

KRUGMAN ♦ OBSTFELD

INTERNATIONAL

Theory & Policy

ECONOMICS

8

## Chapter 14

Money, Interest  
Rates, and  
Exchange Rates

# Preview

- What is money?
- Control of the supply of money
- The willingness to hold monetary assets
- A model of real monetary assets and interest rates
- A model of real monetary assets, interest rates, and exchange rates
- Long run effects of changes in money on prices, interest rates, and exchange rates

# What Is Money?

- Money is an asset that is widely used as a means of payment.
  - ◆ Different groups of assets may be classified as money.
    - Money can be defined narrowly or broadly.
    - Currency in circulation, checking deposits, and debit card accounts form a narrow definition of money.
    - Deposits of currency are excluded from this narrow definition, although they may act a substitute for money in a broader definition.

# What Is Money? (cont.)

- Money is a *liquid* asset: it can be easily used to pay for goods and services or to repay debt without substantial transaction costs.
  - ◆ But monetary or liquid assets earn *little or no interest*.
- Illiquid assets require substantial transaction costs in terms of time, effort or fees to convert them to funds for payment.
  - ◆ But they generally earn a higher interest rate or rate of return than monetary assets.

# What Is Money? (cont.)

- Let's group assets into monetary assets (or liquid assets) and non-monetary assets (or illiquid assets).
- The demarcation between the two is arbitrary,
  - ◆ but currency in circulation, checking deposits, debit card accounts, savings deposits, time deposits are generally more liquid than bonds, loans, deposits of currency in the foreign exchange markets, stocks, real estate, and other assets.

# Money Supply

- The central bank substantially controls the quantity of money that circulates in an economy, the **money supply**.
  - ◆ In the US, the central banking system is the Federal Reserve System.
    - The Federal Reserve System directly regulates the amount of currency in circulation.
    - It indirectly influences the amount of checking deposits, debit card accounts, and other monetary assets.

# Money Demand

- **Money demand** represents the amount of monetary assets that people are willing to hold (instead of illiquid assets).
  - ◆ What influences willingness to hold monetary assets?
  - ◆ We consider individual demand of money and aggregate demand of money

# What Influences Demand of Money for Individuals and Institutions?

- 1. Interest rates/expected rates of return** on monetary assets relative to the expected rates of returns on non-monetary assets.
- 2. Risk:** the risk of holding monetary assets principally comes from unexpected inflation, which reduces the purchasing power of money.
  - ◆ but many other assets have this risk too, so this risk is not very important in defining the demand of monetary assets versus non-monetary assets
- 3. Liquidity:** A need for greater liquidity occurs when the price of transactions increases or the quantity of goods bought in transactions increases.

# What Influences Aggregate Demand of Money?

- 1. Interest rates/expected rates of return:** monetary assets pay little or no interest, so the interest rate on non-monetary assets like bonds, loans, and deposits is the opportunity cost of holding monetary assets.
  - ◆ A higher interest rate means a higher opportunity cost of holding monetary assets → lower demand of money.
- 2. Prices:** the prices of goods and services bought in transactions will influence the willingness to hold money to conduct those transactions.
  - ◆ A higher level of average prices means a greater need for liquidity to buy the same amount of goods and services → higher demand of money.

# What Influences Aggregate Demand of Money? (cont.)

3. **Income:** greater income implies more goods and services can be bought, so that more money is needed to conduct transactions.
  - ◆ A higher real national income (GNP) means more goods and services are being produced and bought in transactions, increasing the need for liquidity → higher demand of money.

# A Model of Aggregate Money Demand

The aggregate demand of money can be expressed as:

$$M^d = P \times L(R, Y)$$

where:

$P$  is the price level

$Y$  is real national income

$R$  is a measure of interest rates on non-monetary assets

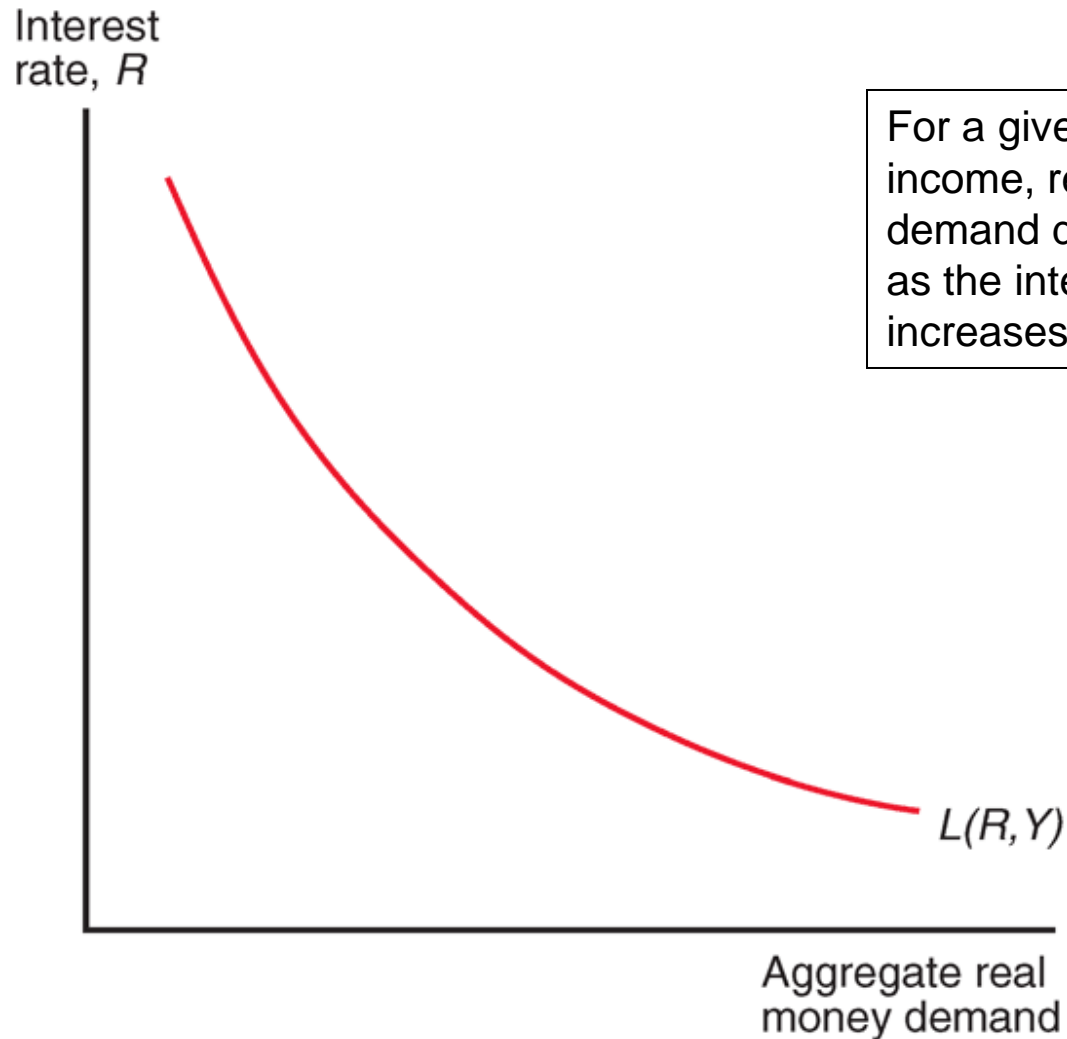
$L(R, Y)$  is the aggregate demand of real monetary assets

Alternatively:

$$M^d/P = L(R, Y)$$

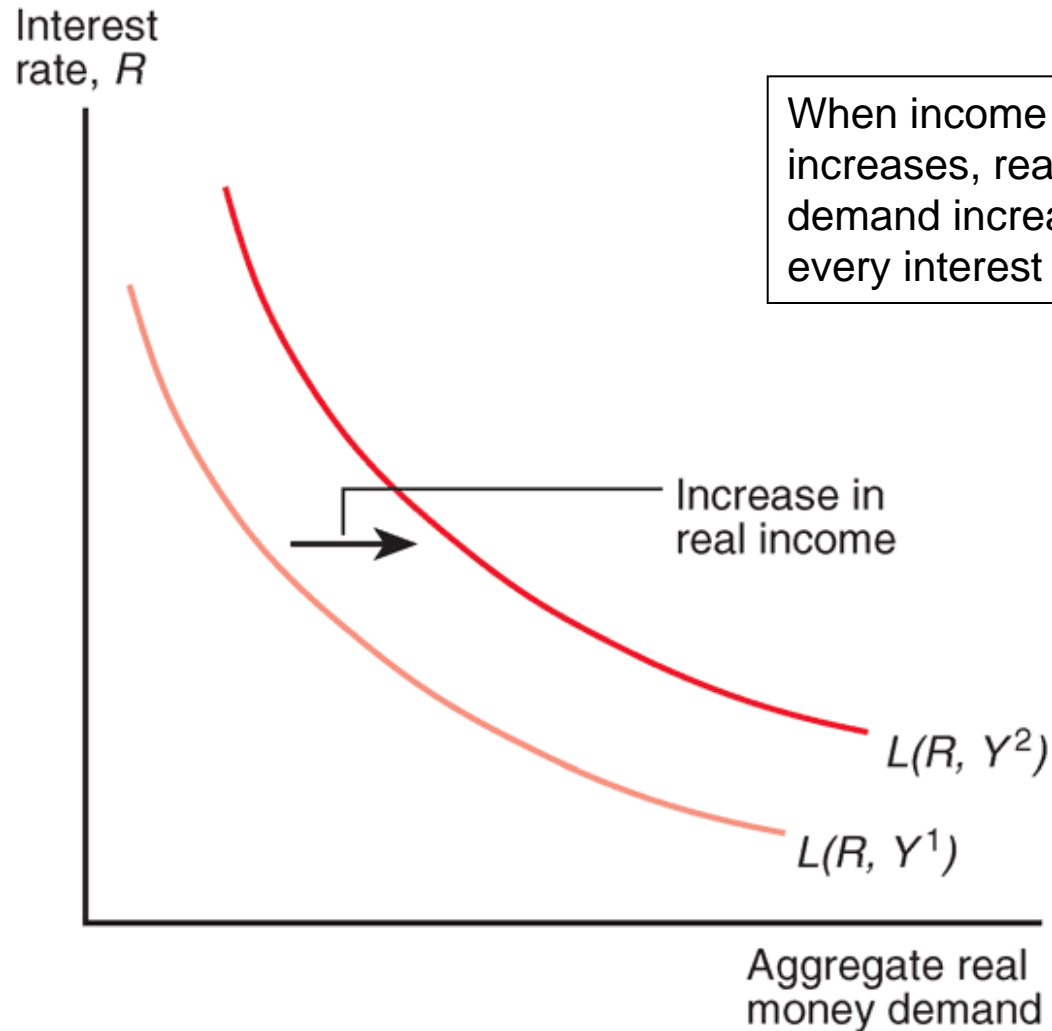
Aggregate demand of real monetary assets is a function of national income and interest rates.

# Fig. 14-1: Aggregate Real Money Demand and the Interest Rate



For a given level of income, real money demand decreases as the interest rate increases.

# Fig. 14-2: Effect on the Aggregate Real Money Demand Schedule of a Rise in Real Income



# A Model of the Money Market

- The money market is where monetary or liquid assets, which are loosely called “money,” are lent and borrowed.
  - ◆ Monetary assets in the money market generally have low interest rates compared to interest rates on bonds, loans, and deposits of currency in the foreign exchange markets.
  - ◆ Domestic interest rates directly affect rates of return on domestic currency deposits in the foreign exchange markets.

# A Model of the Money Market

- When no shortages (excess demand) or surpluses (excess supply) of monetary assets exist, the model achieves an equilibrium:

$$M^s = M^d$$

- Alternatively, when the quantity of real monetary assets supplied matches the quantity of real monetary assets demanded, the model achieves an equilibrium:

$$M^s/P = L(R, Y)$$

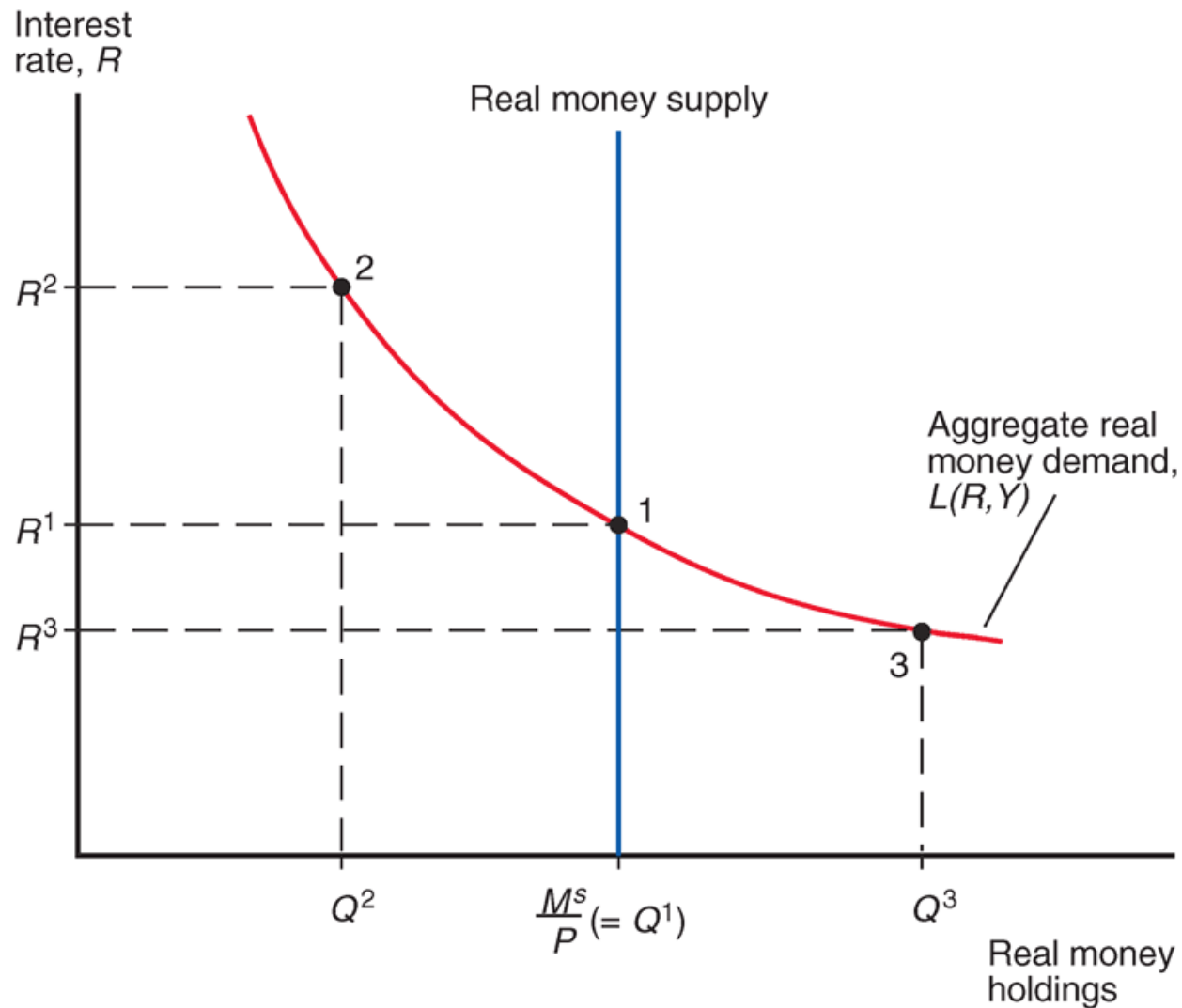
# A Model of the Money Market (cont.)

- When there is an excess supply of monetary assets, there is an excess demand for interest bearing assets like bonds, loans, and deposits.
  - ◆ People with an excess supply of monetary assets are willing to offer or accept interest-bearing assets (by giving up their money) at lower interest rates.
  - ◆ Others are more willing to hold additional monetary assets as interest rates (the opportunity cost of holding monetary assets) falls.

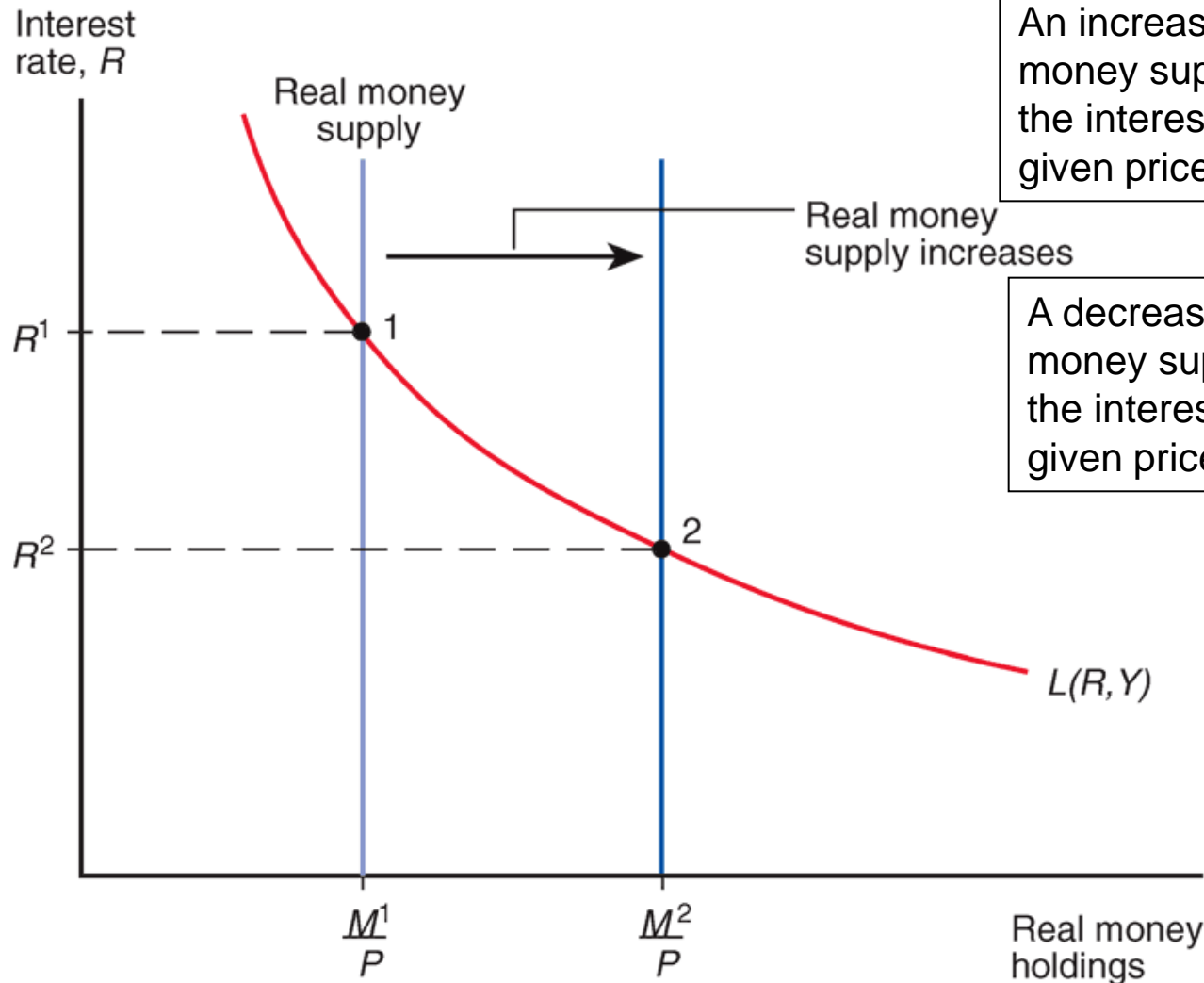
# A Model of the Money Market (cont.)

- When there is an excess demand of monetary assets, there is an excess supply of interest bearing assets like bonds, loans, and deposits.
  - ◆ People who desire monetary assets but do not have access to them are willing to sell non-monetary assets in return for the monetary assets that they desire.
  - ◆ Those with monetary assets are more willing to give them up in return for interest-bearing assets as interest rates (the opportunity cost of holding money) rises.

# Fig 14-3: Determination of the Equilibrium Interest Rate



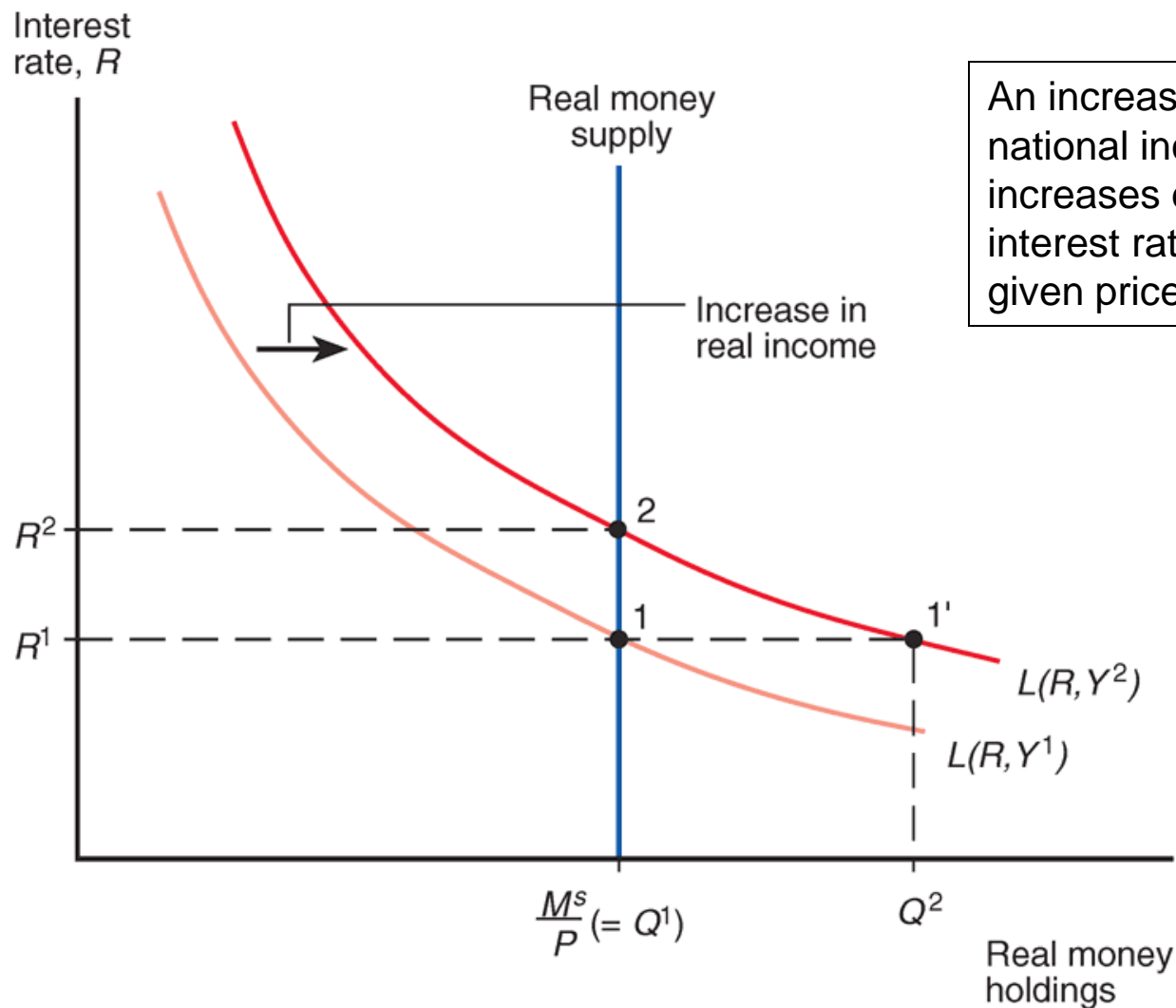
# Fig 14-4: Effect of an Increase in the Money Supply on the Interest Rate



An increase in the money supply lowers the interest rate for a given price level.

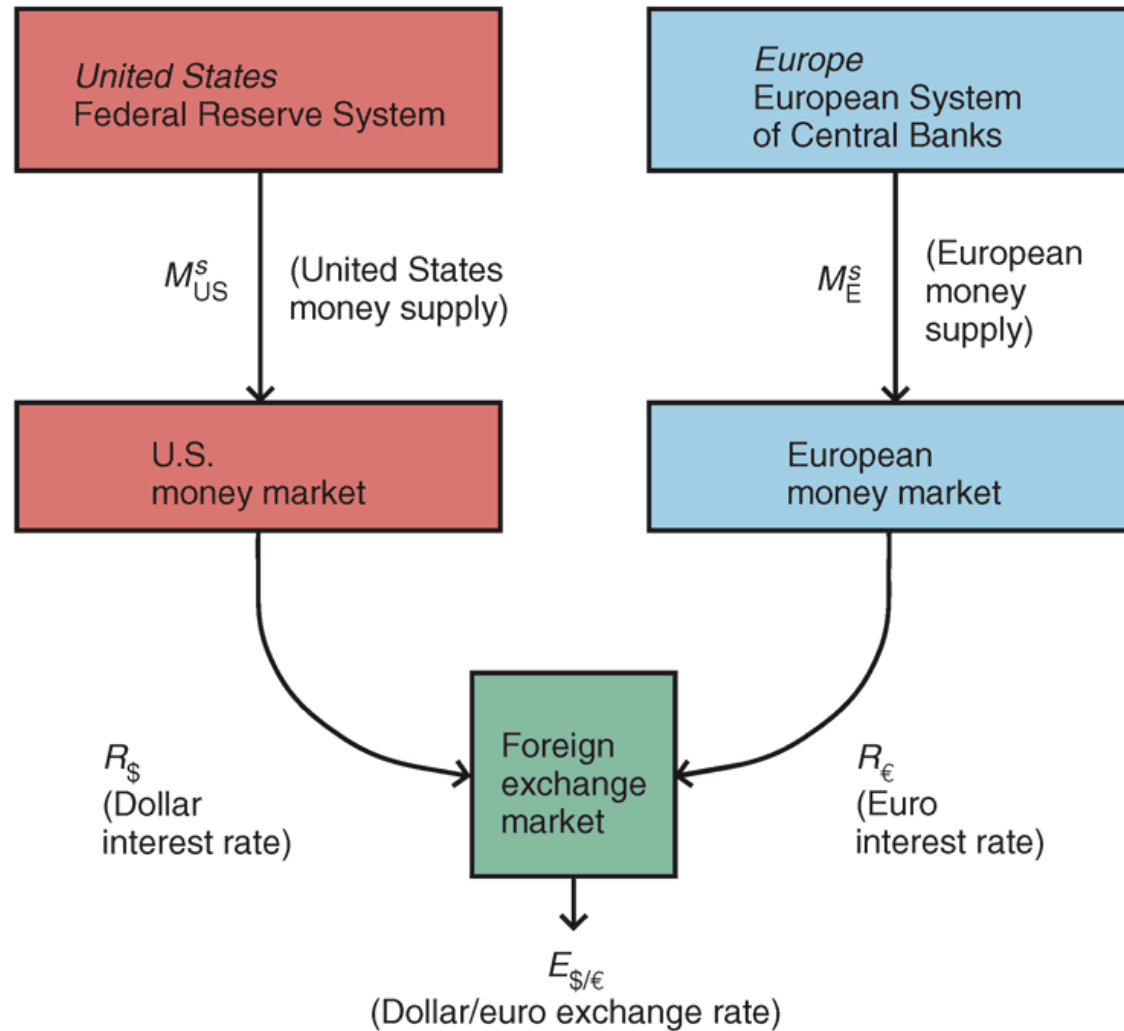
A decrease in the money supply raises the interest rate for a given price level.

# Fig 14-5: Effect on the Interest Rate of a Rise in Real Income

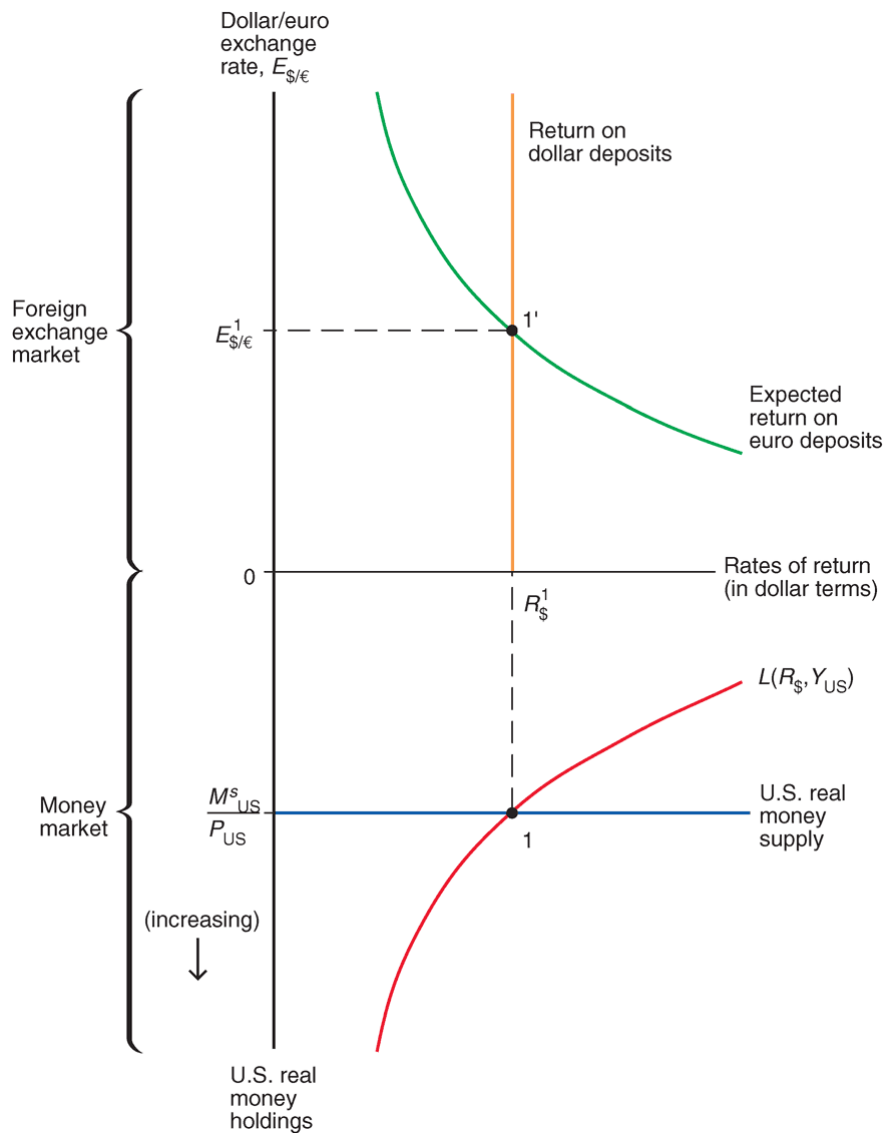


An increase in national income increases equilibrium interest rates for a given price level.

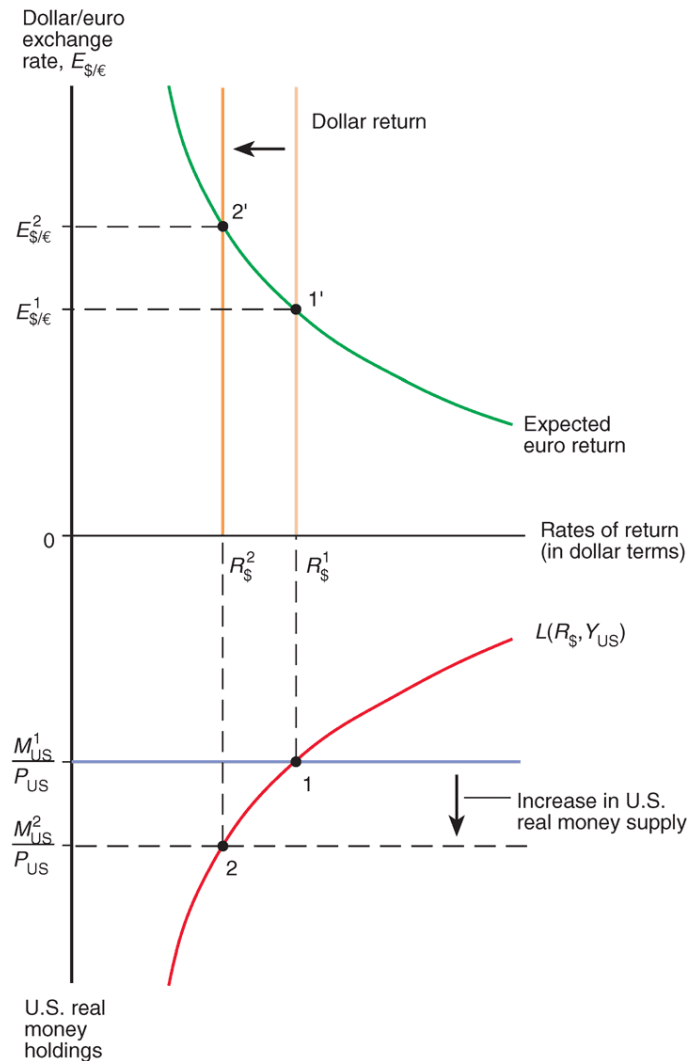
# Fig 14-7: Money Market/Exchange Rate Linkages



# Fig 14-6: Simultaneous Equilibrium in the U.S. Money Market and the Foreign Exchange Market



# Fig 14-8: Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply



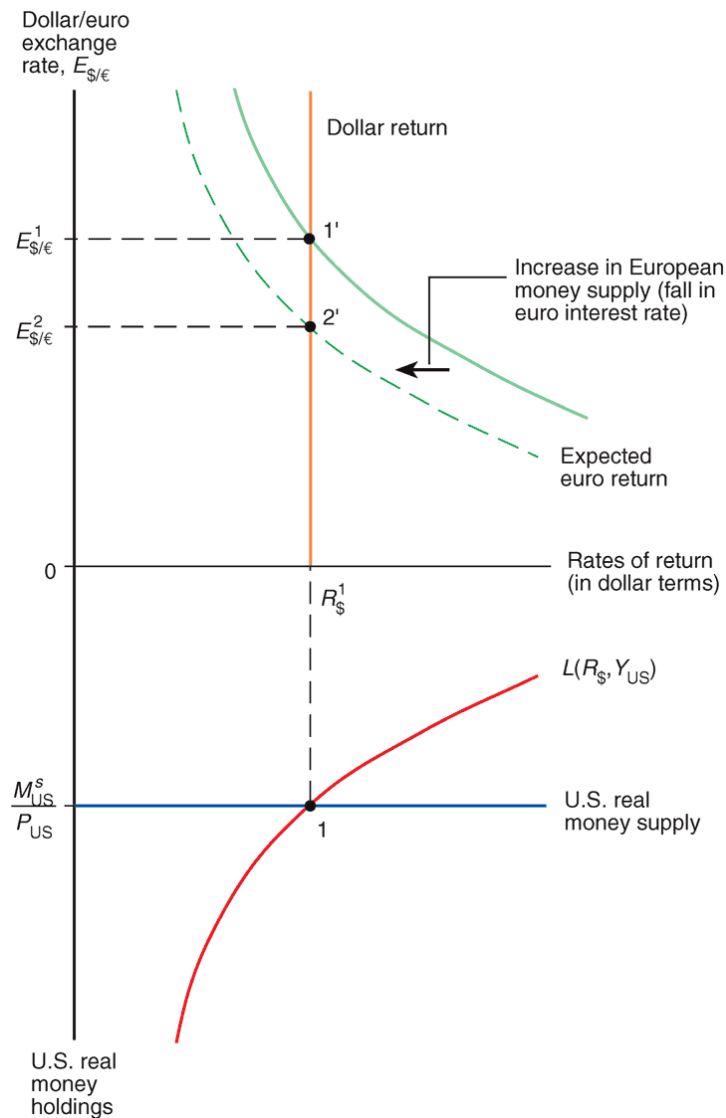
# Changes in the Domestic Money Supply

- An increase in a country's money supply causes interest rates to fall, rates of return on domestic currency deposits to fall, and the domestic currency to depreciate.
- A decrease in a country's money supply causes interest rates to rise, rates of return on domestic currency deposits to rise, and the domestic currency to appreciate.

# Changes in the Foreign Money Supply

- How would a change in the supply of euros affect the U.S. money market and foreign exchange markets?
- An increase in the supply of euros causes a depreciation of the euro (appreciation of the dollar).
- A decrease in the supply of euros causes an appreciation of the euro (a depreciation of the dollar).

# Fig 14-9: Effect of an Increase in the European Money Supply on the Dollar/Euro Exchange Rate



## Changes in the Foreign Money Supply (cont.)

- The increase in the supply of euros reduces interest rates in the EU, reducing the expected rate of return on euro deposits.
- This reduction in the expected rate of return on euro deposits causes the euro to depreciate.
- We predict no change in the U.S. money market due to the change in the supply of euros.

# Long Run and Short Run

- In the *short run*, prices do not have sufficient time to adjust to market conditions.
  - ◆ the analysis heretofore has been a short run analysis.
- In the *long run*, prices of factors of production and of output have sufficient time to adjust to market conditions.
  - ◆ Wages adjust to the demand and supply of labor.
  - ◆ Real output and income are determined by the amount of workers and other factors of production—by the economy's productive capacity—not by the quantity of money supplied.
  - ◆ (Real) interest rates depend on the supply of saved funds and the demand of saved funds.

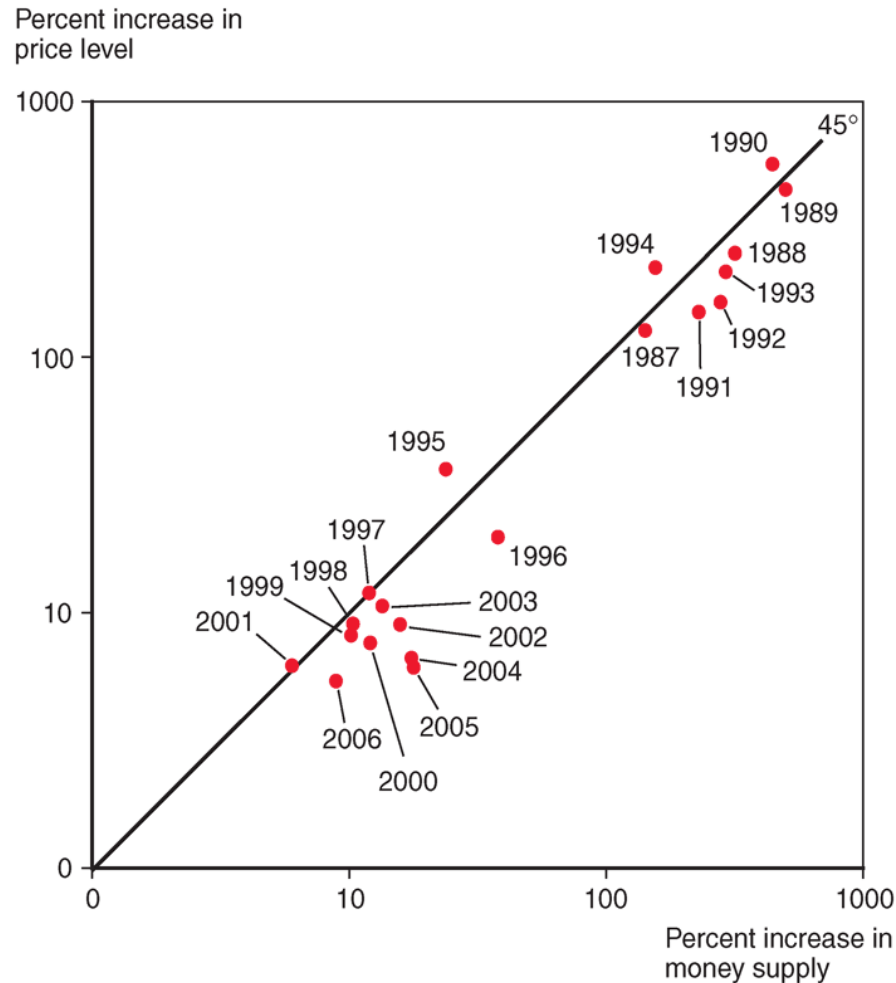
## Long Run and Short Run (cont.)

- In the long run, the quantity of money supplied is predicted not to influence the amount of output, (real) interest rates, and the aggregate demand of real monetary assets  $L(R, Y)$ .
- However, the quantity of money supplied is predicted to make level of average prices *adjust proportionally* in the long run.
  - ◆ The equilibrium condition  $M^s/P = L(R, Y)$  shows that  $P$  is predicted to adjust proportionally when  $M^s$  adjusts because  $L(R, Y)$  does not change.

# Long Run and Short Run (cont.)

- In the long run, there is a direct relationship between the inflation rate and changes in the money supply.
  - ◆  $M^s = P \times L(R, Y)$
  - ◆  $P = M^s / L(R, Y)$
  - ◆  $\Delta P / P = \Delta M^s / M^s - \Delta L / L$
  - ◆ The inflation rate is predicted to equal the growth rate in money supply minus the growth rate in money demand.

# Fig 14-10: Average Money Growth and Inflation in Western Hemisphere Developing Countries, by Year, 1987–2006



**Source:** IMF, *World Economic Outlook*, various issues. Regional aggregates are weighted by shares of dollar GDP in total regional dollar GDP.

# Money and Prices in the Long Run

- How does a change in the money supply cause prices of output and inputs to change?
- 1. **Excess demand of goods and services:** a higher quantity of money supplied implies that people have more funds available to pay for goods and services.
  - ◆ To meet high demand, producers hire more workers, creating a strong demand of labor services, or make existing employees work harder.
  - ◆ Wages rise to attract more workers or to compensate workers for overtime.
  - ◆ Prices of output will eventually rise to compensate for higher costs.

# Money and Prices in the Long Run (cont.)

- ◆ Alternatively, for a fixed amount of output and inputs, producers can charge higher prices and still sell all of their output due to the high demand.

## 2. Inflationary expectations:

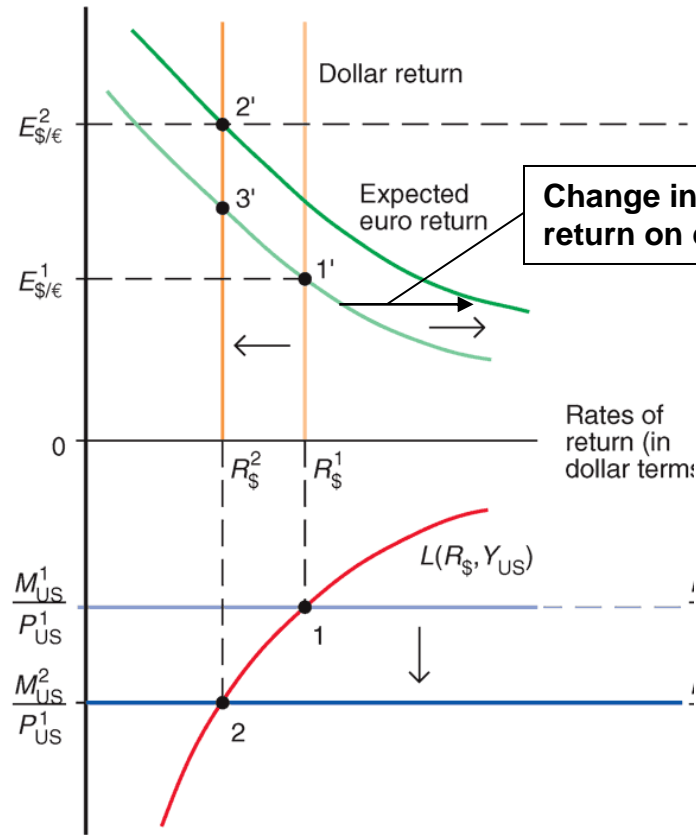
- ◆ If workers expect future prices to rise due to an expected money supply increase, they will want to be compensated.
- ◆ And if producers expect the same, they are more willing to raise wages.
- ◆ Producers will be able to match higher costs if they expect to raise prices.
- ◆ Result: expectations about inflation caused by an expected increase in the money supply causes actual inflation.

# Money, Prices, Exchange Rates, and Expectations

- When we consider price changes in the long run, inflationary expectations will have an effect in foreign exchange markets.
- Suppose that expectations about inflation change as people change their minds, but actual adjustment of prices occurs afterwards.

# Fig 14-12: Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, $Y$ )

Dollar/euro exchange rate,  $E_{\$/\epsilon}$



**Change in expected return on euro deposits**

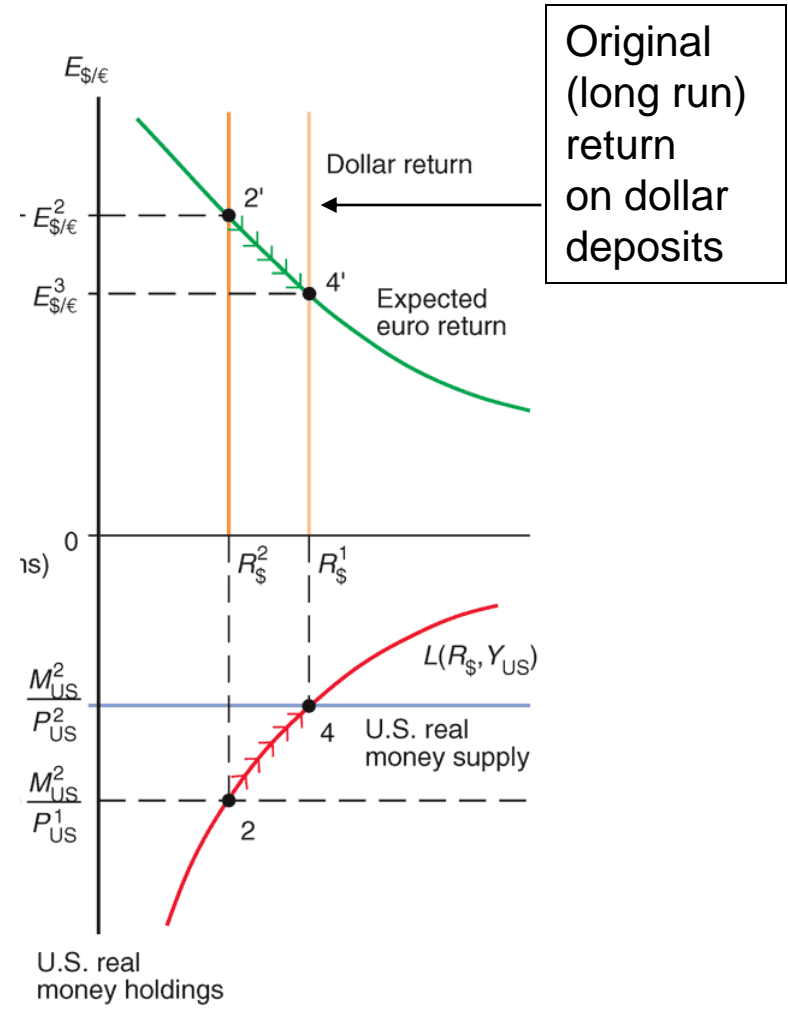
The expected return on euro deposits rises because of inflationary expectations:

- The dollar is expected to be less valuable when buying goods and services and less valuable when buying euros.
- The dollar is expected to depreciate, increasing the return on deposits in euros.

(a) Short-run effects

# Fig 14-12: Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, $Y$ )

As prices increase, the real money supply decreases and the domestic interest rate returns to its long run rate.



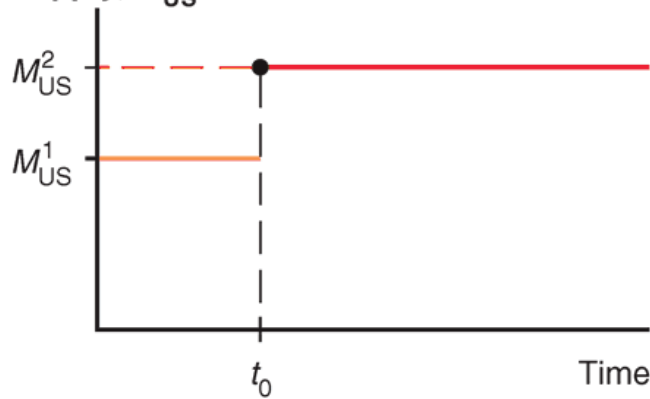
(b) Adjustment to long-run equilibrium

# Money, Prices, and Exchange Rates in the Long Run (cont.)

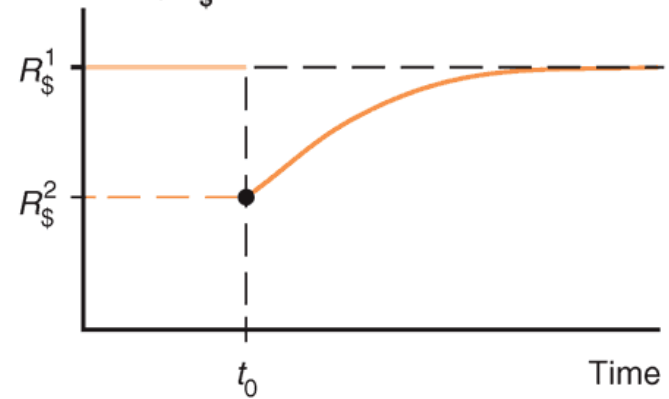
- A permanent increase in a country's money supply causes a proportional long run depreciation of its currency.
  - ◆ However, the dynamics of the model predict a large depreciation first and a smaller *subsequent appreciation*.
- A permanent decrease in a country's money supply causes a proportional long run appreciation of its currency.
  - ◆ However, the dynamics of the model predict a large appreciation first and a smaller *subsequent depreciation*.

# Fig 14-13: Time Paths of U.S. Economic Variables After a Permanent Increase in the U.S. Money Supply

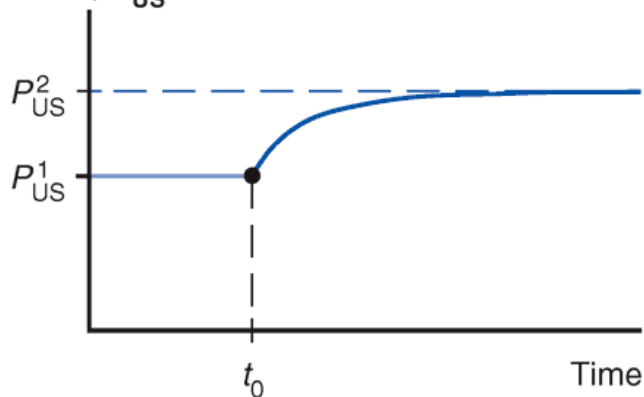
(a) U.S. money supply,  $M_{US}$



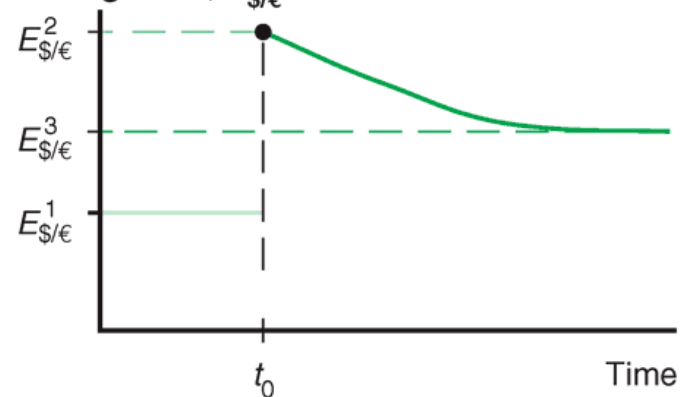
(b) Dollar interest rate,  $R_{\$}$



(c) U.S. price level,  $P_{US}$



(d) Dollar/euro exchange rate,  $E_{\$/\epsilon}$

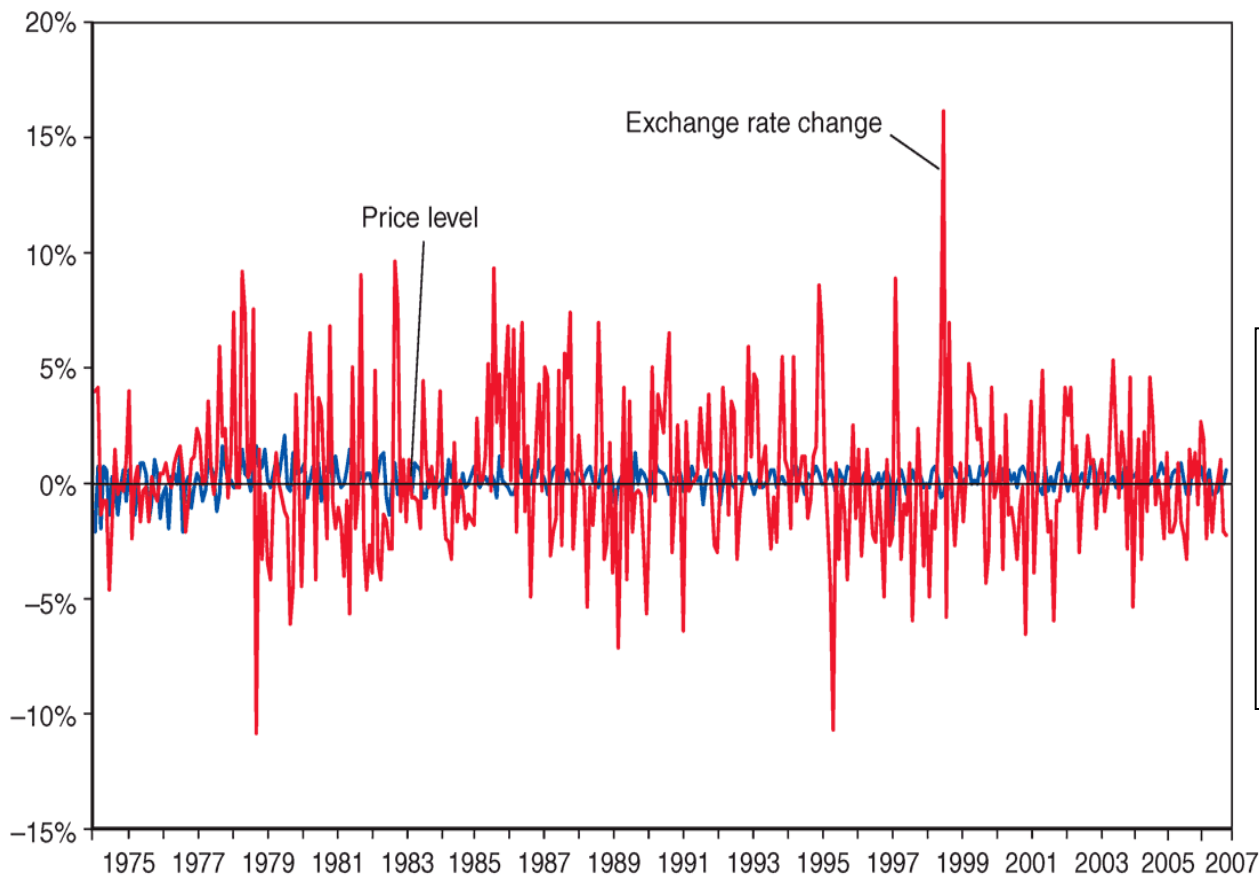


# Exchange Rate Overshooting

- The exchange rate is said to **overshoot** when its immediate response to a change is greater than its long run response.
- Overshooting is predicted to occur when monetary policy has an immediate effect on interest rates, but not on prices and (expected) inflation.
- Overshooting helps explain why exchange rates are so *volatile*.

# Fig 14-11: Month-to-Month Variability of the Dollar/Yen Exchange Rate and of the U.S./Japan Price Level Ratio, 1974–2007

Changes in exchange rates and price level ratios—U.S./Japan (percent per month)



Changes in price levels are less volatile, suggesting that price levels change slowly.

Exchange rates are influenced by interest rates and expectations, which may change rapidly, making exchange rates volatile.

Source: International Monetary Fund, *International Financial Statistics*

# Summary

1. Money demand for individuals and institutions is primarily determined by interest rates and the need for liquidity, the latter of which is influenced by prices and income.
2. Aggregate money demand is primarily determined by interest rates, the level of average prices, and national income.
  - ◆ Aggregate demand of real monetary assets depends negatively on the interest rate and positively on real national income.

## Summary (cont.)

3. When the money market is in equilibrium, there are no surpluses or shortages of monetary assets: the quantity of real monetary assets supplied matches the quantity of real monetary assets demanded.
4. Short run scenario: changes in the money supply affect domestic interest rates, as well as the exchange rate.
  - ◆ An increase in the domestic money supply
    1. lowers domestic interest rates,
    2. lowering the rate of return on deposits of domestic currency,
    3. causing the domestic currency to depreciate.

# Summary (cont.)

5. Long run scenario: changes in the quantity of money supplied are matched by a proportional change in prices, and do not affect real income and real interest rates.
  - ◆ An increase in the money supply
    1. causes expectations about inflation to adjust,
    2. causing the domestic currency to depreciate further,
    3. and causes prices to adjust proportionally in the long run,
    4. causing interest rates return to their long run values,
    5. and causes a proportional long run depreciation in the domestic currency.

## Summary (cont.)

- Interest rates adjust immediately to changes in monetary policy, but prices and (expected) inflation may adjust only in the long run, which results in overshooting of the exchange rate.
  - ◆ Overshooting occurs when the immediate response of the exchange rate due to a change is greater than its long run response.
  - ◆ Overshooting helps explain why exchange rates are so volatile.