

KRUGMAN | OBSTFELD | MELITZ
INTERNATIONAL
ECONOMICS
THEORY & POLICY



TENTH EDITION

ALWAYS LEARNING

Chapter 15

Money, Interest Rates, and Exchange Rates

PEARSON



Preview

- What is money?
- Money supply
- Money demand
- A model of the money market
- A model of the money market and foreign exchange market
- Short-run and long-run effects of changes in money



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 (**M1**) or broadly (**M2, M3**).
 - Narrow definition of money (**M1**): currency in circulation, checking deposits, and debit card accounts.
 - Deposits of currency are excluded from this narrow definition (M1), although they may act as a substitute for money in a broader definition (M2).
- Money is a *liquid* asset: it can be easily used to pay for goods without substantial transaction costs.
 - But monetary or liquid assets earn *little or no interest*.



What Is Money?

- 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.
- Let's group assets into liquid monetary assets (**M1**) and illiquid nonmonetary assets.
- The demarcation between the two is arbitrary,
 - but currency in circulation, checking deposits, and debit card accounts 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 U.S., the central banking system is the Federal Reserve System (FED), in the euroarea it is ECB, in CR it is CNB, in UK it is BoE.
- 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 nonmonetary 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 (bonds, loans, deposit) is the opportunity cost of holding money.
 - A higher interest rate means a higher opportunity cost of holding monetary assets → lower demand of money.
- 2. Prices:** the prices of goods bought in transactions will influence the willingness to hold money to conduct those transactions.
 - A higher price level means a greater need for liquidity to buy the same amount of goods and services → higher demand of money.
- 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.



Aggregate Money Demand

The aggregate demand of money can be expressed as:

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

P is the price level

Y is real national income

R is a measure of interest rates on nonmonetary assets

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

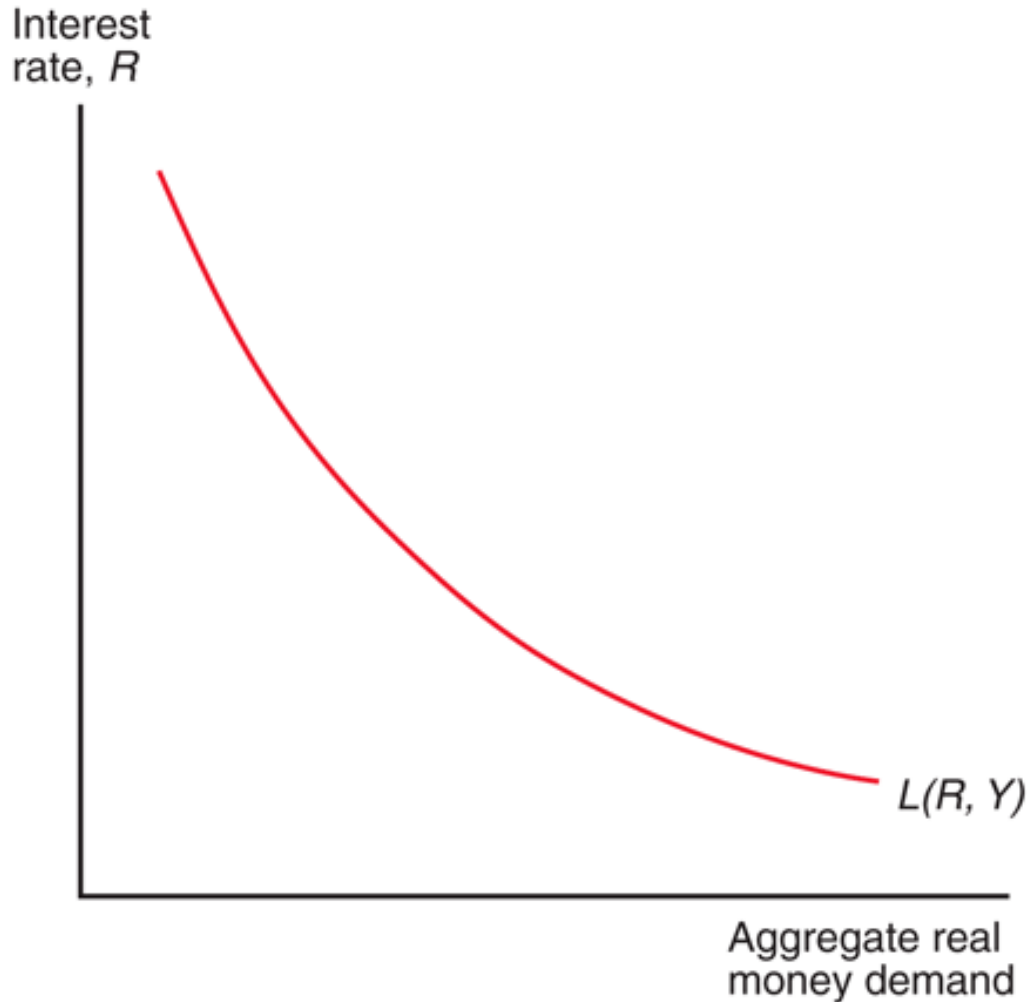
Alternatively:

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

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



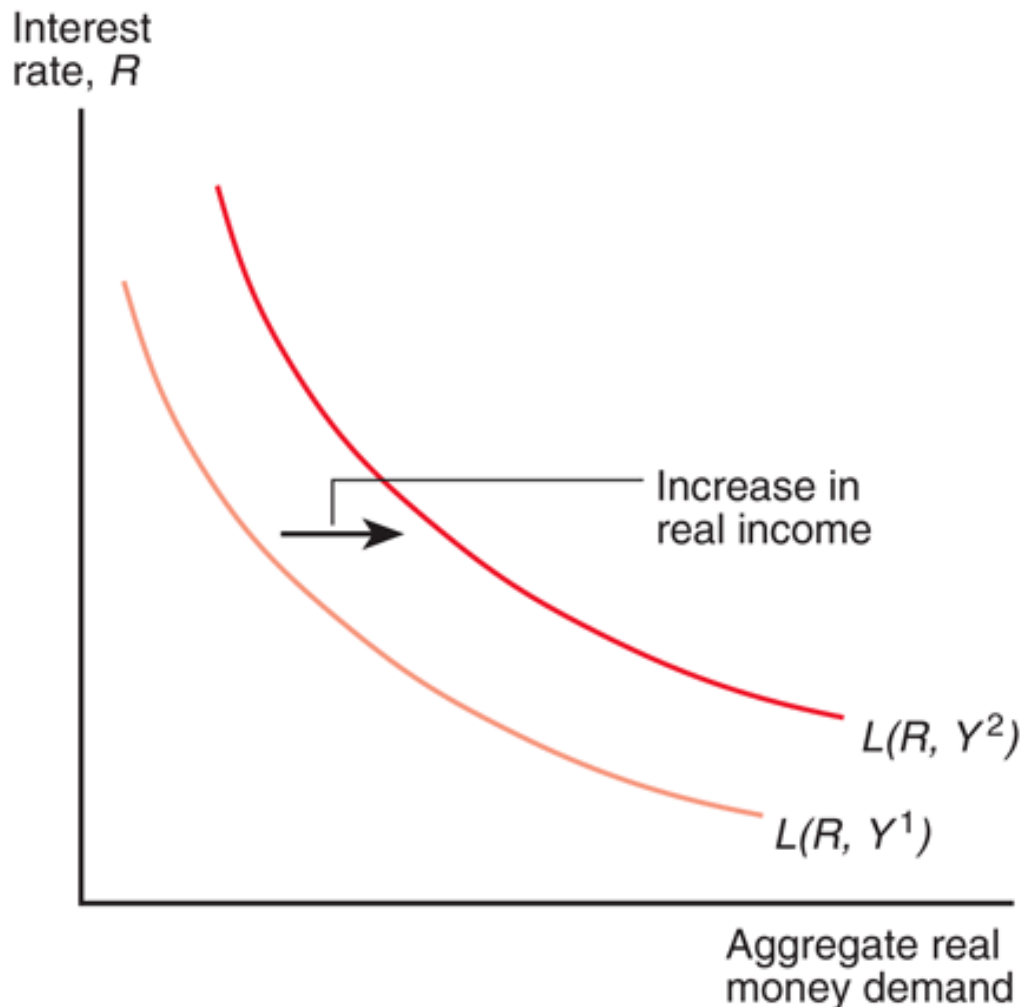
Fig. 15-1: Aggregate Real Money Demand and the Interest Rate



The downward-sloping real money demand schedule shows that for a given real income level Y , real money demand rises as the interest rate falls.



Fig. 15-2: Effect on the Aggregate Real Money Demand Schedule of a Rise in Real Income



An increase in real income from Y^1 to Y^2 raises the demand for real money balances at every level of the interest rate and causes the whole demand schedule to shift upward.



A Model of the Money Market

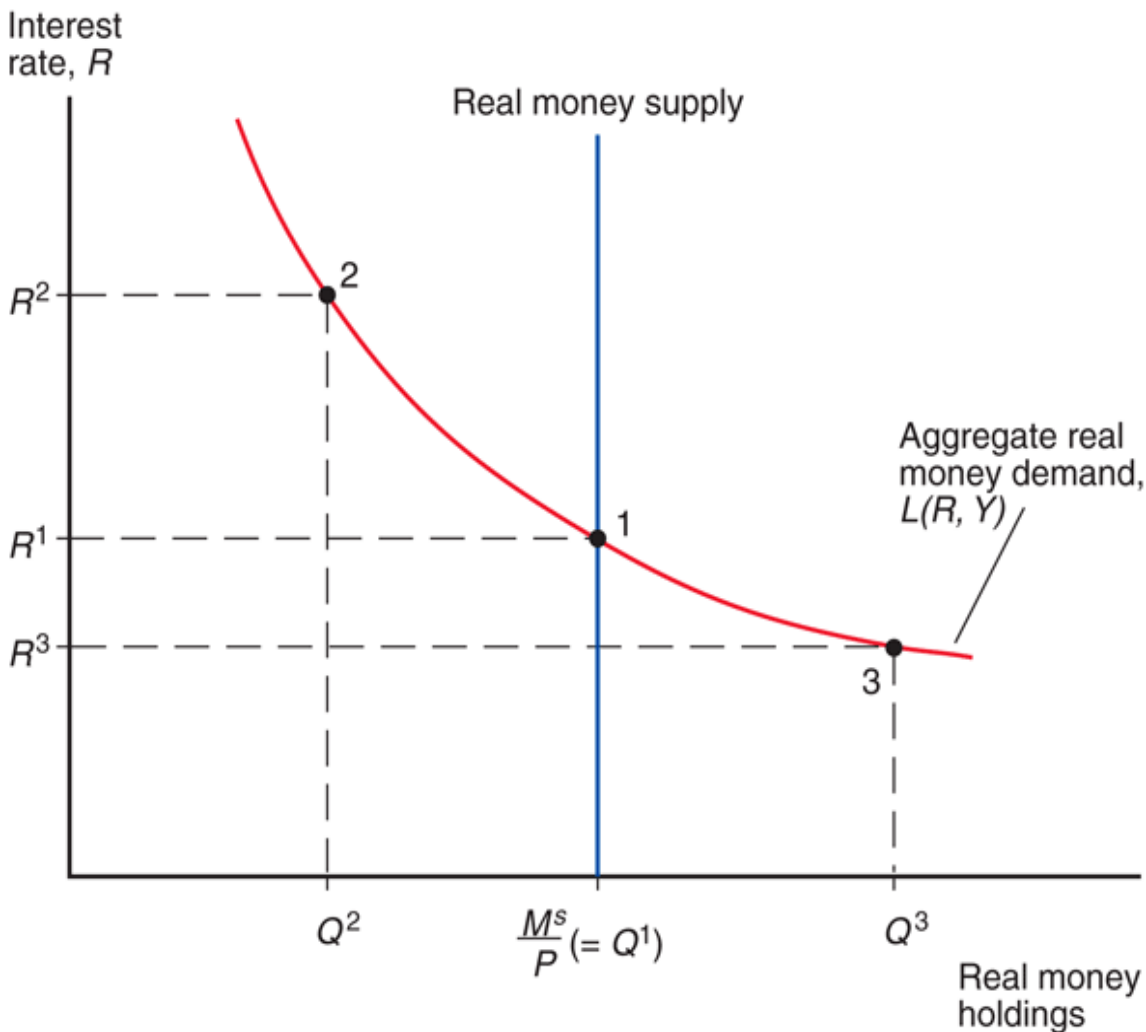
- The money market is where monetary liquid assets, which are loosely called money, are lent and borrowed.
- In equilibrium, the money supply M^s (controlled by central bank) matches the demand for money M^d :

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

- Alternatively, in equilibrium the quantity of real monetary assets supplied matches the quantity of real monetary assets demanded:

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

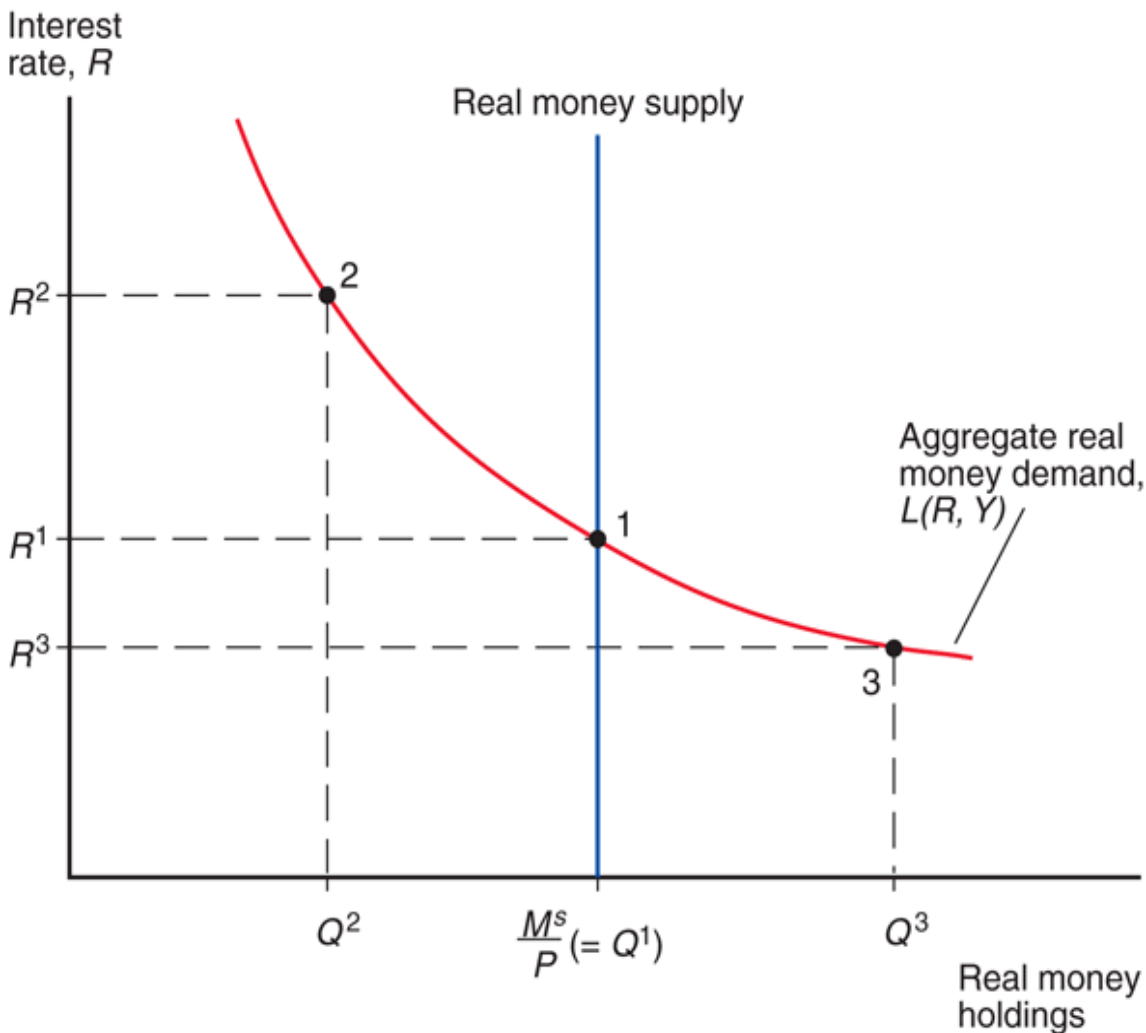
Fig. 15-3: Determination of the Equilibrium Interest Rate



When there is an excess supply of monetary assets (point 2), people hold more money than they want and there is an excess demand for interest-bearing assets like bonds, loans, and deposits.

The excess demand for interest-bearing assets pushes the interest rate downwards (from R^2 to R^1)

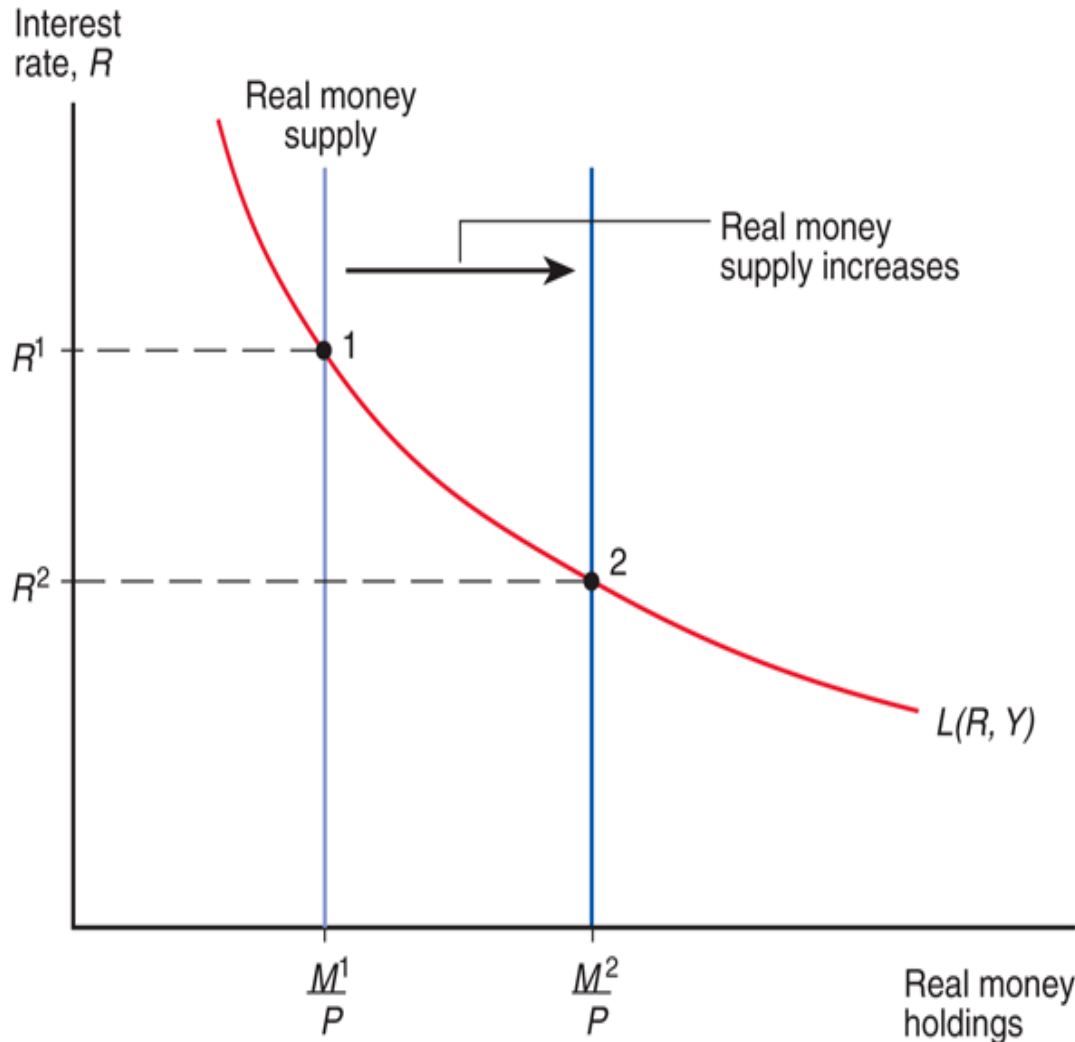
Fig. 15-3: Determination of the Equilibrium Interest Rate



When there is an excess demand for monetary assets (point 3), people want to hold more money than they have and there is an excess supply of interest-bearing assets like bonds, loans, and deposits.

The excess supply of interest-bearing assets pushes the interest rate upwards (from R^3 to R^1).

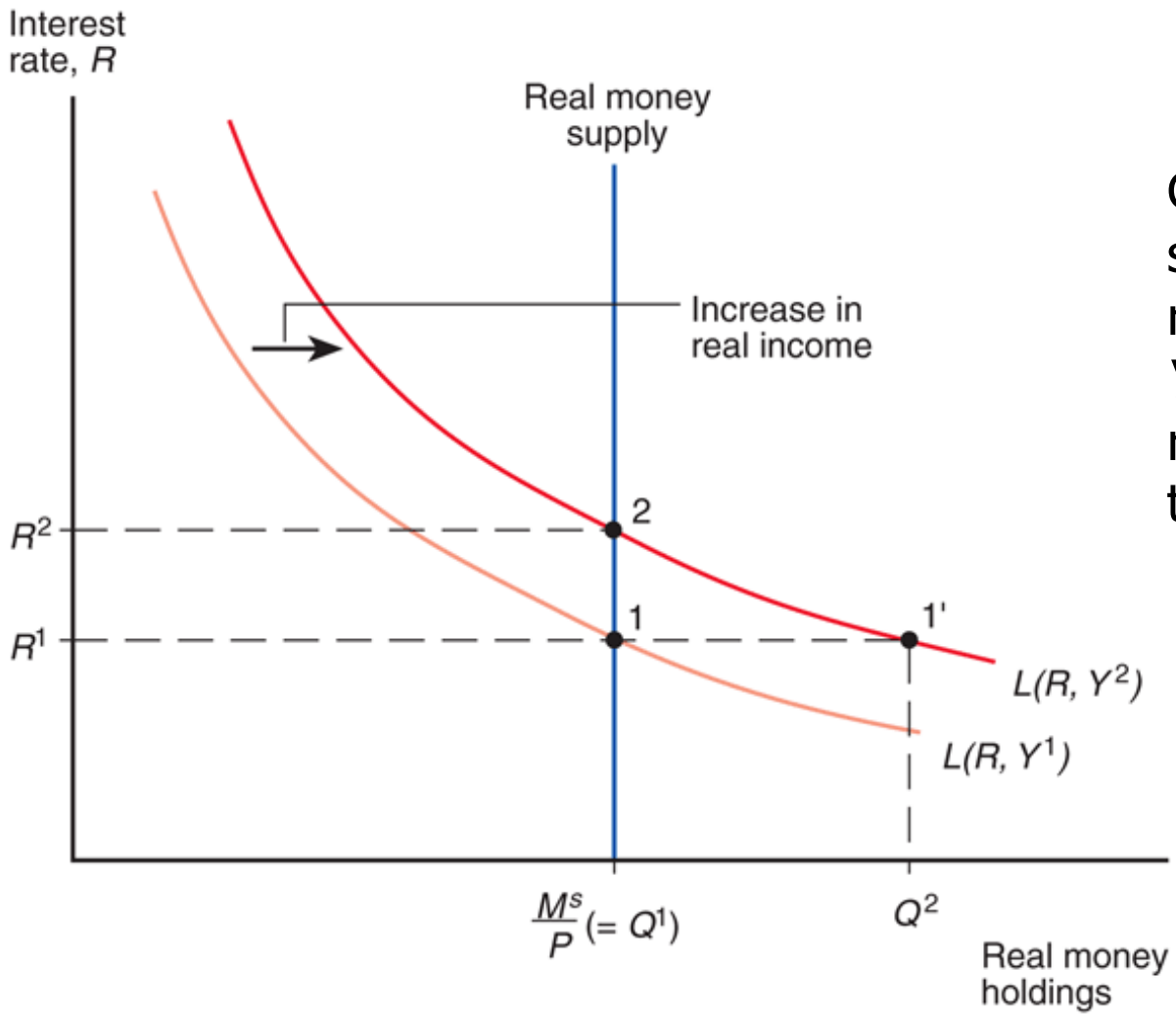
Fig. 15-4: Effect of an Increase in the Money Supply on the Interest Rate



For a given price level P and real income level Y , an increase in the money supply from M^1 to M^2 reduces the interest rate from R^1 (point 1) to R^2 (point 2)



Fig. 15-5: Effect of a Rise in Real Income on the Interest Rate



Given the real money supply M^S/P , a rise in real income from Y^1 to Y^2 raises the interest rate from R^1 (point 1) to R^2 (point 2).



Fig. 15-6: Simultaneous Equilibrium in the U.S. Money Market and the Foreign Exchange Market

The money market and the foreign exchange market are in equilibrium at the interest rate R^1 and exchange rate E^1 .

At these values, money supply equals money demand (point 1) and the interest parity condition holds (point 1').

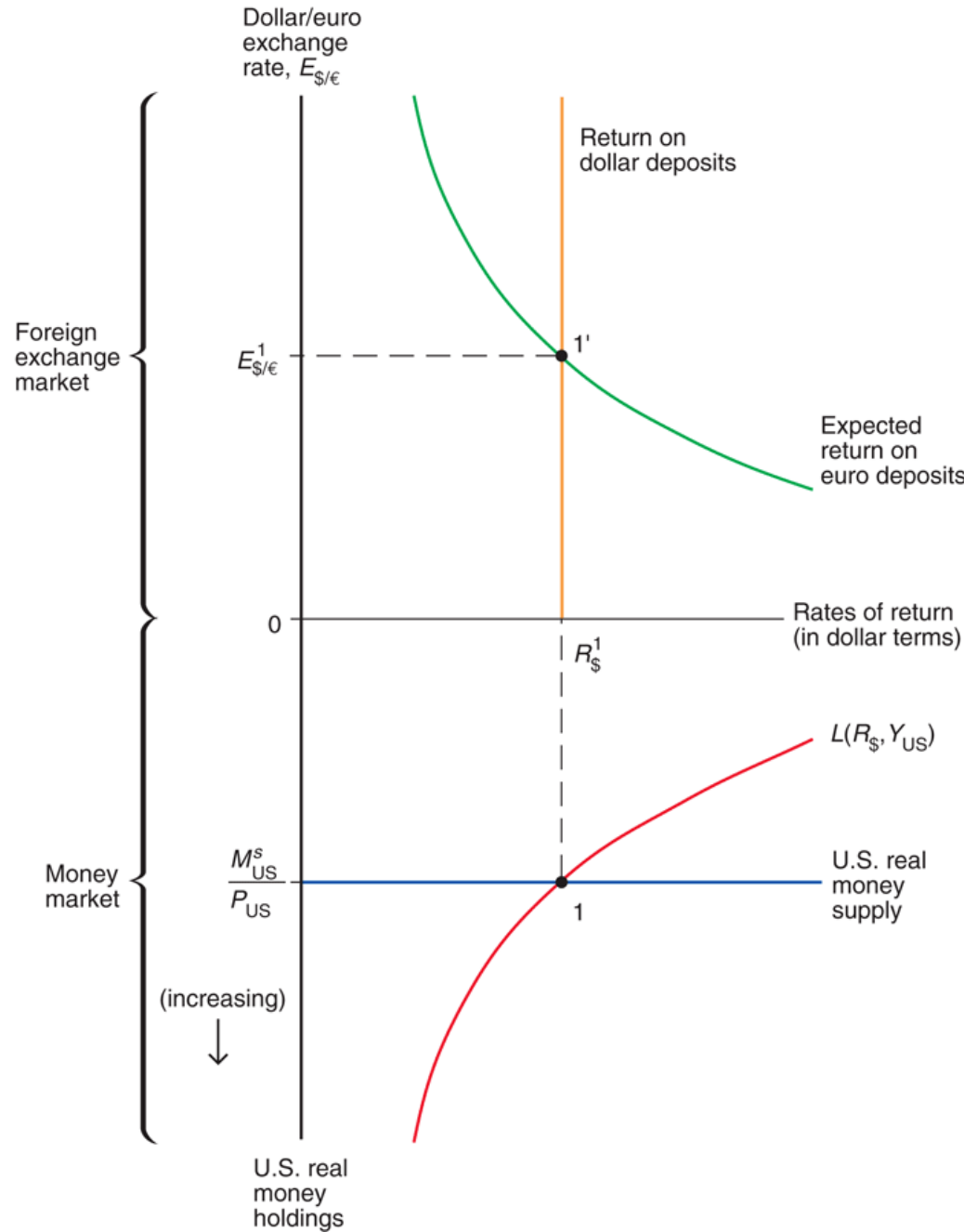




Fig. 15-7: Money Market/Exchange Rate Linkages

Monetary policy actions by the Fed affect the U.S. interest rate, changing the dollar/euro exchange rate that clears the foreign exchange market.

The ECB can affect the exchange rate by changing the European money supply and interest rate.

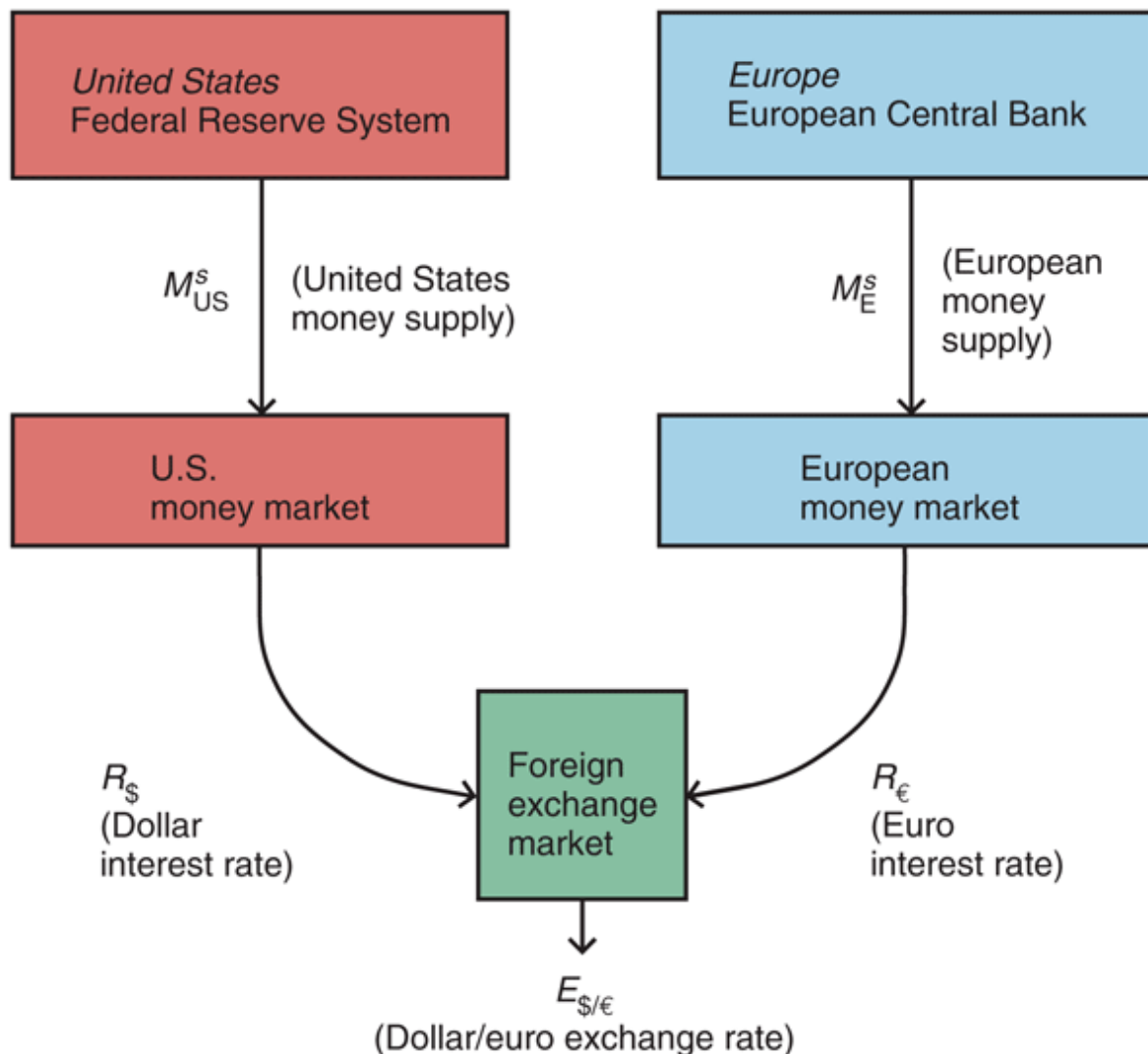




Fig. 15-8: Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply

Given the price level P_{US} and real income Y_{US} , an increase in the money supply from M^1 to M^2 reduces dollar interest rate and the money market equilibrium is reestablished at point 2.

As a result, the dollar depreciates against euro and the foreign exchange market equilibrium is reestablished at point 2'.

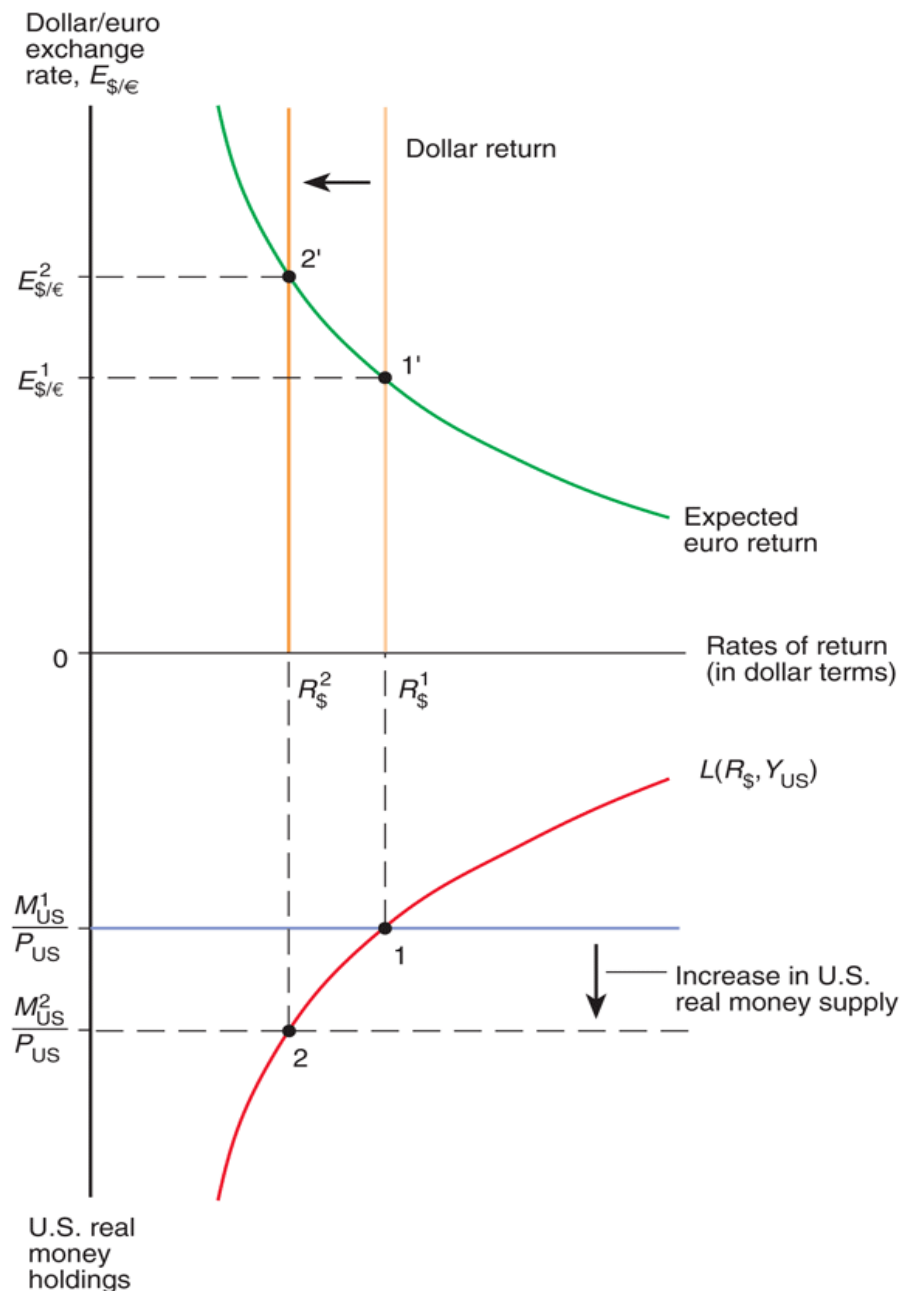


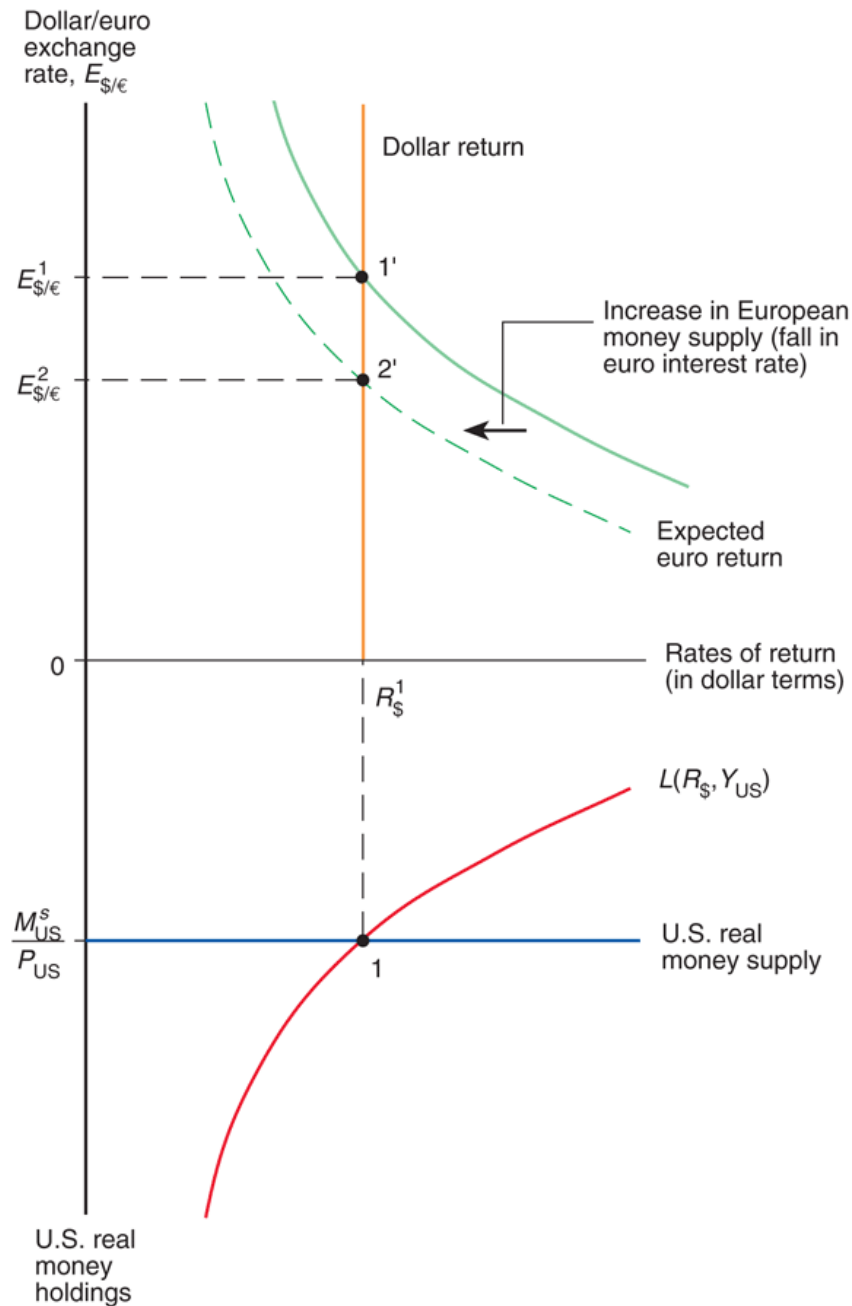


Fig. 15-9: Effect of an Increase in the European Money Supply on the Dollar/Euro Exchange Rate

An increase in Europe's money supply causes the euro interest rate to fall and it also lowers the expected rate of return from the euro deposits in dollar terms.

As a result, the euro depreciates and the dollar appreciates.

It does not have any effect on the money market in U.S.





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 inputs and of output have sufficient time to adjust to market conditions.
 - Wages adjust to the demand and supply of labor.
 - Real output is determined by the economy's productive capacity.
 - (Real) interest rates depend on the supply of saved funds and the demand of saved funds.
- In the long run, the money supply do not to influence the amount of output, (real) interest rates, and the aggregate demand of real monetary assets $L(R, Y)$.



Long Run and Short Run

- In the long run, the price level is predicted to *adjust proportionally* to the quantity of money supplied.
 - 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.
- In the long run, there is a direct relationship between the inflation rate and changes in the money supply.

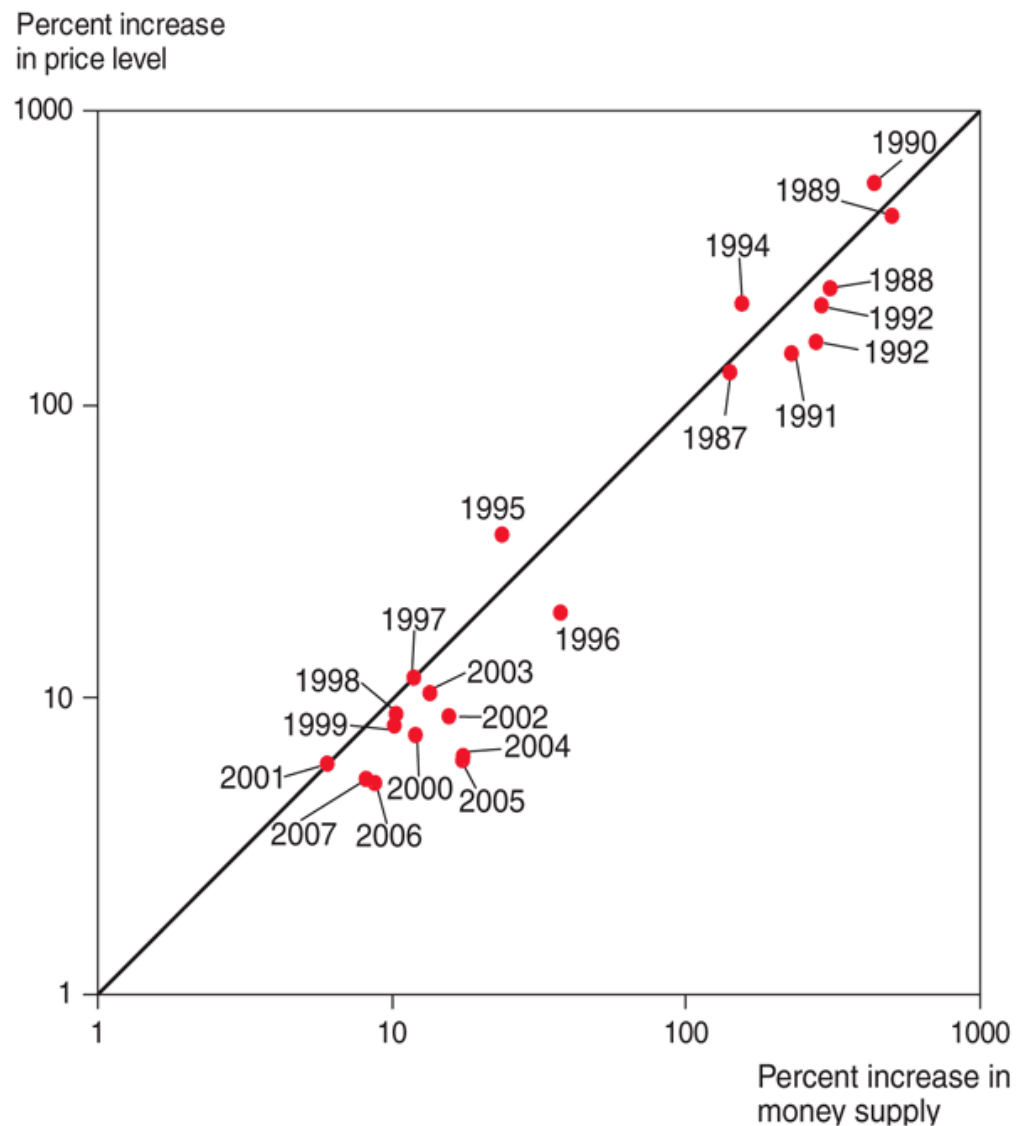
$$M^s = P \times L(R, Y) \Rightarrow P = M^s/L(R, Y)$$

$$\Delta P/P = \Delta M^s/M^s - \Delta L/L$$

- The inflation rate is predicted to equal the growth rate in money supply minus the growth rate in money demand.



Fig. 15-10: Average Money Growth and Inflation in Latin-American Countries, by Year, 1987–2007



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.
 - 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.



Money and Prices in the Long Run

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.

3. Raw material prices

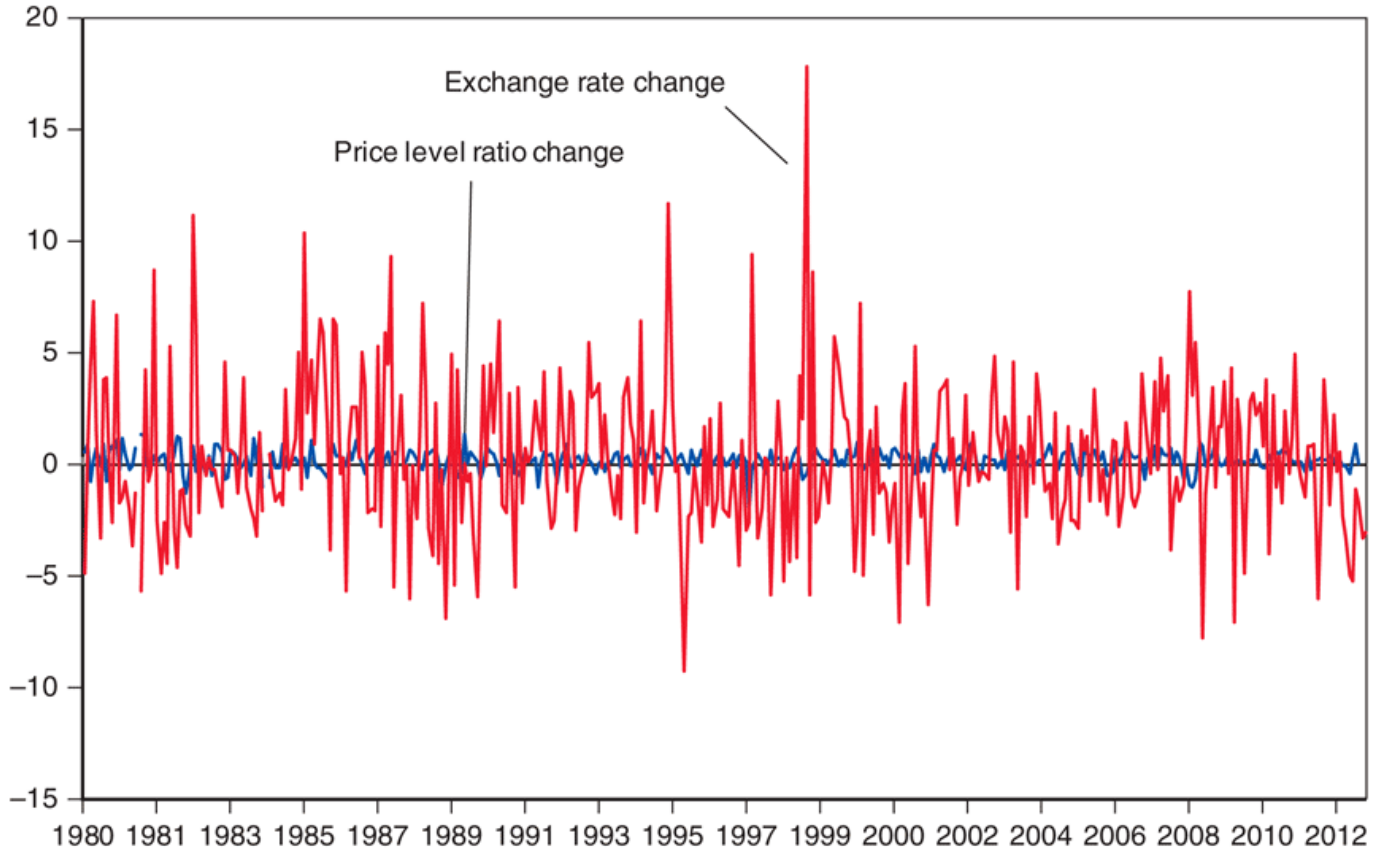
- The prices of raw materials are very flexible.
- An increase in money supply causes the prices of raw materials to jump upward. It raises the production costs of final goods and in the end it forces the producers of final goods to increase their prices as well.



Fig. 15-11: Month-to-Month Variability of the Dollar/Yen Exchange Rate and of the U.S./Japan Price Level Ratio, 1980–2013

Changes in exchange rate and price level ratios-U.S./Japan (percent change per month)

MyEconLab Real-time data



Source: Price levels from International Monetary Fund, *International Financial Statistics*. Exchange rate from Global Financial Data.



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. 15-12: Short-Run and Long-Run Effects of an Increase in the U.S. Money Supply (Given Real Output, Y)

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*.

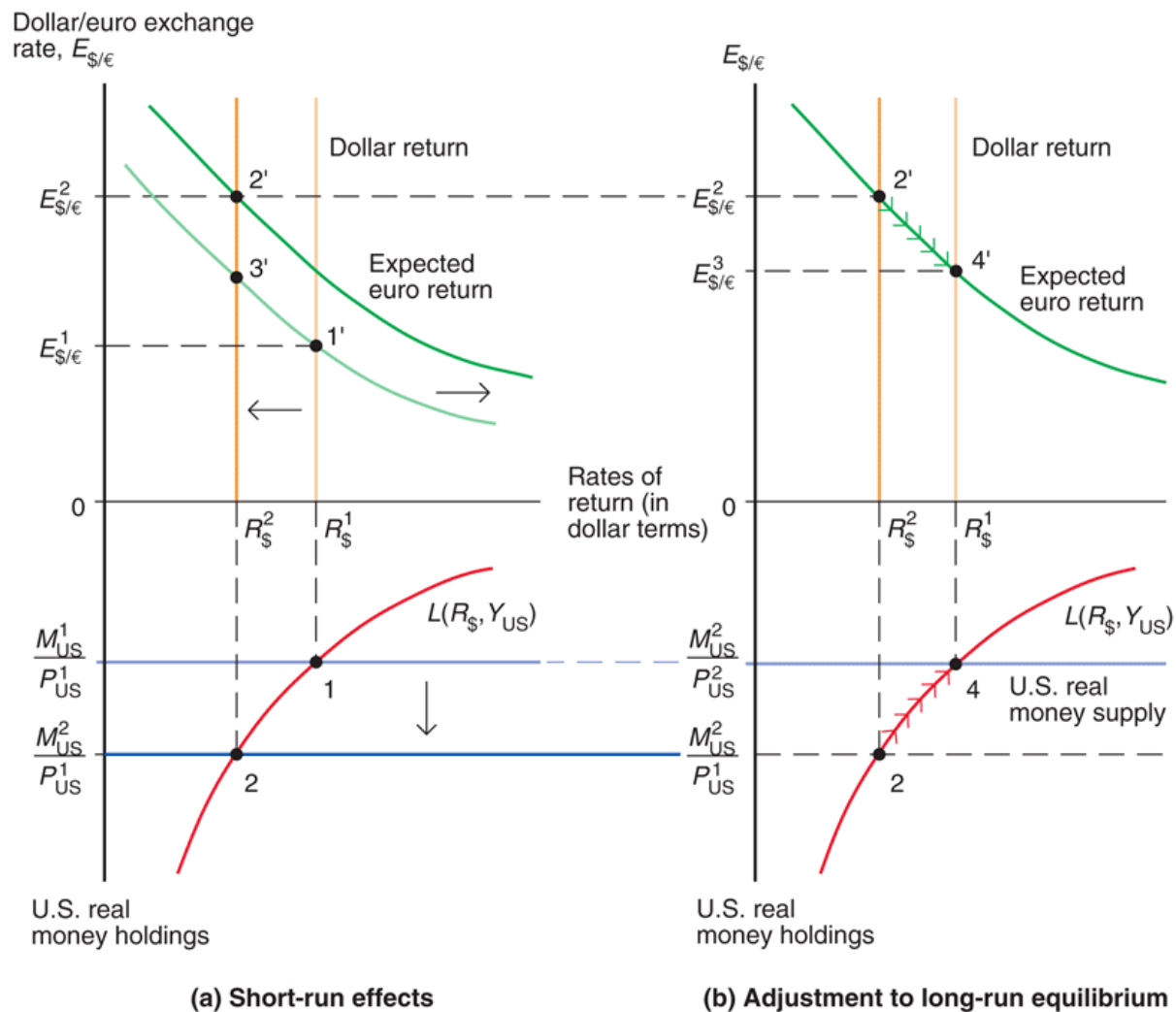
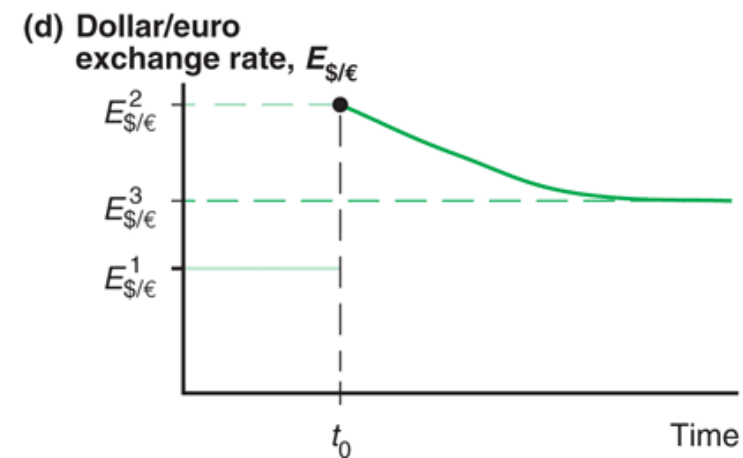
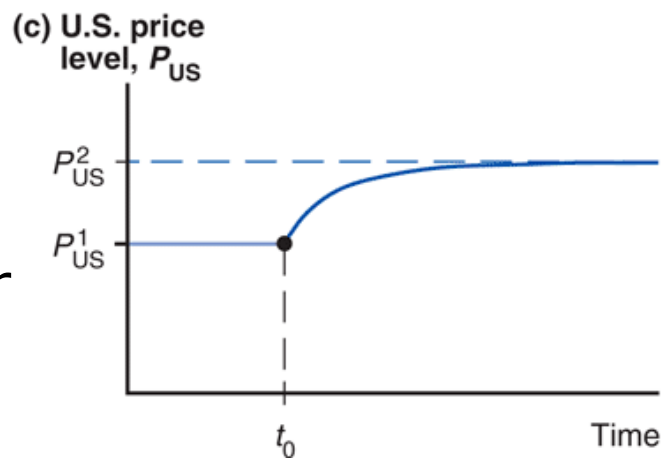
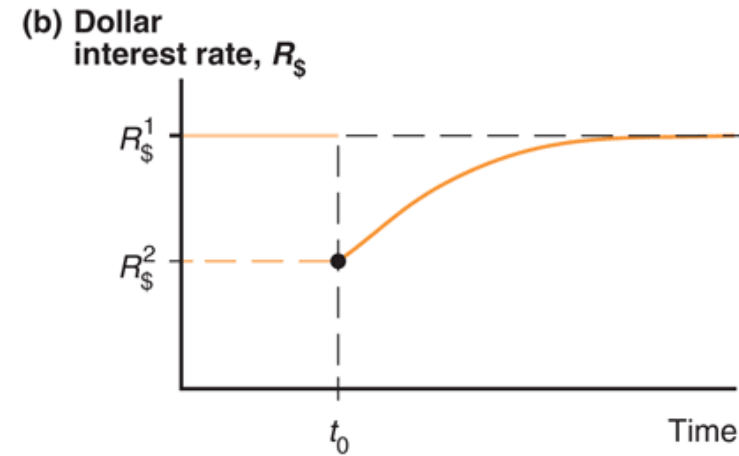
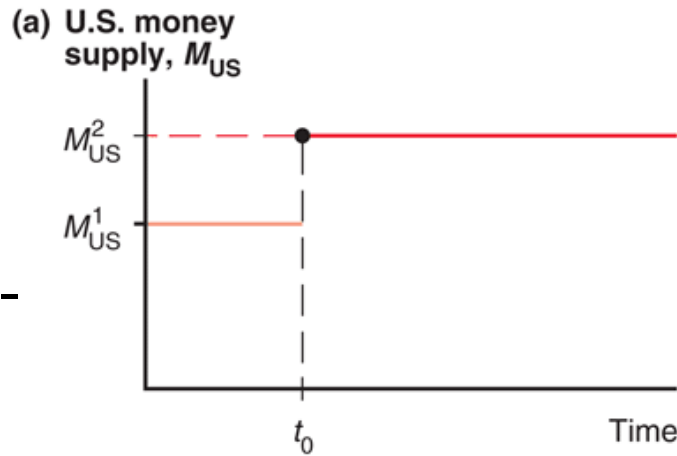




Fig. 15-13: Time Paths of U.S. Economic Variables after a Permanent Increase in the U.S. Money Supply

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*.





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*, see Fig. 15-11.



Can Higher Inflation Lead to Currency Appreciation?

- In the overshooting model, an increase in money supply lead to higher inflation and currency depreciation.
 - The reason for currency depreciation is that an increase in money supply lowers the interest rate.
- Financial Times, May 24, 2007: “Inflation Drives Canadian Dollar Higher.”
- Can Higher Inflation Lead to Currency Appreciation?
 - Yes, if it means higher-than-expected inflation. **Why?**



Can Higher Inflation Lead to Currency Appreciation?

1. The interest rate, not the money supply, is the prime instrument of monetary policy.
 - It is because money demand shifts around unpredictably in practice. If the CB were to fix money supply, the result would be high and damaging interest rate volatility. Fixing interest rate is therefore more practical monetary policy.
2. Most CBs adjust their policy interest rates in order to keep inflation in check.
 - Raise the interest rate when inflation is running higher and lower the interest rate when inflation is running lower.
- Higher-than-expected inflation makes an incentive for the CB to raise the interest rate. The result would be currency appreciation.



Can Higher Inflation Lead to Currency Appreciation?

- Clarida, Waldman (2008): They measure unexpected inflation as the initial inflation estimate announced by a government less the median of inflation forecasts by analysts.
 - Australia, Britain, Canada, the euro area, Japan, New Zealand, Norway, Sweden, Switzerland, and the U.S.
 - On average, unexpected inflation leads to currency appreciation.
 - The effect is stronger for core inflation than for headline inflation.
 - The effect is stronger for inflation-targeting countries with explicit inflation target.
 - The effect is present after the introduction of inflation targeting, but not before.



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.
3. When the money market is in equilibrium, the quantity of real monetary assets supplied matches the quantity of real monetary assets demanded.



Summary

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. thus lowering the rate of return on deposits of domestic currency,
 3. thus causing the domestic currency to depreciate.



Summary

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. thus causing the domestic currency to depreciate further,
 3. and causes prices to adjust proportionally in the long run,
 4. thus causing interest rates to return to their long-run values,
 5. and causes a proportional *long-run* depreciation in the domestic currency.



Summary

6. 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.