Lecture 5: Price Levels and Exchange Rate in Long Run

Instructor: Fei Tan

@econdojo   @BusinessSchool101   Saint Louis University

Course: International Macroeconomics

Date: February 1, 2026

LOOP & PPP

No arbitrage condition

$$P_\$ = E_{\$/€} \times P_€ \quad \Rightarrow \quad E_{\$/€} = \frac{P_\$}{P_€}$$

- Law of One Price (LOOP)

  - $P_\$$ = dollar price of a single good

  - $P_€$ = euro price of identical good

- Absolute Purchasing Power Parity (PPP)

  - $P_\$$ = dollar price of a basket of goods

  - $P_€$ = euro price of identical basket of goods

  - absolute PPP implies relative PPP

$$\%\Delta E_{\$/€} \approx \%\Delta P_\$ - \%\Delta P_€$$

The Road Ahead

1. Monetary Approach to Exchange Rates

2. A General Model of Long-Run Exchange Rates

Monetary Approach to Exchange Rates

A long-run exchange rate model

$$E_{\$/€} = \frac{P_\$}{P_€} = \frac{M_\$^s}{M_€^s} \times \frac{L(R_€, Y_€)}{L(R_\$, Y_\$)}$$

- Use monetary factors to predict long-run exchange rates, *assuming* absolute PPP

- Predictions of monetary approach

  ○ $M_\$^s \uparrow \Rightarrow P_\$ \uparrow \Rightarrow E_{\$/€} \uparrow$ in proportion
  ○ $R_\$ \uparrow \Rightarrow L(R_\$, Y_\$) \downarrow \Rightarrow P_\$ \uparrow \Rightarrow E_{\$/€} \uparrow$
  ○ $Y_\$ \uparrow \Rightarrow L(R_\$, Y_\$) \uparrow \Rightarrow P_\$ \downarrow \Rightarrow E_{\$/€} \downarrow$

- Does $R_\$ \uparrow \Rightarrow E_{\$/€} \uparrow$ contradict Lecture 4 result?

Fisher Effect
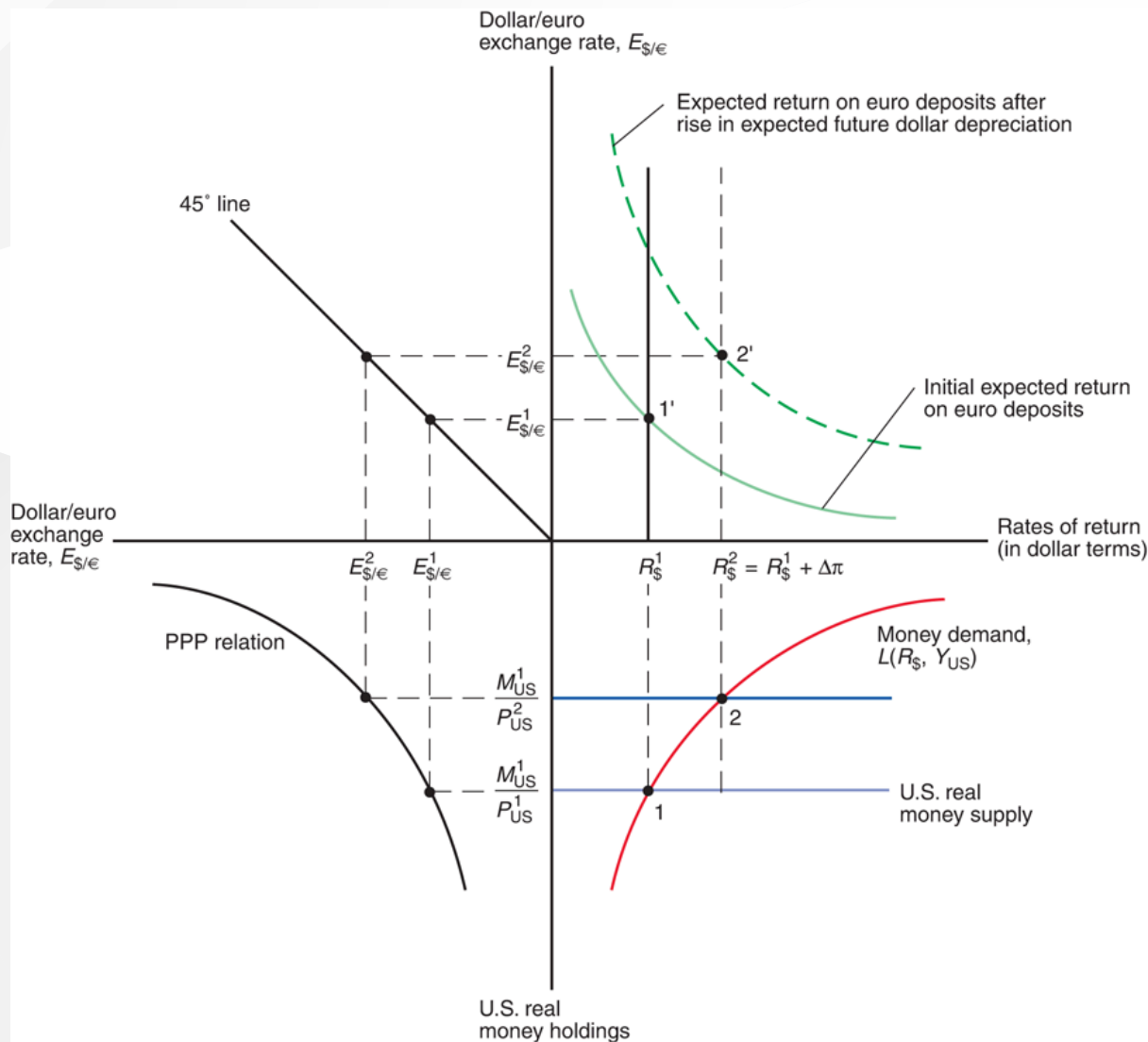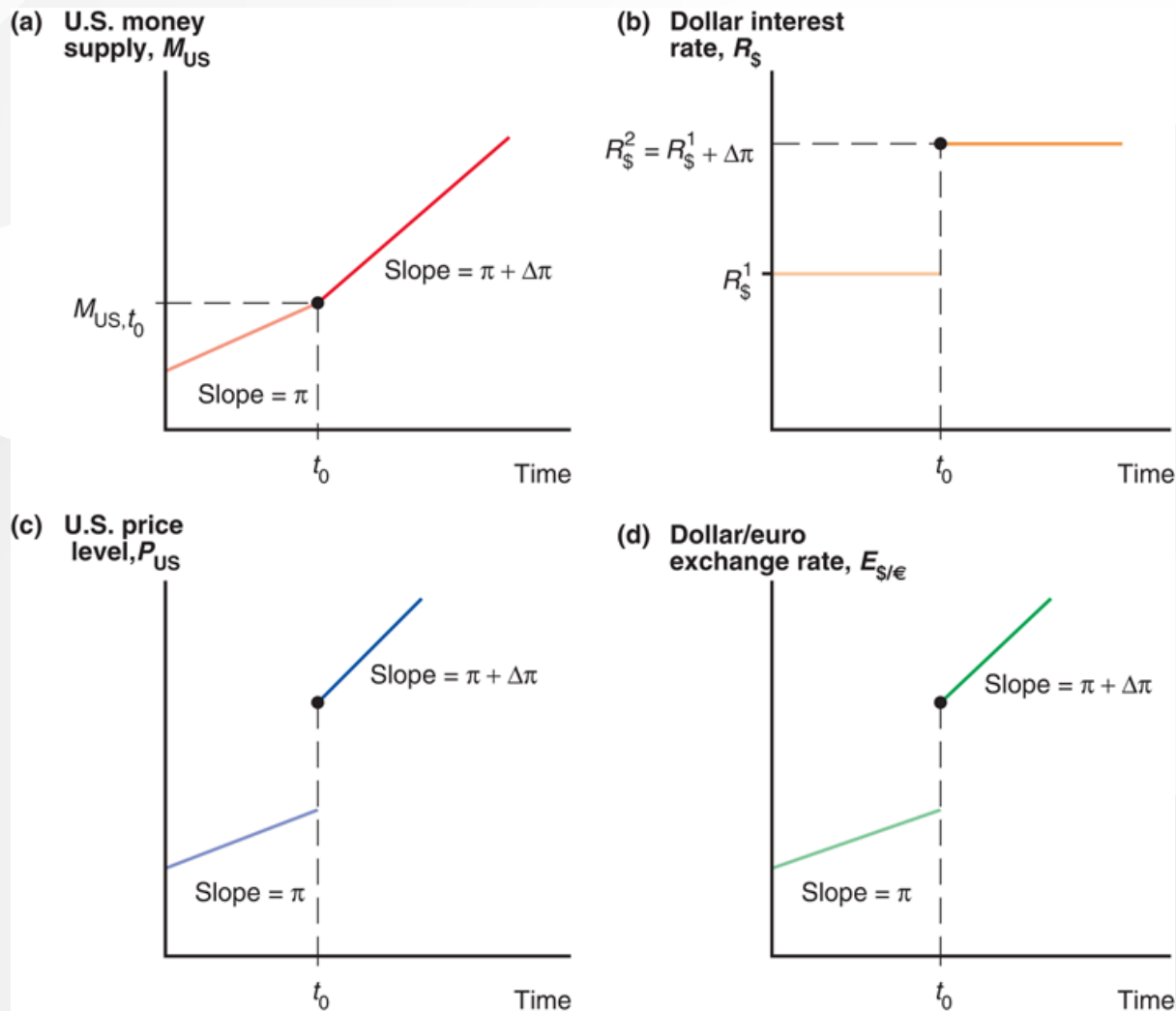
IP + PPP

$$
R_\$ - R_€ = \overbrace{\frac{E^e_{\$/€} - E_{\$/€}}{E_{\$/€}}}^{\text{Interest Parity (IP)}} = \underbrace{\underbrace{\frac{P^e_\$ - P_\$}{P_\$}}_{\pi^e_\$} - \underbrace{\frac{P^e_€ - P_€}{P_€}}_{\pi^e_€}}_{\text{"expected" version of relative PPP}}
$$

- What is Fisher effect?

  ○ long-run relation b/w inflation & interest rate

  ○ e.g. $\pi^e_\$ \uparrow$ by 5% $\Rightarrow R_\$ \uparrow$ by 5%

- Secret behind interest rate rise

  ○ sticky price: $M^s_\$ \downarrow \Rightarrow (P^e_\$, E^e_{\$/€}) \downarrow + R_\$ \uparrow \Rightarrow E_{\$/€} \downarrow$

  ○ flexible price: $g_{M^s_\$} \uparrow \Rightarrow (\pi^e_\$, E^e_{\$/€}) \uparrow + R_\$ \uparrow \Rightarrow E_{\$/€} \uparrow$
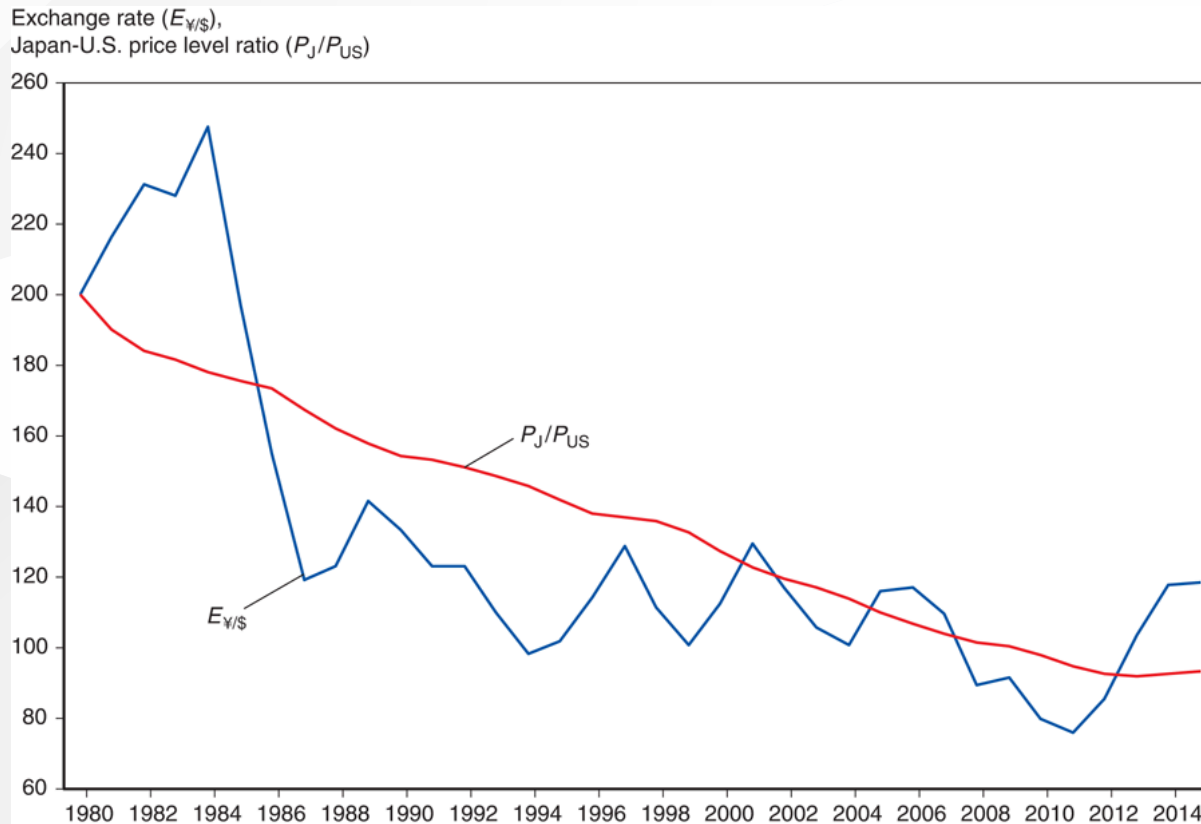
Monetary Approach

Monetary Approach (Cont'd)

Failure of PPP

- transport costs, trade barriers, nontradables

- departures from free competition

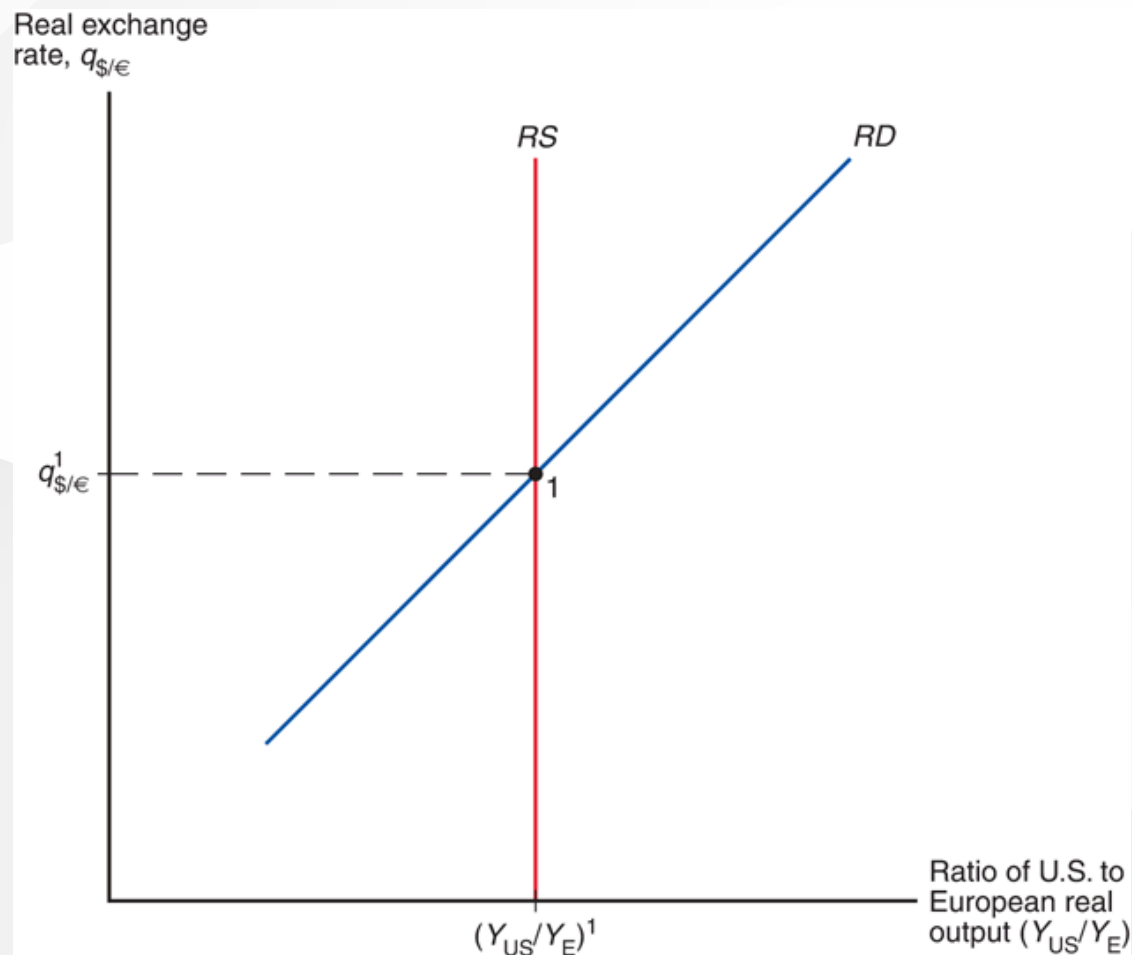- differences in price level measurement

Real Exchange Rate

- What is real exchange rate?

  - price of foreign goods in domestic goods

$$q_{\$/€} = E_{\$/€} \times P_{€}/P_{\$}$$

  - $q_{\$/€} \uparrow (\downarrow)$ means real depreciation (appreciation) of dollar against euro

- PPP implies unchanged $q_{\$/€}$

  - absolute PPP holds if $q_{\$/€} = 1$

  - relative PPP holds if $\%\Delta q_{\$/€} = 0$ or

$$\underbrace{\%\Delta P_{\$} - \%\Delta P_{€}}_{\text{inflation differential}} = \underbrace{\%\Delta E_{\$/€}}_{\text{depreciation rate of dollar}}$$

Long-Run Real Exchange Rate

- Equilibrium $q_{\$/€}$ occurs when relative demand (RD) equals relative supply (RS)

Real Exchange Rate Approach

A long-run exchange rate model

$$E_{\$/€} = q_{\$/€} \times \frac{P_\$}{P_€} = \textcolor{red}{q_{\$/€}} \times \frac{M_\$^s}{M_€^s} \times \frac{L(R_€, Y_€)}{L(R_\$, Y_\$)}$$

- Generalize monetary approach to determining long-run exchange rates, allowing for deviations from PPP

- **Predictions of real exchange rate approach**
  - $M_\$^s \uparrow$ in level $\Rightarrow (q_{\$/€}, R_\$, Y_\$)$ no change $\Rightarrow (P_\$, E_{\$/€}) \uparrow$ in proportion (relative PPP)
  - $M_\$^s \uparrow$ in growth $\Rightarrow (q_{\$/€}, Y_\$)$ no change, $R_\$ \uparrow \Rightarrow (P_\$, E_{\$/€}) \uparrow$ in proportion (relative PPP)
  - $RD \uparrow \Rightarrow (R_\$, Y_\$, P_\$)$ no change $\Rightarrow (q_{\$/€}, E_{\$/€}) \downarrow$
  - $RS \uparrow \Rightarrow L(R_\$, Y_\$) \uparrow, P_\$ \downarrow, q_{\$/€} \uparrow \Rightarrow E_{\$/€}$?

A Summary

Change	Long-run $E_{\$/€}$
Money market	
1. Increase in U.S. money supply level	Proportional increase
2. Increase in European money supply level	Proportional decrease
3. Increase in U.S. money supply growth	Increase
4. Increase in European money supply growth	Decrease
Output market	
1. Increase in demand for U.S. output	Decrease
2. Increase in demand for European output	Increase
3. Output supply increase in U.S.	Ambiguous
4. Output supply increase in Europe	Ambiguous

A Second Look on Fisher Effect

International interest rate gap

$$R_\$ - R_\euro = \overbrace{\frac{E^e_{\$/\euro} - E_{\$/\euro}}{E_{\$/\euro}}}^{\text{Interest Parity (IP)}} = \underbrace{\frac{q^e_{\$/\euro} - q_{\$/\euro}}{q_{\$/\euro}} + \left(\pi^e_\$ - \pi^e_\euro\right)}_{\text{from definition of real exchange rate}}$$

- Fisher effect: long-run relation among inflation, nominal & real interest rates

- Real interest parity condition

$$r_\$ - r_\euro = \left(R_\$ - \pi^e_\$\right) - \left(R_\euro - \pi^e_\euro\right) = \frac{q^e_{\$/\euro} - q_{\$/\euro}}{q_{\$/\euro}}$$

Readings & Exercises

- Readings

  - KOM: chapter 16

- Exercises

  - KOM: problem 1, 2, 3, 4

  - Derive real interest parity condition

  - What is international *real* interest rate gap when relative PPP is expected to hold?