can be earned in the cheaper."

– J. M. Keynes, *A Tract on Monetary Reform* (1923)

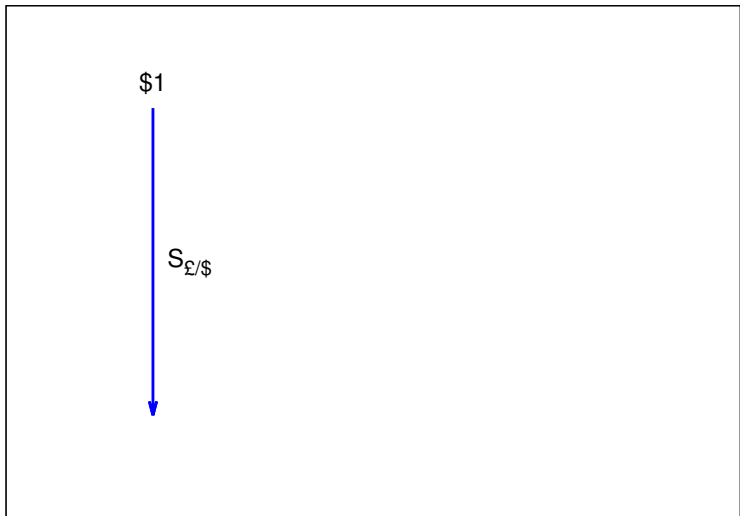
Covered Interest Parity:

Begin with one US dollar (\$1).

\$1

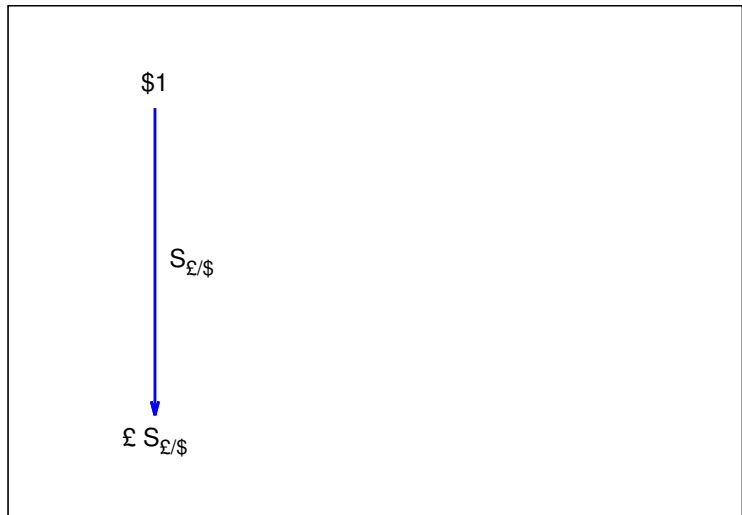
Covered Interest Parity:

Convert into £ at the spot foreign-exchange rate $S_{£/\$}$.



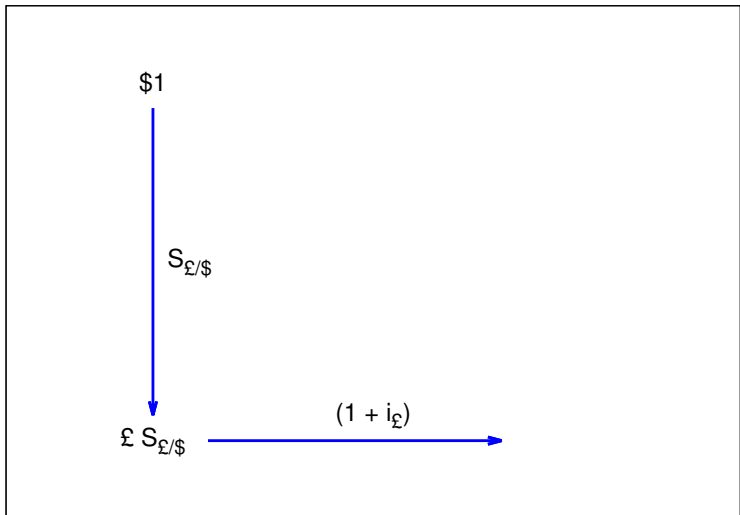
Covered Interest Parity:

We now have $£S_{£/\$}$.



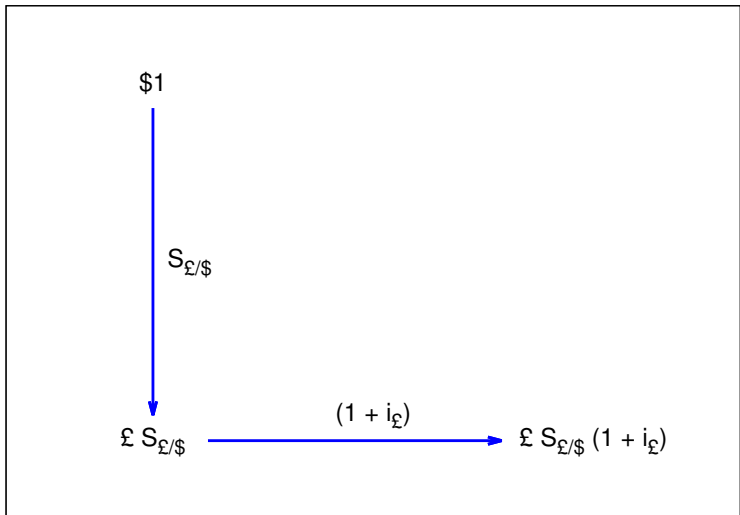
Covered Interest Parity:

Put our $\$S_{\$/\pounds}$ into a UK bank to earn $i_{\pounds}$ per year.



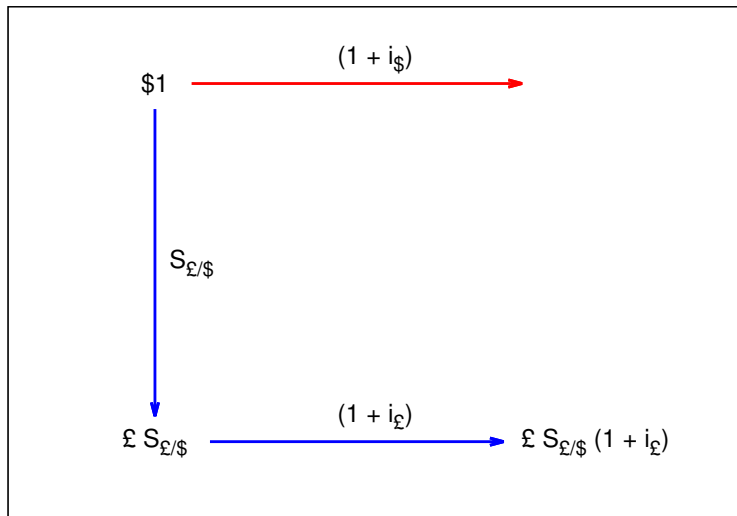
Covered Interest Parity:

In one year we have $\pounds S_{\pounds/\$} (1 + i_{\pounds})$.



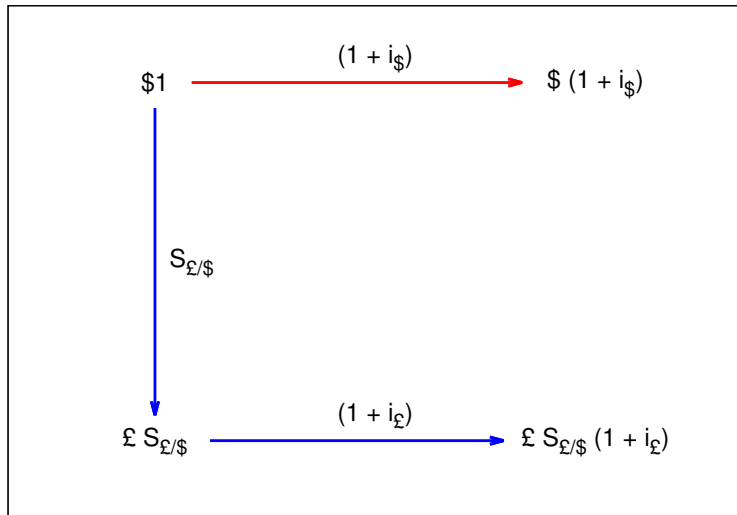
Covered Interest Parity:

Put our \$1 into a US bank to earn $i_{\$}$ per year.



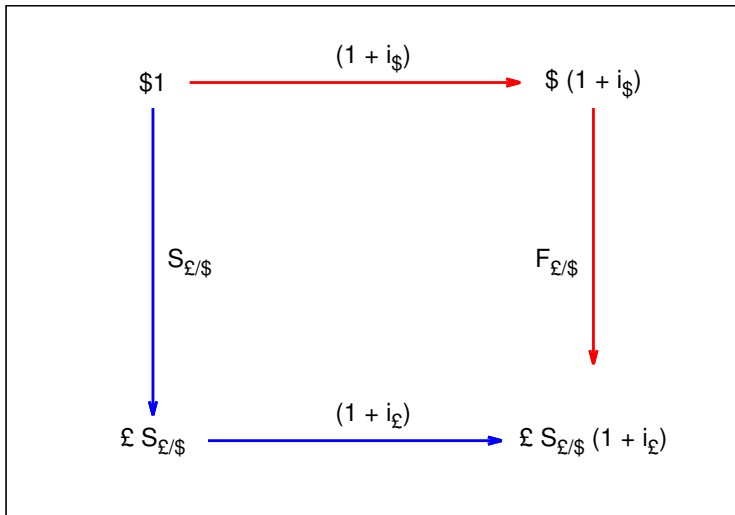
Covered Interest Parity:

In one year we would have $\$(1 + i_{\$})$.

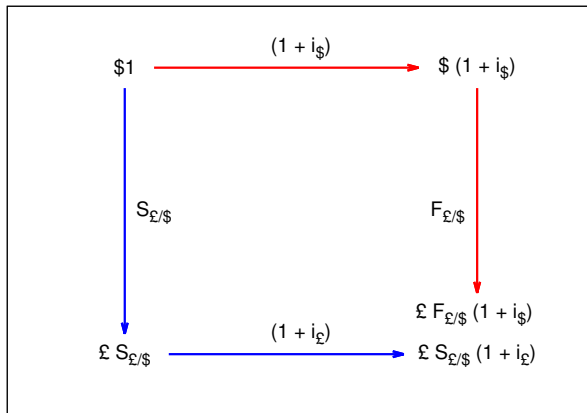


Covered Interest Parity:

Convert into £ at the forward foreign-exchange rate $F_{\$/\pounds}$.



Covered Interest Parity: Forward Price in Pounds



By arbitrage or the law of one price:

$$S_{\pounds/\$} (1 + i_{\pounds}) = (1 + i_{\$}) F_{\pounds/\$} \text{ or } S_{\pounds/\$} (1 + i_{\pounds}) = (1 + i_{\$}) F_{\pounds/\$}$$

Covered Interest Parity: Examples

By arbitrage: $S_{f/d} (1 + i_f) = (1 + i_d) F_{f/d}$

Two basic questions:

- 1 Solve for one variable given the other three.
- 2 Identify ~~arbitrage trade opportunities.~~

CIP Example 1:

Solving for the spot foreign-exchange rate

Given $F_{\text{£}/\$} = 0.60$ £/\$, $i_{\$} = 5\%$ and $i_{\text{£}} = 10\%$, what is $S_{\text{£}/\$}$?

Solution Steps:

Draw the arbitrage square and write the equation:

$$S_{\text{f}/\text{d}} (1 + i_{\text{f}}) = (1 + i_{\text{d}}) F_{\text{f}/\text{d}} .$$

Then rearrange the equation to read:

$$S_{\text{f}/\text{d}} = \frac{(1 + i_{\text{d}}) F_{\text{f}/\text{d}}}{(1 + i_{\text{f}})} .$$

Finally, substitute variables and solve:

$$S_{\text{£}/\$} = \frac{(1 + 0.05) 0.60}{(1 + 0.10)} = 0.57 \text{ £}/\$.$$

CIP Example 2:

Solving for the foreign interest rate

Given $S_{\text{£}/\$} = 0.60 \text{ £}/\$$, $i_{\$} = 7.0\%$ and $F_{\text{£}/\$} = 0.57 \text{ £}/\$$, what is $i_{\text{£}}$?

Solution Steps:

Draw the arbitrage square and write the equation:

$$S_{f/d} (1 + i_f) = (1 + i_d) F_{f/d} .$$

Then rearrange the equation to read:

$$(1 + i_f) = \frac{(1 + i_d) F_{f/d}}{S_{f/d}} \implies i_f = \frac{(1 + i_d) F_{f/d}}{S_{f/d}} - 1 .$$

Finally, substitute variables and solve:

$$i_{\text{£}} = \frac{(1 + 0.07) 0.57}{0.60} - 1 = 0.0165 = 1.65\% .$$

CIP Example 3:

Solving for the domestic interest rate

Given $S_{\text{£}/\$} = 0.60 \text{ £}/\$$, $i_{\text{£}} = 5.0\%$ and $F_{\text{£}/\$} = 0.57 \text{ £}/\$$, what is $i_{\$}$?

Solution Steps:

Draw the arbitrage square and write the equation:

$$S_{\text{f}/\text{d}} (1 + i_{\text{f}}) = (1 + i_{\text{d}}) F_{\text{f}/\text{d}} .$$

Then rearrange the equation to read:

$$(1 + i_{\text{d}}) = \frac{S_{\text{f}/\text{d}} (1 + i_{\text{f}})}{F_{\text{f}/\text{d}}} \implies i_{\text{d}} = \frac{S_{\text{f}/\text{d}} (1 + i_{\text{f}})}{F_{\text{f}/\text{d}}} - 1 .$$

Finally, substitute variables and solve:

$$i_{\$} = \frac{0.60 (1 + 0.05)}{0.57} - 1 = 0.1053 = 10.53\% .$$

CIP Example 4:

Solving for the forward foreign-exchange rate

Given $S_{\text{£}/\$} = 0.60$ £/\$, $i_{\$} = 5\%$ and $i_{\text{£}} = 10\%$, what is $F_{\text{£}/\$}$?

Solution Steps:

Draw the arbitrage square and write the equation:

$$S_{f/d} (1 + i_f) = (1 + i_d) F_{f/d} .$$

Then rearrange the equation to read:

$$F_{f/d} = \frac{S_{f/d} (1 + i_f)}{(1 + i_d)} .$$

Finally, substitute variables and solve:

$$F_{\text{£}/\$} = \frac{0.60 (1 + 0.1)}{(1 + 0.05)} = 0.63 \text{ £}/\$.$$

The Differential: the f/d version

Recall our basic equality: $S_{f/d}(1 + i_f) = (1 + i_d)F_{f/d}$.

Collecting currency rates and interest rates:

$$\frac{S_{f/d}}{F_{f/d}} = \frac{(1 + i_d)}{(1 + i_f)}.$$

For small i_f you can expand the denominator as:

$$\frac{1}{(1 + i_f)} = 1 - i_f + \text{higher-order terms}$$

Thus, we can write:

$$\frac{S_{f/d}}{F_{f/d}} \approx 1 + i_d - i_f$$

or

$$\frac{S_{f/d} - F_{f/d}}{F_{f/d}} \approx i_d - i_f$$

The Differential: the d/f version

Recall our basic equality: $S_{f/d}(1 + i_f) = (1 + i_d)F_{f/d}$.

Cross rates are inverses:

$$S_{f/d} = \frac{1}{S_{d/f}} \quad \text{and} \quad F_{f/d} = \frac{1}{F_{d/f}} .$$

Then by substitution:

$$\frac{S_{f/d}}{F_{f/d}} \approx 1 + i_d - i_f \implies \frac{F_{d/f}}{S_{d/f}} \approx 1 + i_d - i_f ,$$

or

$$\frac{F_{d/f} - S_{d/f}}{S_{d/f}} \approx i_d - i_f$$

Sources of Exchange-Rate Volatility

Remember the components of the nominal rate:

The spot forex rate

$$S_{f/d} = \frac{(1 + i_d) F_{f/d}}{(1 + i_f)}$$

and the forward forex rate

$$F_{f/d} = \frac{S_{f/d} (1 + i_f)}{(1 + i_d)}$$

are functions of the *nominal* interest rate

$$i_d = r_d + \pi_d \quad \text{and} \quad i_f = r_f + \pi_f$$

in *both* countries.