International Economics - B.Sc. IBP
10. Open-Economy Macroeconomics: Price Levels and the Exchange Rate in the Long Run

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Plan for Today

Chapter 16:

- The law of one price
- Purchasing power parity
- A long-run exchange rate model based on PPP
- The Fisher effect
- A General Model of Long-Run Exchange Rates

Chapter 16: Price Levels and the Exchange Rate in the Long Run

The Law of One Price (1)

The prices of identical goods sold in different countries must be the same when expressed in terms of the same currency.

- This law applies only in competitive markets free of transport costs and official barriers to trade.
- Example: If the dollar/pound exchange rate is USD 1.50 per pound, a sweater that sells for USD 45 in New York must sell for £30 in London.

The Law of One Price (2)

The dollar price of good i is the same wherever it is sold

$$P^i_{US} = \left(E_{USD/EURO}\right) x \left(P^i_E\right)$$

where:

- P^i_{US} is the dollar price of good i when sold in the U.S.
- P^i_E is the corresponding euro price in Europe
- $\left(E_{USD/EURO}\right)$ is the dollar/euro exchange rate

Purchasing Power Parity (PPP)(1)

PPP

- is the application of the law of one price across countries for *all* goods and services.
- compares average prices across countries
- predicts a dollar/euro exchange rate of

$$E_{USD/EURO} = \frac{P_{US}}{P_E}$$

where

  - P_{US} is the dollar price of a reference commodity basket sold in the United States
  - P_E is the euro price of the same basket in Europe

Purchasing Power Parity (PPP)(2)

Rearranging,

$$P_{US} = \left(E_{USD/EURO}\right) x \left(P_E\right)$$

All countries' price levels are equal when measured in terms of the same currency

PPP & Law of One Price

- The law of one price applies to individual commodities; PPP applies to the general price level
- If the law of one price holds true for every commodity $\Rightarrow$ PPP must hold for the same reference baskets across countries
- BUT if PPP holds, this does not mean that law of one price is respected

Purchasing Power Parity (PPP)(3)

1. Absolute PPP: exchange rates equal relative price levels
2. Relative PPP: the percentage change in the exchange rate between two currencies equals the difference between the percentage changes in national price levels.

$$\frac{\left(E_{USD/EURO,t} - E_{USD/EURO,t-1}\right)}{E_{USD/EURO,t-1}} = \pi_{US,t} - \pi_{E,t}$$

where π_t = inflation rate from period $t-1$ to t

Absolute & Relative PPP (1)

If absolute PPP holds $\Rightarrow$ relative PPP holds

	$t-1$	t
Absolute PPP	$P_{US,t-1} = USD100$ $E_{t-1}P_{E,t-1} = USD100$	$P_{US,t} = USD110$ $E_tP_{E,t} = USD110$
	$\Rightarrow$	
Relative PPP	$\pi_{US,t-1} = 10\%$ $\pi_{E,t-1} = \frac{(E_t - E_{t-1})}{E_{t-1}}$	

Absolute & Relative PPP (2)

Not the other way around!

	$t-1$	t
Relative PPP	$\pi_{US,t} = 10\%$ $\pi_{E,t} = \frac{(E_t - E_{t-1})}{E_{t-1}}$	
NOT TRUE $\Rightarrow$		
Absolute PPP	$P_{US,t-1} = USD200$ $E_{t-1}P_{E,t-1} = USD100$	$P_{US,t-1} = USD220$ $E_tP_{E,t} = USD110$

A Long-Run Exchange Rate Model Based on PPP

- Monetary approach to the exchange rate
- A theory of how exchange rates and monetary factors interact in the long run.
- The fundamental equation of the monetary approach
- Price levels can be expressed in terms of domestic money demand and supplies.

1. In the United States:

$$P_{US} = \frac{M^s_{US}}{L(R_{USD}, Y_{US})}$$

2. In Europe:

$$P_E = \frac{M^s_E}{L(R_{EURO}, Y_E)}$$

PPP and Money Market

$$E_{USD/EURO} = \frac{P_{US}}{P_E} = \frac{\frac{M^s_{US}}{L(R_{USD}, Y_{US})}}{\frac{M^s_E}{L(R_{EURO}, Y_E)}}$$

Specific Predictions:

1. Money supplies: if M^s_{US} (M^s_{EU}) $\Uparrow\Rightarrow$ long-run depreciation (appreciation) of the dollar against the euro
2. interest rates: if R_{USD} (R_{EU}) $\Uparrow\Rightarrow$ causes a depreciation (appreciation) of the dollar against the euro
3. Output levels: a rise if Y_{US} (Y_E) $\Uparrow\Rightarrow$ causes an appreciation (depreciation) of the dollar against the euro.

The Fisher Effect (1)

- A more reasonable description of monetary policy is constantly growing money supply
- Money supply grows at a constant growth rate results in ongoing inflation at the same rate

The Fisher Effect (2)

$$E_{USD/EURO} = \frac{P_{US}}{P_E} = \frac{\frac{M^s_{US}}{L(R_{USD}, Y_{US})}}{\frac{M^s_E}{L(R_{EURO}, Y_E)}}$$

Given M^s_E and P_{EURO} constant, if M^s_{US} grows by π, P_{US} grows by π_{US}

$$\Rightarrow$$

E depreciated by π each period

$$\frac{E_{USD/EURO,t} - E_{USD/EURO,t-1}}{E_{USD/EURO,t}} = \pi_{US,t} - \pi_{US,t-1}$$

Monetary policies in the US and Euroland determine the development in the exchange rate

The Fisher Effect (3)

Given Uncovered Interest Rate Parity,

$$R_{USD,t} = R_{EURO,t} + \left(\frac{E^e_{USD/EURO,t+1} - E_{USD,/EUROt}}{E_{USD/EURO,t}} \right)$$

and relative PPP

$$\frac{\left(E_{USD/EURO,t} - E_{USD/EURO,t-1}\right)}{E_{USD/EURO,t-1}} = \pi_{US,t} - \pi_{E,t}$$

$$\Rightarrow$$

Real interest rates are equal

$$\Rightarrow$$

$$R_{USD} - R_{EURO} = \pi^e_{US} - \pi^e_E$$

or

$$R_{USD} - \pi^e_{US} = R_{EURO} - \pi^e_E$$

The Fisher Effect (4)

- A rise (fall) in a country's expected inflation rate will eventually cause an equal rise (fall) in the interest rate that deposits of its currency offer.
- In the long run, purely monetary developments should have no real effects.
- expected growth in money supply affects the interest rate through inflation.

Interest and Monetary Policy (1)

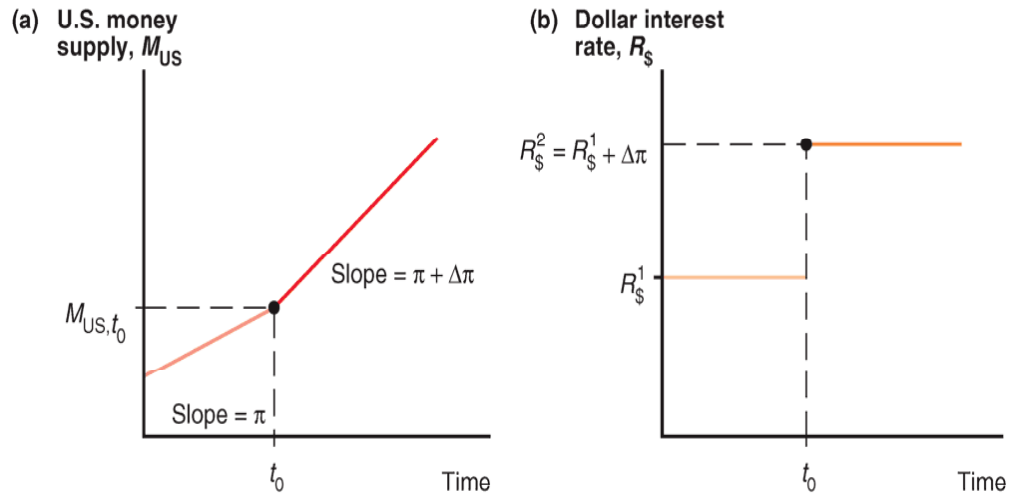
- If growth in M^s_{US} changes permanently from π to $\pi + \Delta\pi$ (and M^s_E is constant) such that $\pi_{US,t}$ and π^e_{US} increases from π to $\pi + \Delta\pi$
- R_{US} increases by $\delta\pi$ (and R_e is unchanged)

Interest and Monetary Policy (2)

- If $R_{US} \Uparrow \Rightarrow L(R_{US}, Y_{US}) \Downarrow \Rightarrow E_{US/EURO} \Uparrow$

$$\Uparrow E_{US/EURO} = \frac{P_{US}}{P_E} = \frac{M^S_{US} L(R_{EURO}, Y_E)}{M^S_E L(R_{US}, Y_{US}) \Downarrow}$$

Fig. 16-1: Long-Run Time Paths of U.S. Economic Variables After a Permanent Increase in the Growth Rate of the U.S. Money Supply



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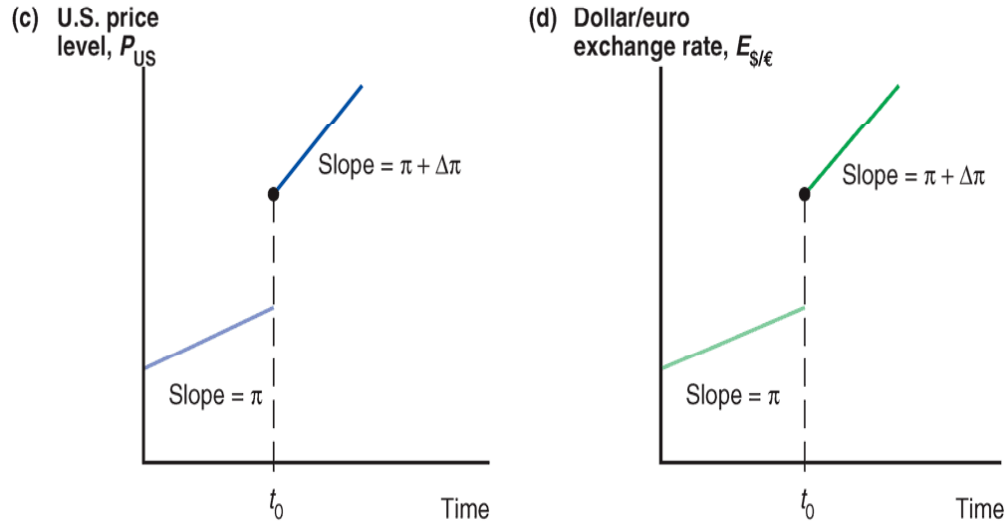

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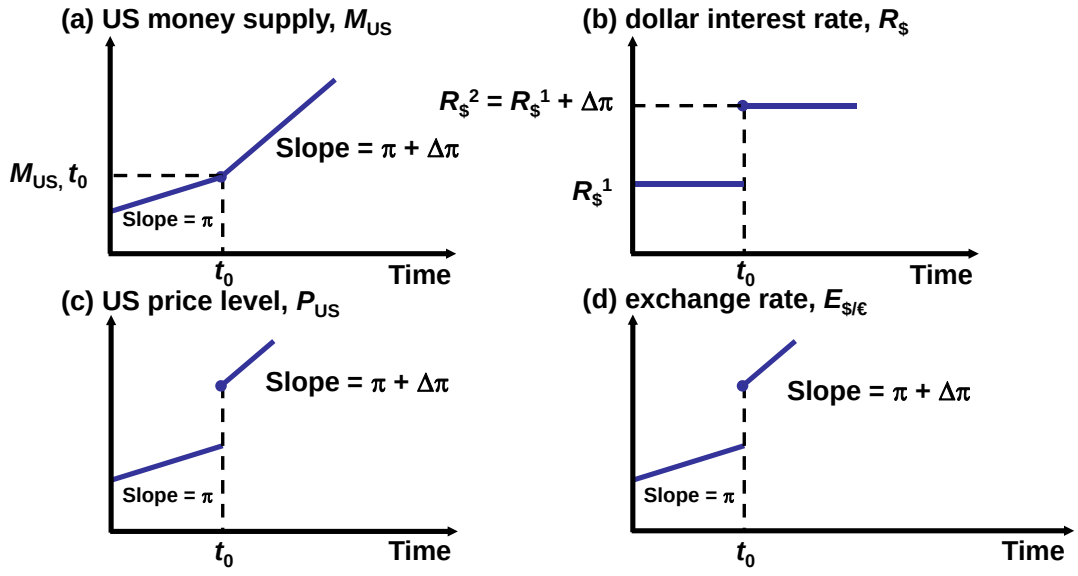


Empirical Evidence on PPP (1)

- The empirical support for PPP and the law of one price is weak.
- The prices of identical commodity baskets, when converted to a single currency, differ substantially across countries.
- Relative PPP also performs poorly.

Fig. 16-2: The Yen/Dollar Exchange Rate and Relative Japan-U.S. Price Levels, 1980-2006

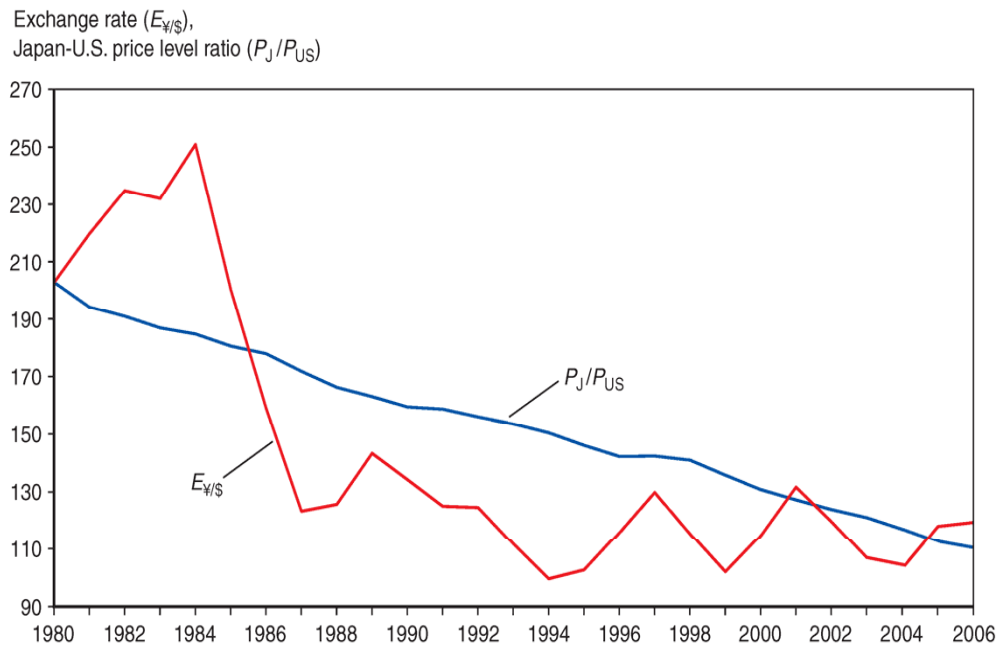


Figure: Empirical Evidence of PPP (1)

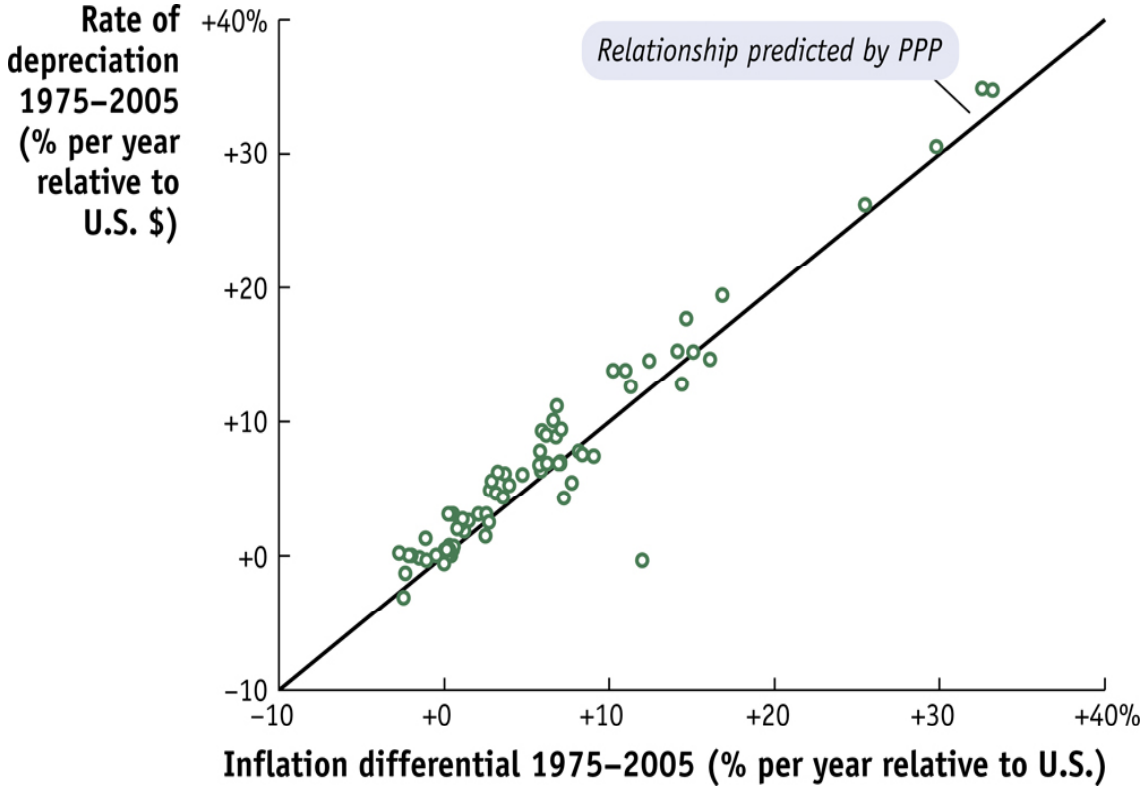


Figure: Empirical Evidence of PPP (2)

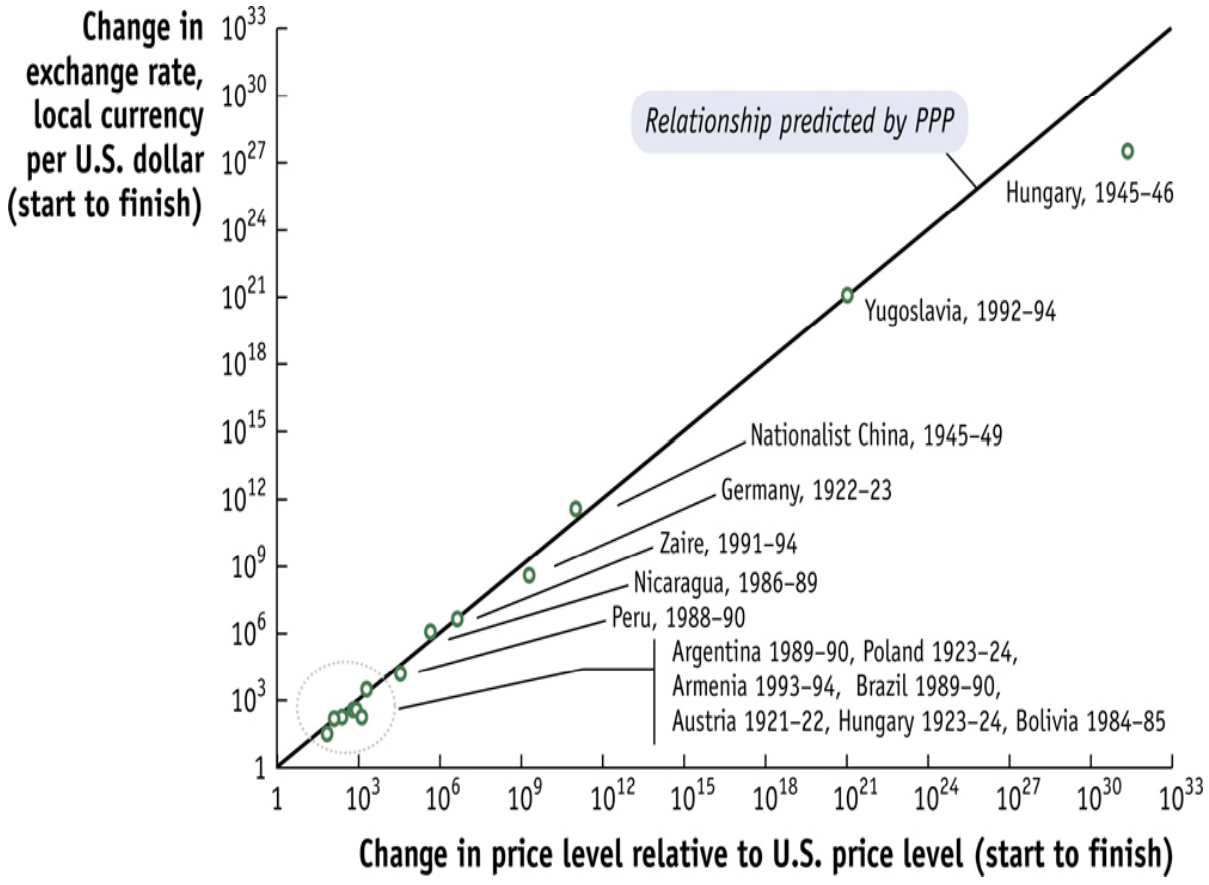


Figure: The Big Mac Index

Our hot tips

Local currency under (-)/over (+) valuation against the dollar, %, using:

	Starbucks tall-latte index	McDonald's Big Mac index
Australia	-4	-17
Britain	+17	+23
Canada	-16	-16
China	-1	-56
Euro area	+33	+24
Hong Kong	+15	-45
Japan	+13	-12
Malaysia	-25	-53
Mexico	-15	-21
New Zealand	-12	-4
Singapore	+2	-31
South Korea	+6	0
Switzerland	+62	+82
Taiwan	-5	-21
Thailand	-31	-46
Turkey	+6	+5

Source: *The Economist*

Reasons

1. Trade barriers and non-tradable products
2. Imperfect competition
3. Differences in measures of average prices for baskets of goods and services

A General Model of Long-Run Exchange Rates (1)

The Real Exchange Rate

- Measure of the prices of one country's goods and services relative to the other's.
- The real exchange rate is the dollar price of the European basket relative to that of the US price:

$$q_{USD/EURO} = \frac{(E_{USD/EURO} x P_E)}{P_{US}}$$

- Observe that PPP only holds for $q_{USD/EURO} = 1$ (absolute) or $q_{USD/EURO,t} - q_{USD/EURO,t-1} = 0$ (conditional)

A General Model of Long-Run Exchange Rates (2)

1. Real depreciation (q increases): If US prices fall in relation to foreign prices (measured in USD). This happens if:
   - Nominal exchange rate depreciates (E increases), or
   - US prices fall, or
   - Euroland prices increase
2. Real appreciation (q falls): If US prices increases relative to foreign prices (measured in USD). This happens if:
   - Nominal exchange rate appreciates (E falls), or
   - US prices increase, or
   - Euroland prices fall

A General Model of Long-Run Exchange Rates (3)

We can express the nominal exchange rate as:

$$E_{USD/EURO} = q_{USD/EURO} x (\frac{P_U S}{P_E})$$

$$\Rightarrow$$

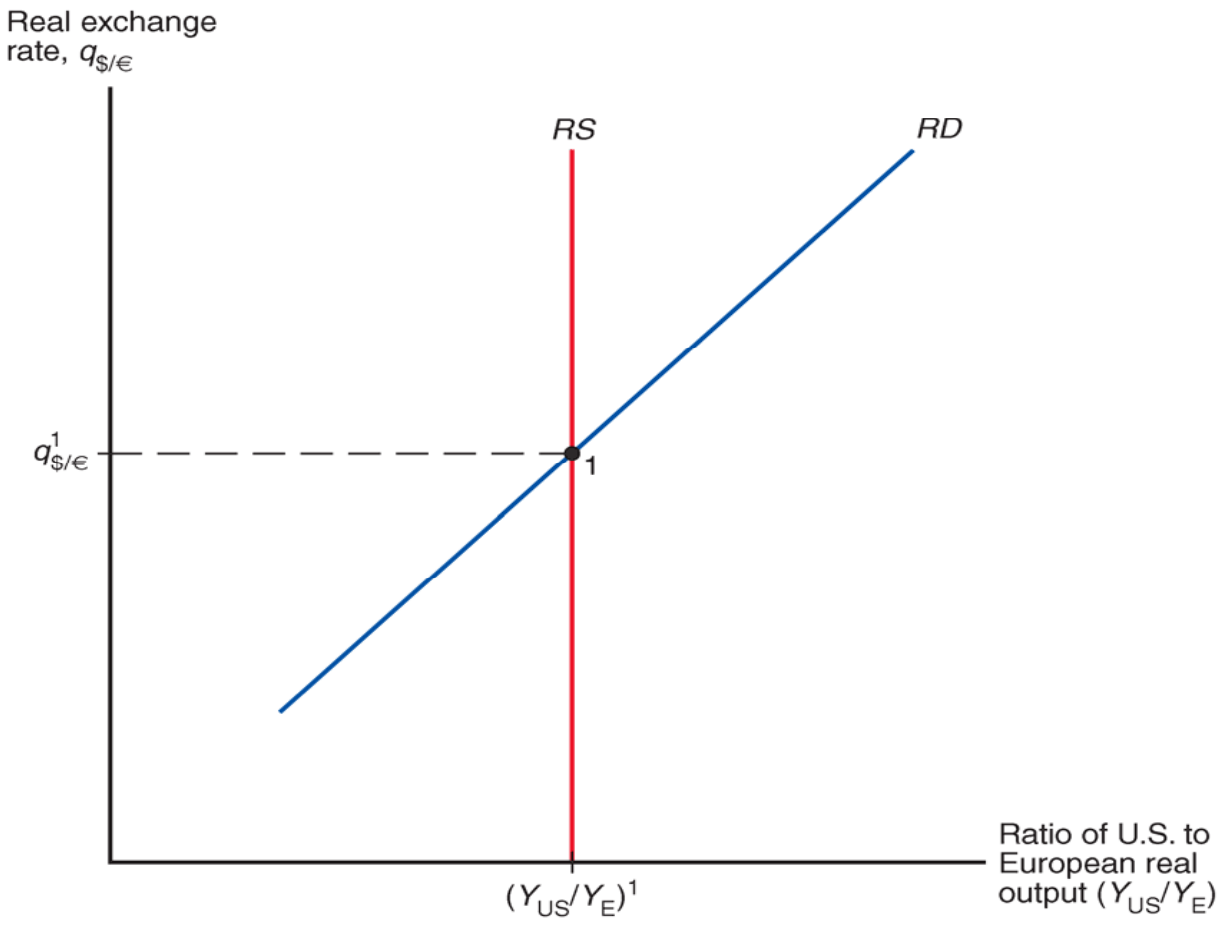
$$\frac{q^e_{USD/EURO} - q_{USD/EURO}}{q_{USD/EURO}} = \frac{E^e_{USD/EURO} - E_{USD/EURO}}{E_{USD/EURO}} - (\pi^e_{US} - \pi^e_{EURO})$$

Combining with the interest parity condition, the international interest gap is equal to:

$$\frac{q^e_{USD/EURO} - q_{USD/EURO}}{q_{USD/EURO}} = \frac{E^e_{USD/EURO} - E_{USD/EURO}}{E_{USD/EURO}} - (\pi^e_{US} - \pi^e_{EURO})$$

$$R_{US} - R_{EURO} = \frac{q^e_{USD/EURO} - q_{USD/EURO}}{q_{USD/EURO}} - (\pi^e_{US} - \pi^e_{EURO})$$

Fig. 16-4: Determination of the Long-Run Real Exchange Rate



Change	Effect on the long-run nominal dollar/euro exchange rate, $E_{\$/€}$
Money market	
1. Increase in U.S. money supply level	Proportional increase (nominal depreciation of $)
2. Increase in European money supply level	Proportional decrease (nominal depreciation of euro)
3. Increase in U.S. money supply growth rate	Increase (nominal depreciation of $)
4. Increase in European money supply growth rate	Decrease (nominal depreciation of euro)
Output market	
1. Increase in demand for U.S. output	Decrease (nominal appreciation of $)
2. Increase in demand for European output	Increase (nominal appreciation of euro)
3. Output supply increase in the United States	Ambiguous
4. Output supply increase in Europe	Ambiguous

Real Interest parity

$$r^e_{US} - r^e_{EU} = \frac{\left(q^e_{US/EU} - q_{US/EU}\right)}{q_{US/EU}}$$

This equation is called real interest parity. It says that differences in real interest rates (in terms of goods and services that are earned or forgone when lending or borrowing) between countries are equal to the expected change in the value/price/cost of goods and services between countries.