Topics for Today

1. Long-Run Price Level Adjustment
   - The "Quantity Theory" of Money

2. Exchange Rate "Overshooting"
**Long-Run Price Adjustment**

**Definition of the "Long-Run"**: Prices of goods & services fully adjust to clear the market.

According to Keynes, the most important rigid price is the price of labor (i.e., wages), due to nominal contracts.

**Key Proposition**: In the long-run, a permanent change in the $M^s$ is neutral. That is, it does not alter real output or the relative prices of goods & services. It only causes a proportionate increase in the price level.

$$\frac{M}{P} = L(Y, R) \implies P = \frac{M}{L(Y, R)}$$

$$\implies \text{with } Y, R \text{ constant, if } M^s \uparrow \text{ by } X\%, \text{ then } P \uparrow \text{ by } X\%$$

This proposition is based on both economic reasoning and empirical evidence.
In a cross-section of countries, long-term changes in money supplies and price levels show a clear positive correlation. (The diagonal line indicates exactly proportional changes in money supplies and price levels.)

Source: OECD, Main Economic Indicators, and IMF, International Financial Statistics.
Exchange Rate Volatility

Figure 1. One-Quarter Changes in the Log Dollar/Deutsche-Mark Exchange Rate

Figure 2. DM/U.S.$ exchange rate and ratio of German to U.S. CPIs, Jan. 1972–May 1995

Source: International Financial Statistics
Why Overshooting?

3 key assumptions are responsible for overshooting:

1.) Goods markets are slow to adjust (i.e., sticky prices)

2.) Asset markets adjust instantly

3.) Investors have "Rational Expectations" - They anticipate future price level changes, and recognize their effects on future exchange rates.

Overshooting = Sticky Prices + UIP + Rational Expectations
Basic Logic Behind Overshooting

Assume initially $\frac{E^e - E}{E} = 0$ and $R = R^*$

1.) $M^s \uparrow \Rightarrow \frac{M^s}{p} \uparrow$ (due to sticky prices)
   $\Rightarrow R \downarrow$ (to clear money mkt.)

2.) From UIP, the only way $R \downarrow$ is if investors expect the domestic currency to appreciate.

3.) However, investors know that the permanent $M^s \uparrow$ will eventually lead to a higher price level and a depreciated currency.

4.) How can the currency both be expected to appreciate and eventually be depreciated in the long-run?
   Answer: It must initially jump above its LR equil. value. It must "overshoot".
Dynamic Response to a Permanent $M^s \uparrow$

\[ R^* + \frac{E_c - E}{E} \]

\[ R^* + \frac{E_c - E}{E} \]

\[ L(Y, \kappa) \]

\[ M/P_1 = M^2/P^2 \]

\[ M^2/P_1 \]
Dynamic Responses to a Permanent $M^P$

- **Money Supply**: Increases permanently by $\frac{M^P - M_1}{M_1} \%$.

- **Interest Rate**: Initially falls, and then gradually returns to initial level.

- **Exchange Rate**: Initially depreciates by more than its long-run amount. Eventually depreciates by the same percentage amount as $M^P$.

- **Price Level**: Gradually rises by the same % amount as the increase in the money supply:
  $$\frac{P_2 - P_1}{P_1} = \frac{M^P - M_1}{M_1}$$