

International Economics

THEORY & POLICY

Seventh Edition



Paul R. Krugman Maurice Obstfeld

Chapter 14

Money, Interest Rates, and Exchange Rates

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Preview

- What is money?
- Control of the supply of money
- The demand for money
- A model of real money balances and interest rates
- A model of real money balances, 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 and accepted as a means of payment.
 - ◆ Different groups of assets may be classified as money.
 - ◆ Currency and checking accounts form a useful definition of money, but the large interest-bearing bank deposits traded in the foreign exchange market are excluded from this definition.

What Is Money? (cont.)

- Money is very *liquid*: it can be easily and quickly used to pay for goods and services.
- Money, however, pays *little or no rate of return*.
- Suppose we can group assets into money (liquid assets) and all other assets (illiquid assets).
 - ◆ All other assets are less liquid but pay a higher return.



Money Supply

- Who controls the quantity of money that circulates in an economy, the **money supply**?
- Central banks determine the money supply.
 - ◆ In the US, the central bank is the Federal Reserve System.
 - ◆ The Federal Reserve directly regulates the amount of currency in circulation, as well as banking system reserves.
 - ◆ It indirectly controls the amount of checking deposits issued by private banks.



Money Demand

- **Money demand** is the proportion of their total assets that people are willing to hold in the form of money (instead of illiquid assets).
 - ◆ We will consider individual money demand and aggregate money demand.
 - ◆ What influences willingness to hold money?

What Influences Individual Demand for Money?

- **Expected returns/interest rate** on money relative to the expected returns on other assets.
- **Risk:** the risk of holding money derives principally from unexpected inflation, which might unexpectedly reduce the purchasing power of money.
 - ◆ but domestic-currency bonds have precisely this risk too, so this risk is not very important in money demand
- **Liquidity:** A need for greater liquidity occurs when either the price of transactions increases or the quantity of goods normally bought in transactions increases.

What Influences Aggregate Demand for Money?

- **Interest rates:** money pays little or no interest, so the interest rate is the opportunity cost of holding money instead of other assets, like bonds, which have a higher expected return/interest rate.
 - ◆ A higher interest rate means a higher opportunity cost of holding money → lower money demand.
- **Prices:** the prices of goods and services 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 money demand.



What Influences Aggregate Demand for Money? (cont.)

- **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 money demand.

A Model of Aggregate Money Demand

The aggregate demand for money can be expressed by:

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

where:

P is the price level

Y is real national income

R is a measure of nominal interest rates

$L(R, Y)$ is the aggregate *real* money demand

Alternatively:

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

Aggregate real money demand is a function of national income and the nominal interest rate.

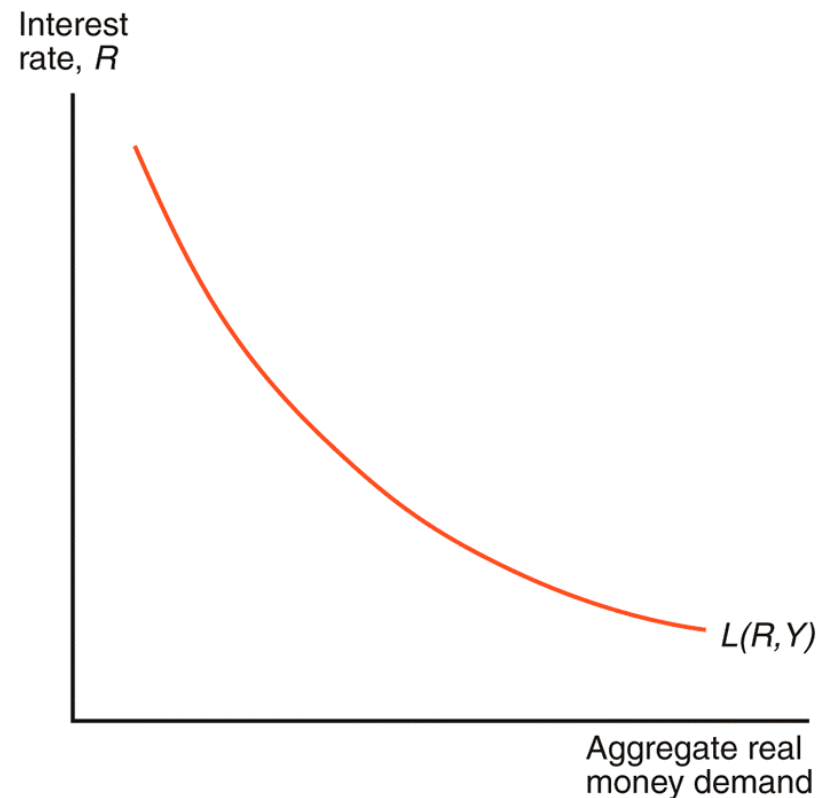
A Model of Aggregate Money Demand (cont.)

Figure 14-1

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.

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



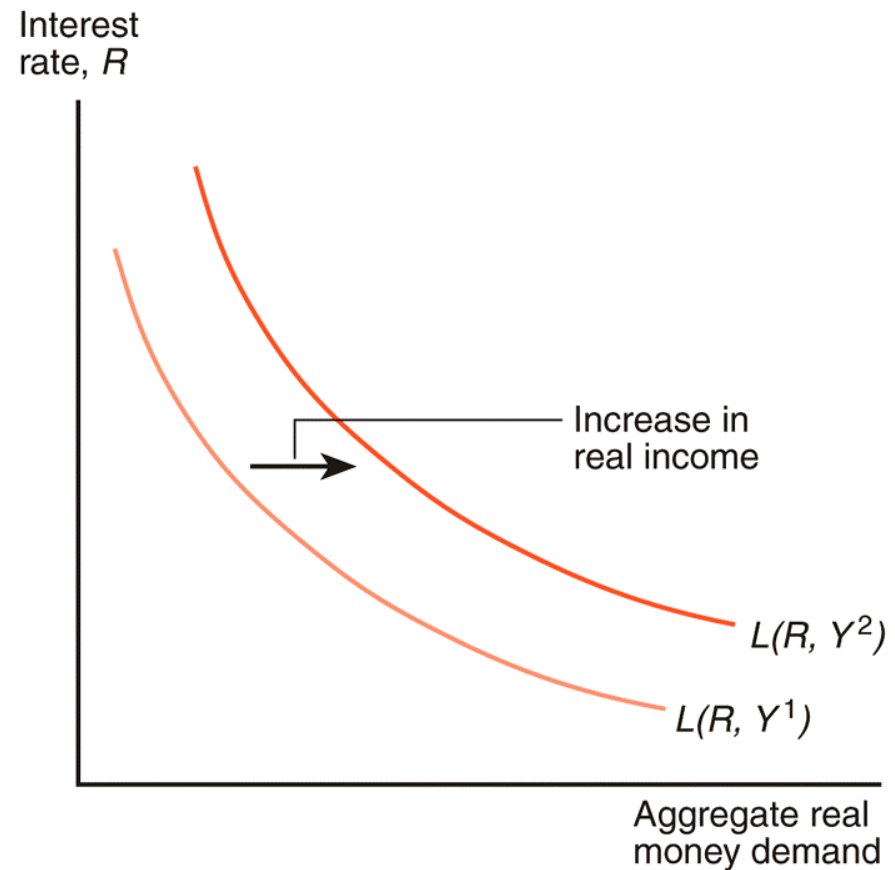
A Model of Aggregate Money Demand (cont.)

Figure 14-2

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.

When income increases, real money demand increases at every interest rate.



The Money Market

- The money market uses the (aggregate) money demand and (aggregate) money supply.
- The condition for equilibrium in the money market is:

$$M^s = M^d$$

- Alternatively, we can define equilibrium using the supply of real money and the demand for real money (by dividing both sides by the price level):

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

- This equilibrium condition will yield an equilibrium nominal interest rate R .

The Money Market (cont.)

- When there is an excess supply of money, there is, correspondingly, an excess demand for alternative, interest-bearing assets.
 - ◆ People holding excessive money balances are willing to acquire interest bearing assets (by buying them with money) at a lower interest rate.
 - ◆ Potential money holders are more willing to hold additional quantities of money as the interest rate (the opportunity cost of holding money) falls.

The Money Market (cont.)

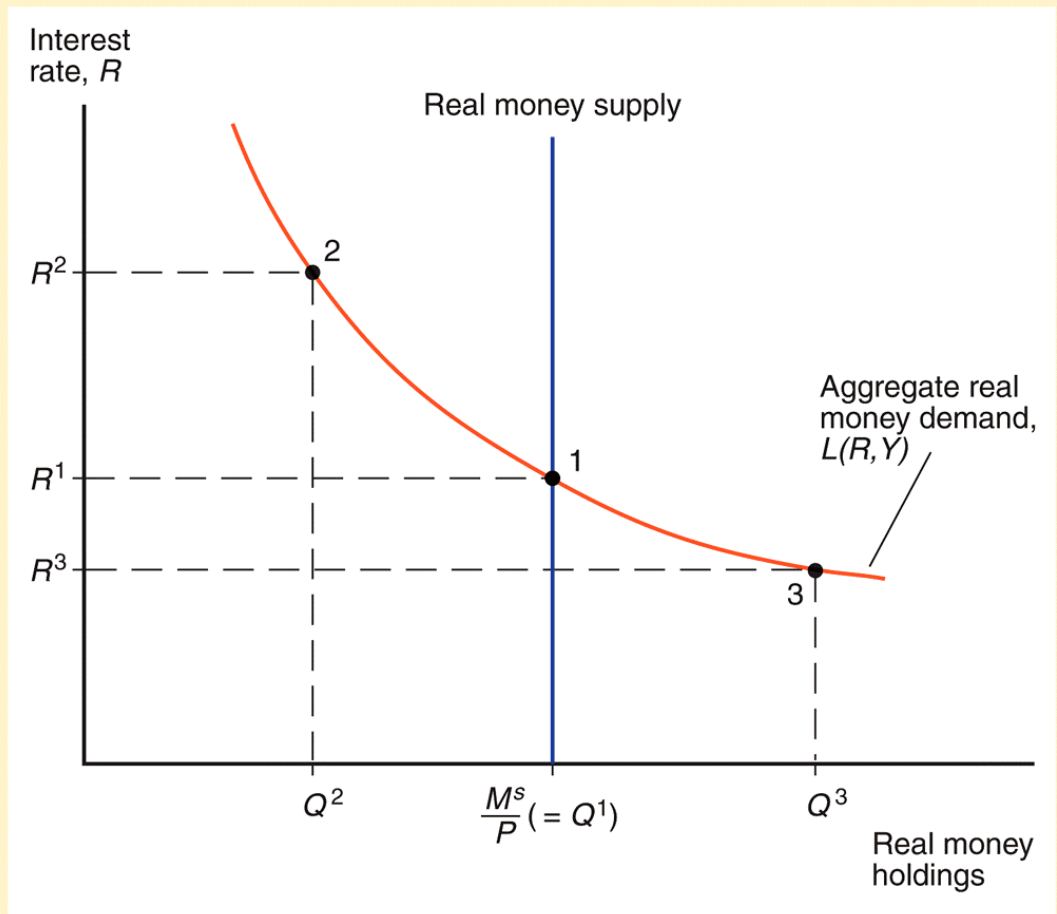
- When there is an excess demand for money, there, correspondingly, is an excess supply of interest-bearing assets.
 - ◆ People who desire money but do not have access to it are willing to sell off assets that offer higher nominal interest rates in return for the money balances that they desire.
 - ◆ Those with money balances are more willing to give them up in return for interest bearing assets as the interest rate on these assets rises and as the opportunity cost of holding money (the nominal interest rate) rises.

Money Market Equilibrium

Figure 14-3

Determination of the Equilibrium Interest Rate

With P and Y given and a real money supply of M^s/P , money market equilibrium is at point 1. At this point aggregate real money demand and the real money supply are equal and the equilibrium interest rate is R^1 .



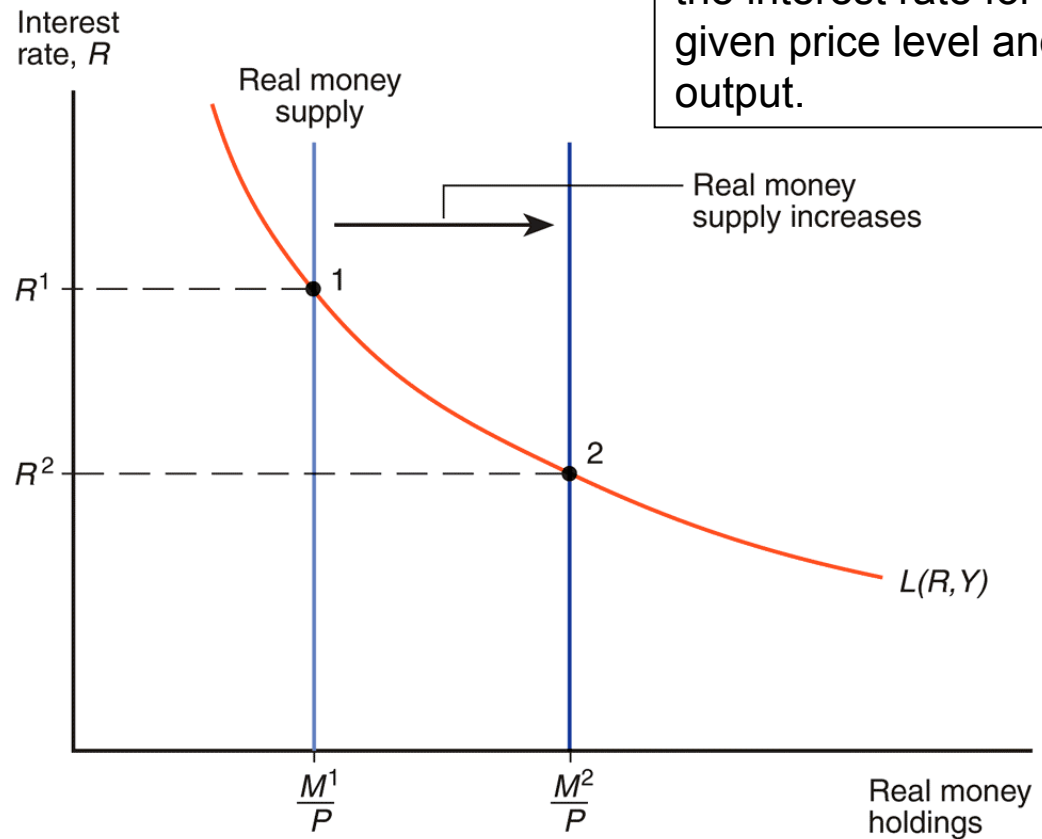
Changes in the Money Supply

Figure 14-4

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).

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



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

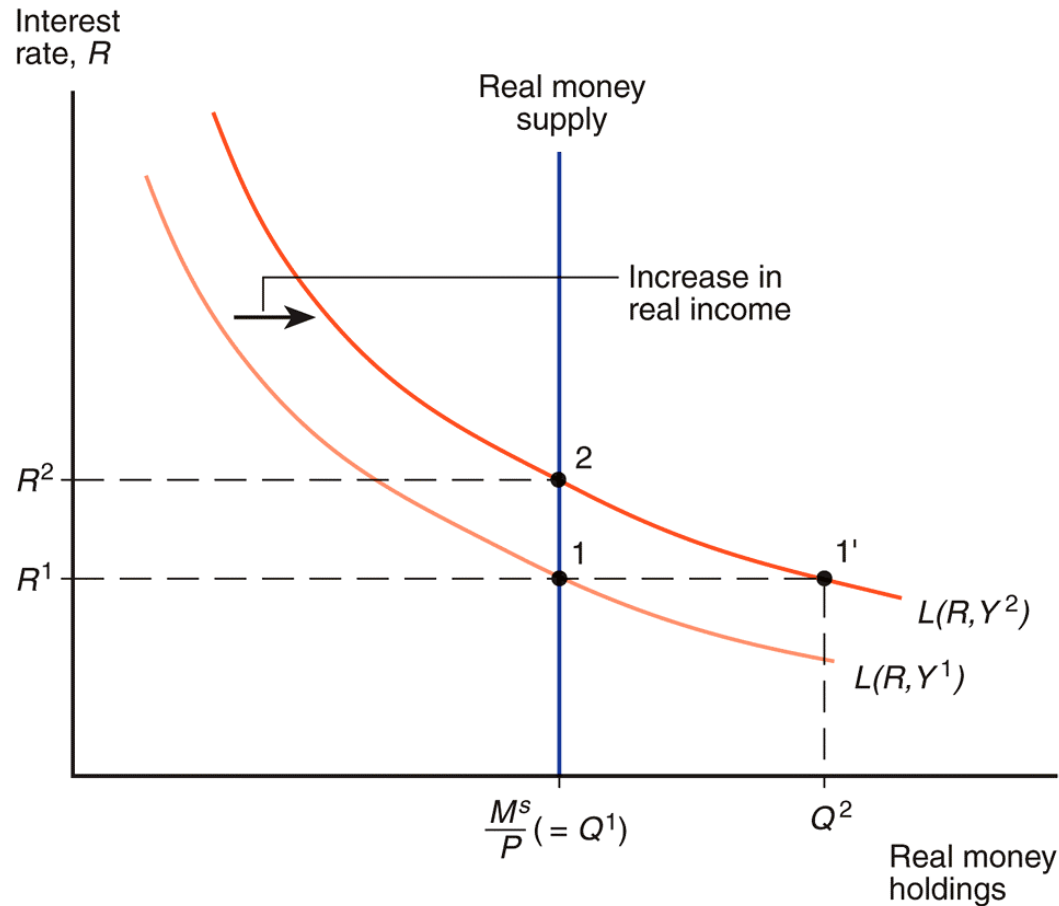
Changes in National Income

Figure 14-5

Effect on the Interest Rate of a Rise in Real Income

Given the real money supply, $M^s/P (= Q^1)$, 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).

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

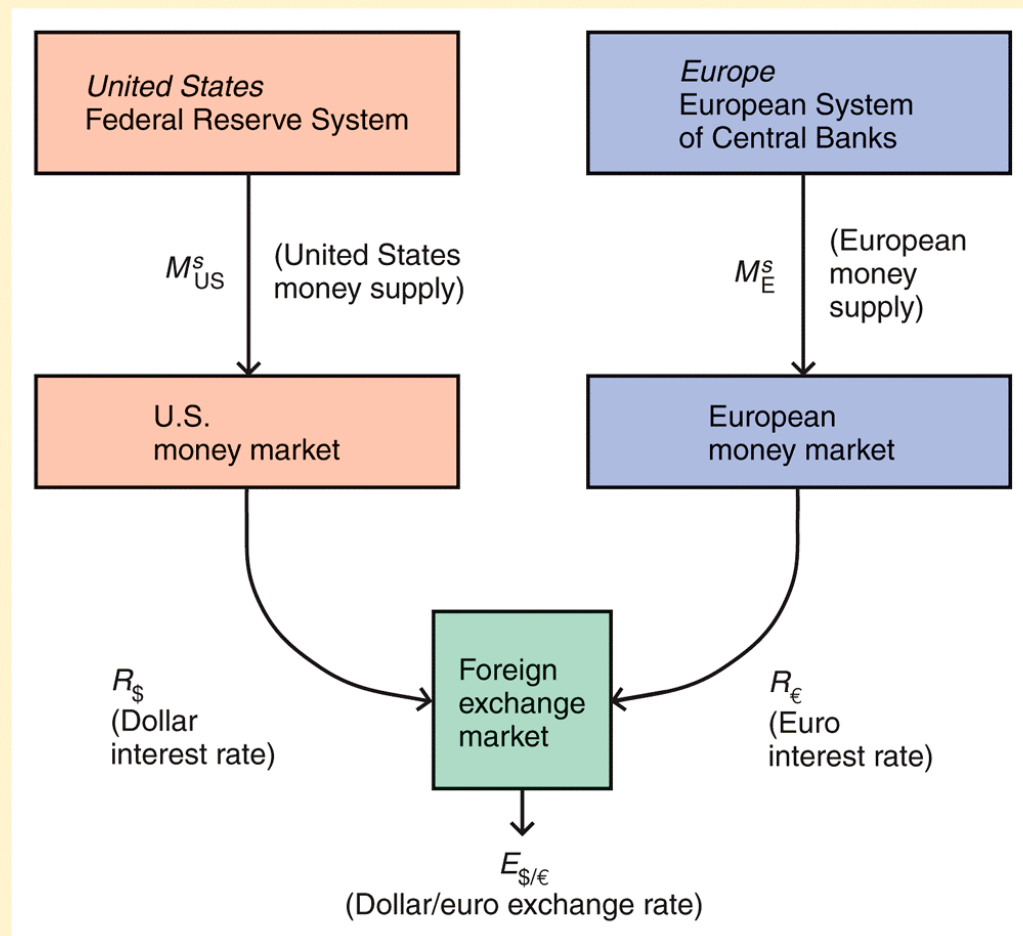


Linking the Money Market to the Foreign Exchange Market

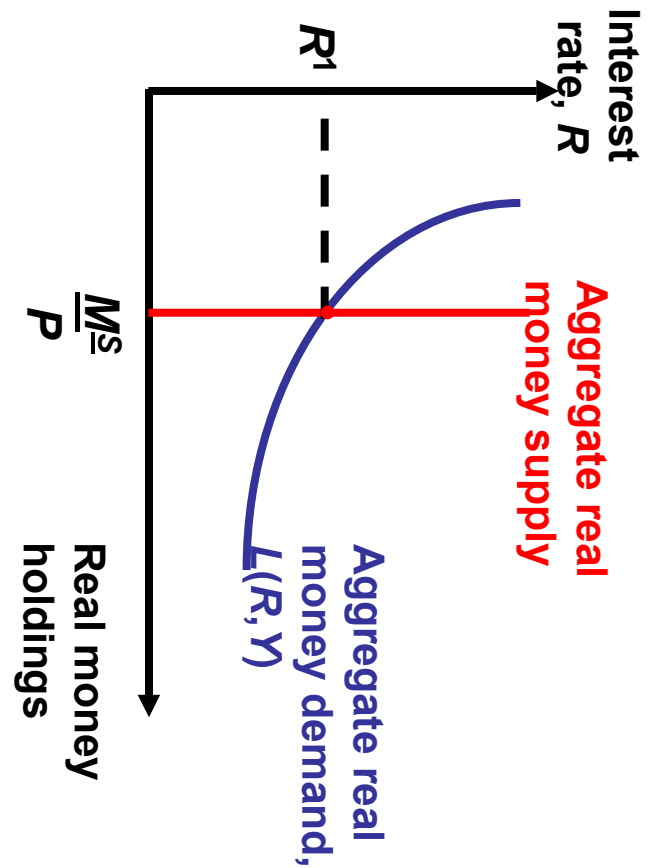
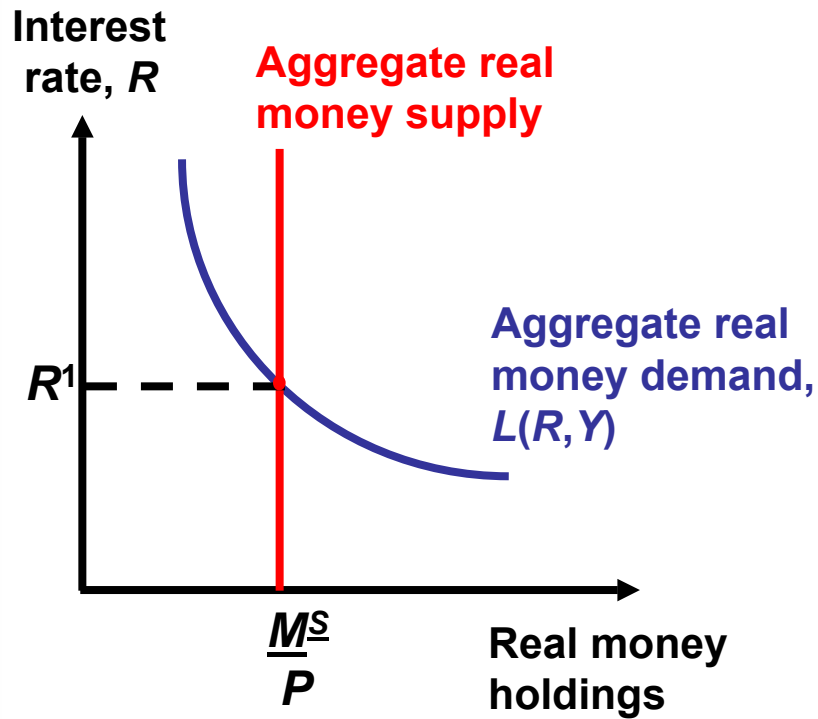
Figure 14-7

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



Linking the Money Market to the Foreign Exchange Market (cont.)



Linking the Money Market to the Foreign Exchange Market (cont.)

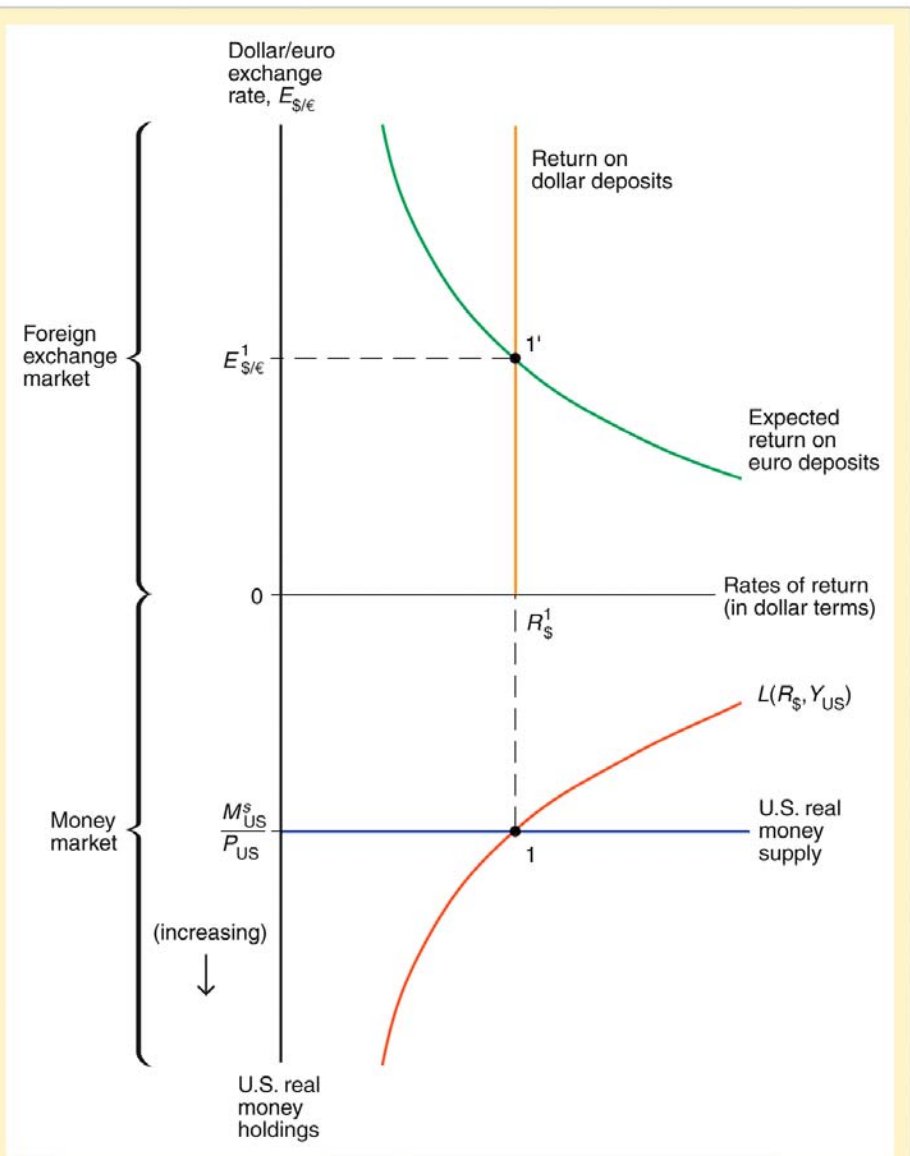


Figure 14-6

Simultaneous Equilibrium in the U.S. Money Market and the Foreign Exchange Market

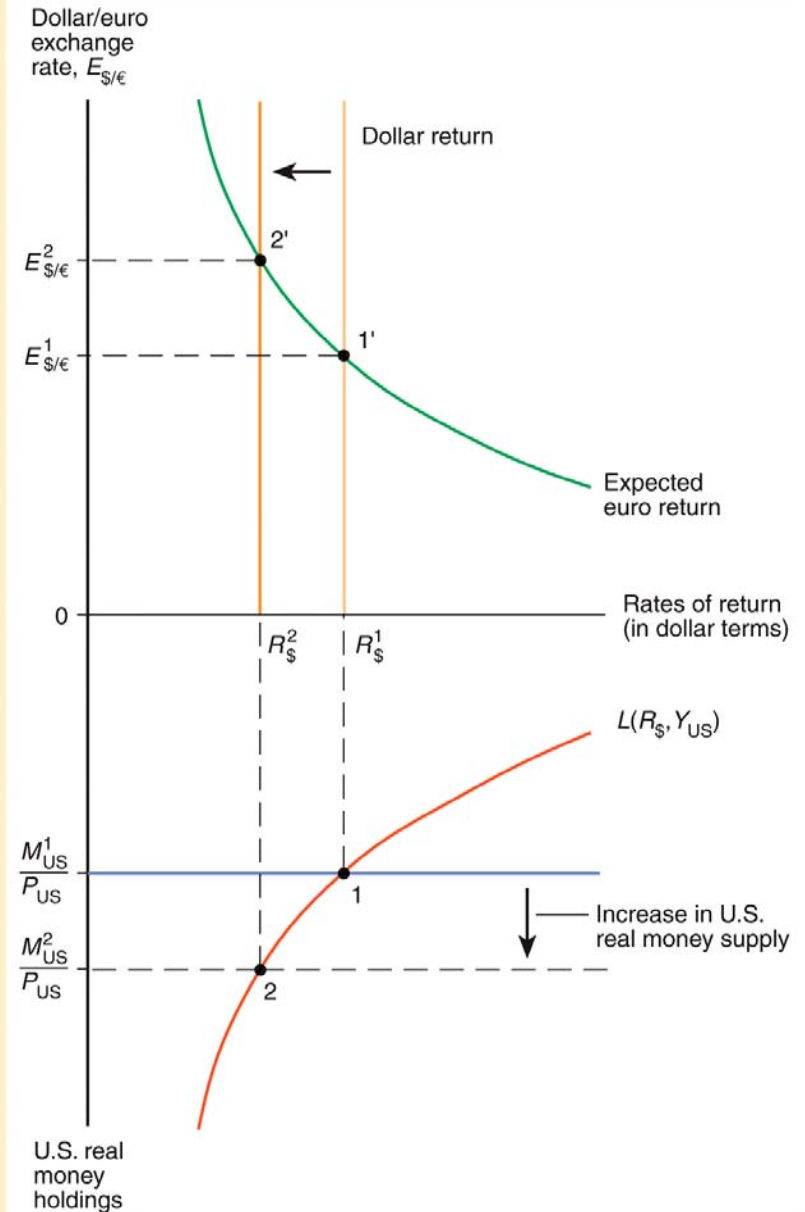
Both asset markets are in equilibrium at the interest rate R_s^1 and exchange rate $E_{\$/\text{€}}^1$; at these values money supply equals money demand (point 1) and the interest parity condition holds (point $1'$).

Changes in the Domestic Money Supply

Figure 14-8

Effect on the Dollar/Euro Exchange Rate and Dollar Interest Rate of an Increase in the U.S. Money Supply

Given P_{US} and Y_{US} , when the money supply rises from M_{US}^1 to M_{US}^2 , the dollar interest rate declines (as money market equilibrium is reestablished at point 2) and the dollar depreciates against the euro (as foreign exchange market equilibrium is reestablished at point 2').



Changes in the Money Supply

- An increase in a country's money supply causes its currency to depreciate.
- A decrease in a country's money supply causes its currency to appreciate.
- (Note: These statements are based on the policy experiment in which we hold the future expected exchange rate $E^e_{\$/\text{€}}$ constant.)



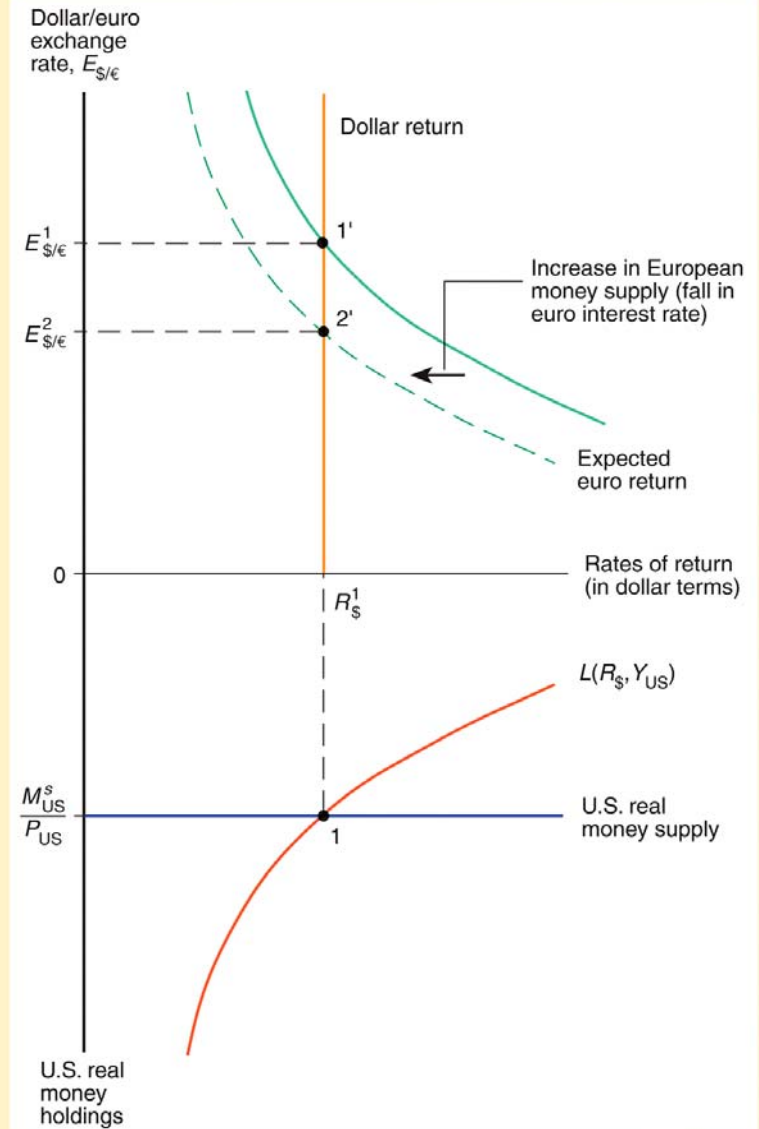
Changes in the Foreign Money Supply

- How would a change in the euro money supply affect the US money market and foreign exchange market (holding expectations constant as before)?
- An increase in the euro zone's money supply causes a depreciation of the euro (an appreciation of the dollar).
- A decrease in the euro zone's money supply causes an appreciation of the euro (a depreciation of the dollar).

Changes in the Foreign Money Supply (cont.)

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

By lowering the dollar return on euro deposits (shown as a leftward shift in the expected euro return curve), an increase in Europe's money supply causes the dollar to appreciate against the euro. Equilibrium in the foreign exchange market shifts from point 1' to point 2', but equilibrium in the U.S. money market remains at point 1.





Changes in the Foreign Money Supply (cont.)

- The increase in the euro zone's money supply reduces interest rates in the euro zone, reducing the expected return on euro deposits.
- This reduction in the expected return on euro deposits leads to a depreciation of the euro.
- The change in the euro zone's money supply does not change the US money market equilibrium.

Long Run and Short Run

- In the *short run*, the money price level is fixed.
 - ◆ our analysis heretofore has been a short run analysis.
- In the *long run*, money prices of factors of production and of goods and services are allowed to adjust to demand and supply in their respective markets.
 - ◆ Nominal wages adjust to the demand and supply of labor.
 - ◆ Real output and income are determined by the supply of labor and other factors of production—by the economy's productive capacity—not by the supply of money.
 - ◆ The interest rate depends on the supply of saving and the demand for saving in the economy and the expected inflation rate—and thus is also independent of the money supply's *level*.

Long Run and Short Run (cont.)

- In the long run, the *level* of the money supply does not influence the amount of real output Y or the nominal interest rate R .
- But in the long run, the money prices of output and factors of production *adjust proportionally* to changes in the money supply:
 - ◆ Long run equilibrium: $M^s/P = L(R, Y)$
 - ◆ $M^s = P \times L(R, Y)$
 - ◆ increases in the money supply are matched by proportional increases in the price level.
 - ◆ analogous to effects of *currency reform*.

Long Run and Short Run (cont.)

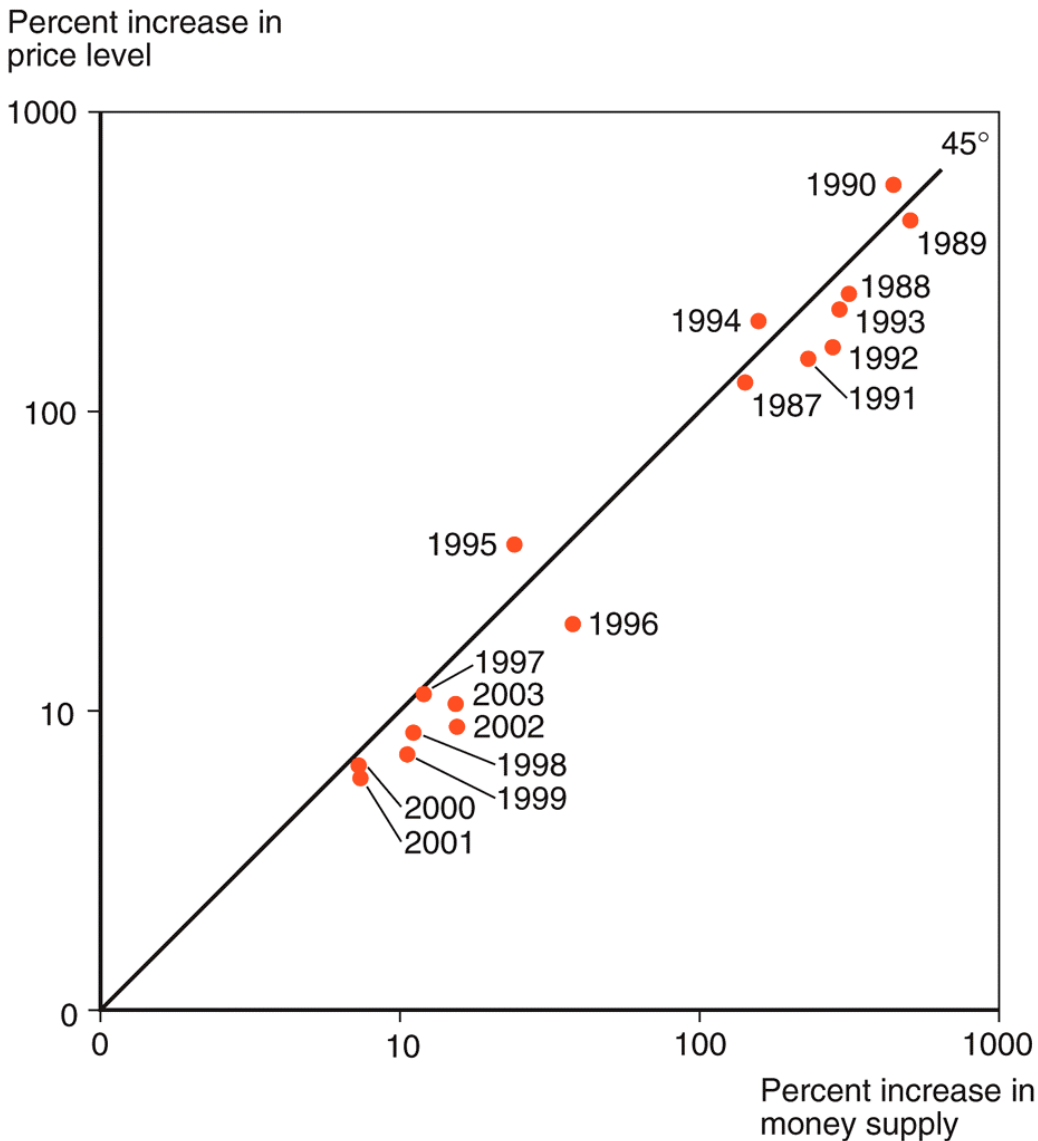
- In the long run, there is a direct relationship between the inflation rate (rate of increase in P) and *ongoing growth* in the money supply:
 - ◆ $M^s = P \times L(R, Y)$
 - ◆ $P = M^s / L(R, Y)$
 - ◆ $\Delta P/P = \Delta M^s/M^s - \Delta L/L$
 - ◆ The inflation rate equals growth rate in money supply minus the growth rate for money demand.

Figure 14-10

Average Money Growth and Inflation in Western Hemisphere Developing Countries, by Year, 1987–2003

Even year by year, there is a strong positive relation between average Latin American money supply growth and inflation. (Both axes have logarithmic scales.)

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?
- **Excess demand:** an increase in the money supply implies that people have more funds available to pay for goods and services.
 - ◆ To meet strong demand, producers hire more workers, creating a strong demand for labor, 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 strong demand.
- **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 money supply increase help to drive actual inflation.

Money and Prices in the Long Run (cont.)

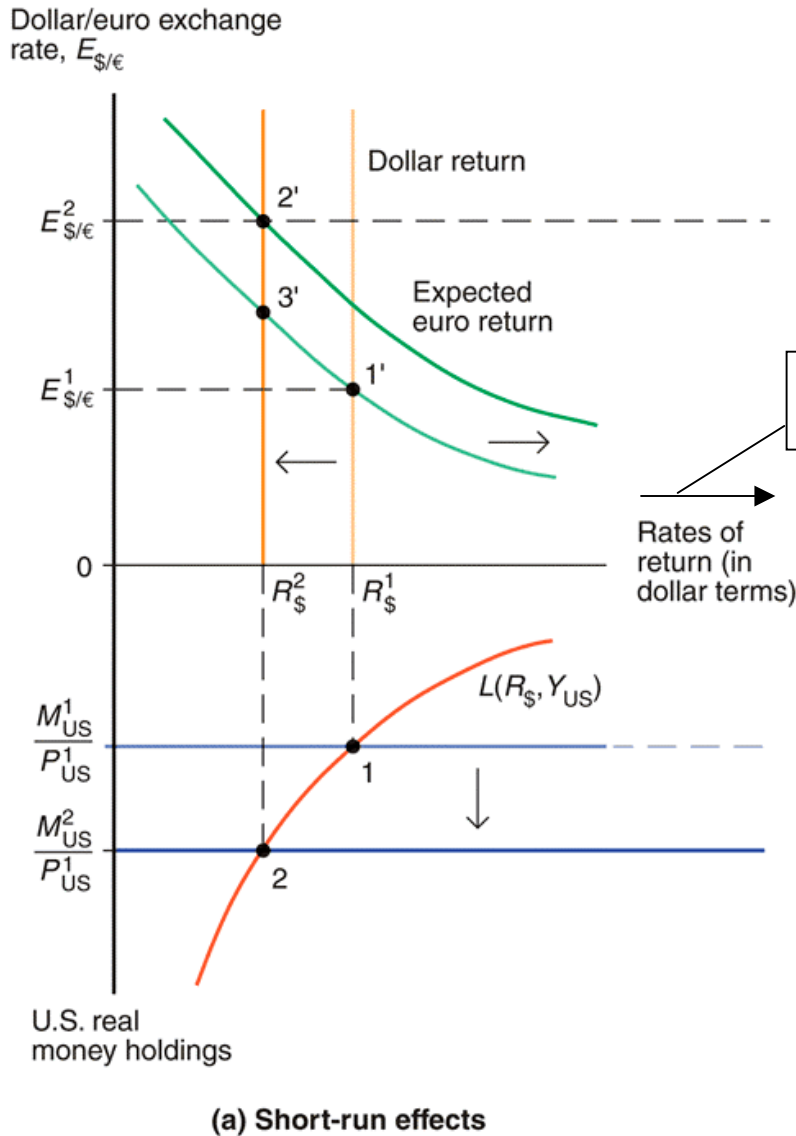
- Principle of “long-run neutrality of money”
- As we have seen (slide 14-28), any permanent increase in the money supply eventually leads to a proportional increase in all money prices
- But it leaves real variables (such as output, nominal interest rate) unchanged
- ***Among the money prices that increase in proportion to M^s are the money prices of foreign currencies in terms of domestic currency: exchange rates***



Money, Prices and the Exchange Rates and Expectations

- When we consider price changes over the long run, inflationary expectations will have an effect in the foreign exchange market.
- They will affect *exchange-rate expectations*.
- Suppose that expectations about inflation change as people receive news about the economy, but that the actual adjustment of prices occurs afterward, gradually.

Money, Prices and the Exchange Rates and Expectations (cont.)



Change in expected return on euro deposits

The expected return on euro deposits rises because of *altered exchange-rate expectations*:

- The dollar is expected to be less valuable in the future when buying goods and services and also less valuable when buying euros.
- The dollar is expected to depreciate in the long run, and this raises the expected dollar return on euro deposits.

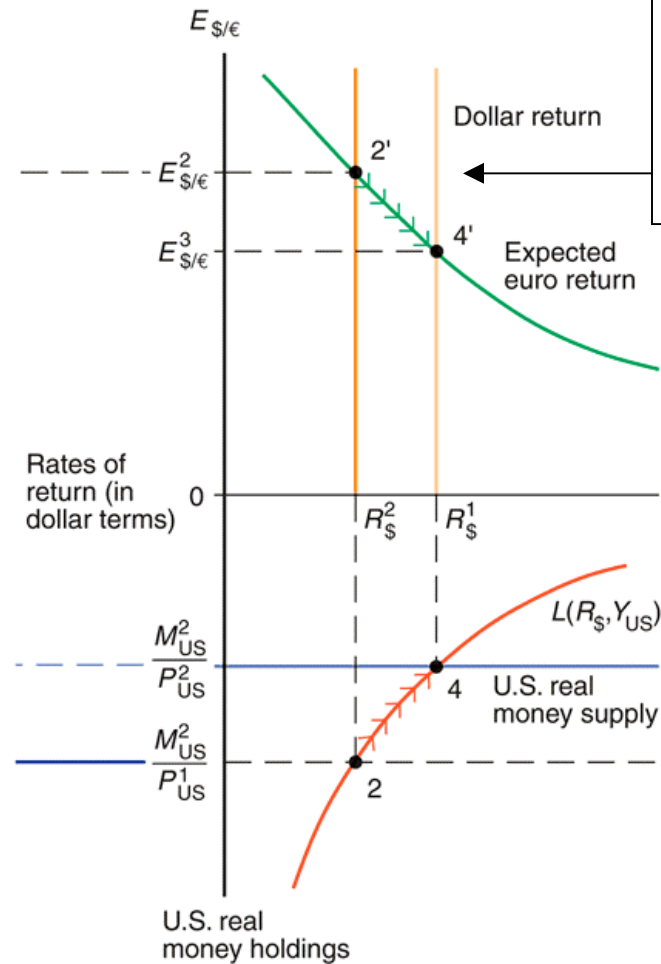
Figure 14-12

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

(a) Short-run adjustment of the asset markets. (b) How the interest rate, price level, and exchange rate move over time as the economy approaches its long-run equilibrium.

Money, Prices and the Exchange Rates in the Long Run

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




Original (long run) return on dollar deposits

(b) Adjustment to long-run equilibrium

Figure 14-12

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

(a) Short-run adjustment of the asset markets. (b) How the interest rate, price level, and exchange rate move over time as the economy approaches its long-run equilibrium.



Money, Prices and the 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*.

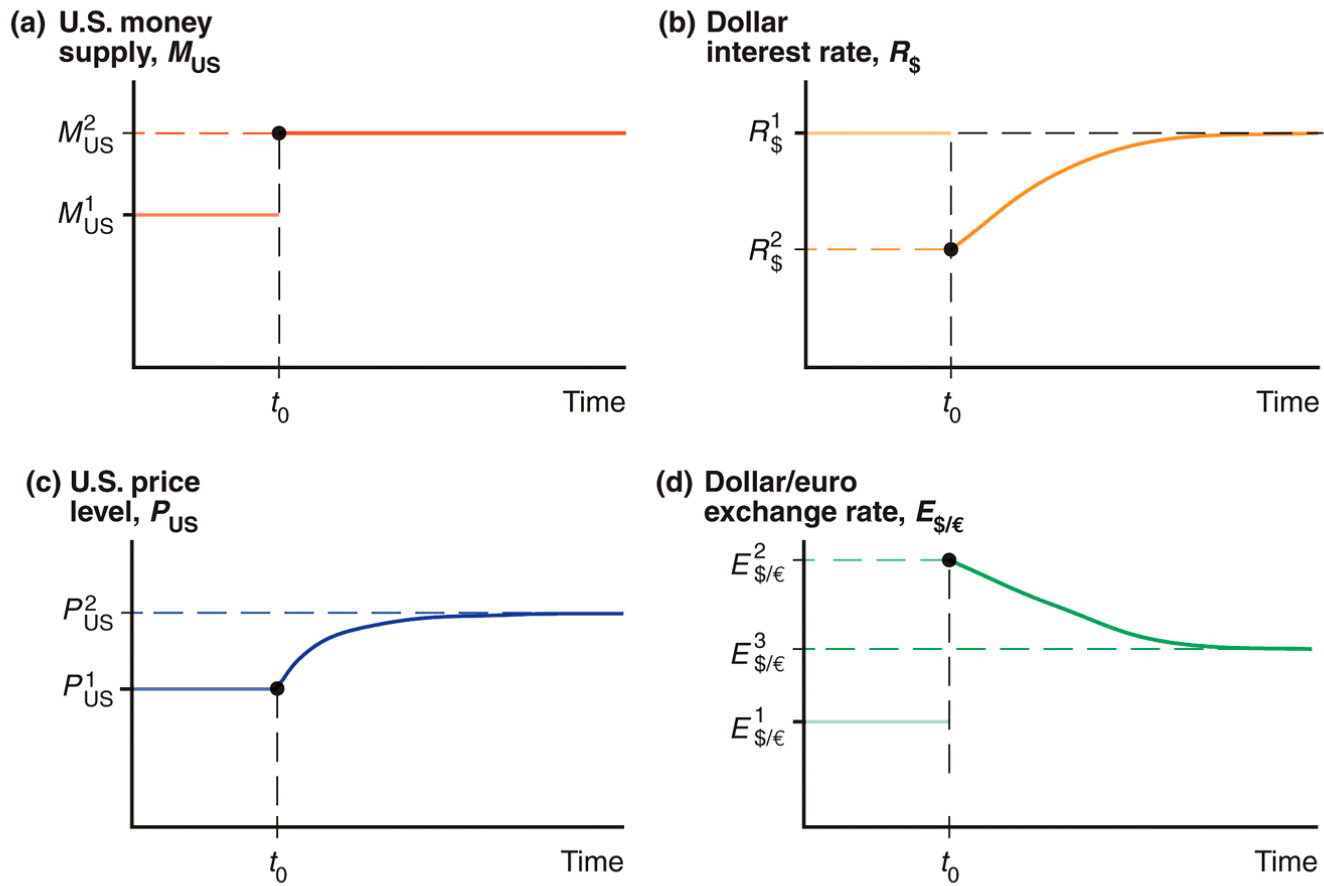


Figure 14-13

Time Paths of U.S. Economic Variables After a Permanent Increase in the U.S. Money Supply

After the money supply increases at t_0 in panel (a), the interest rate (in panel (b)), price level (in panel (c)), and exchange rate (in panel (d)) move as shown toward their long-run levels. As indicated in panel (d) by the initial jump from $E_{\$/\text{€}}^1$ to $E_{\$/\text{€}}^2$, the exchange rate overshoots in the short run before settling down to its long-run level, $E_{\$/\text{€}}^1$.

Exchange Rate Overshooting

- The exchange rate is said to **overshoot** when its immediate response to a change is greater than its long run response.
 - ◆ We assume that changes in the money supply have immediate effects on interest rates and exchange rates.
 - ◆ We assume that people change their expectations about the long run immediately after a change in the money supply.
- Overshooting helps explain why exchange rates are so *volatile*.
- Overshooting occurs in the model because prices do not adjust quickly, but expectations and asset markets do.

Exchange Rate Volatility

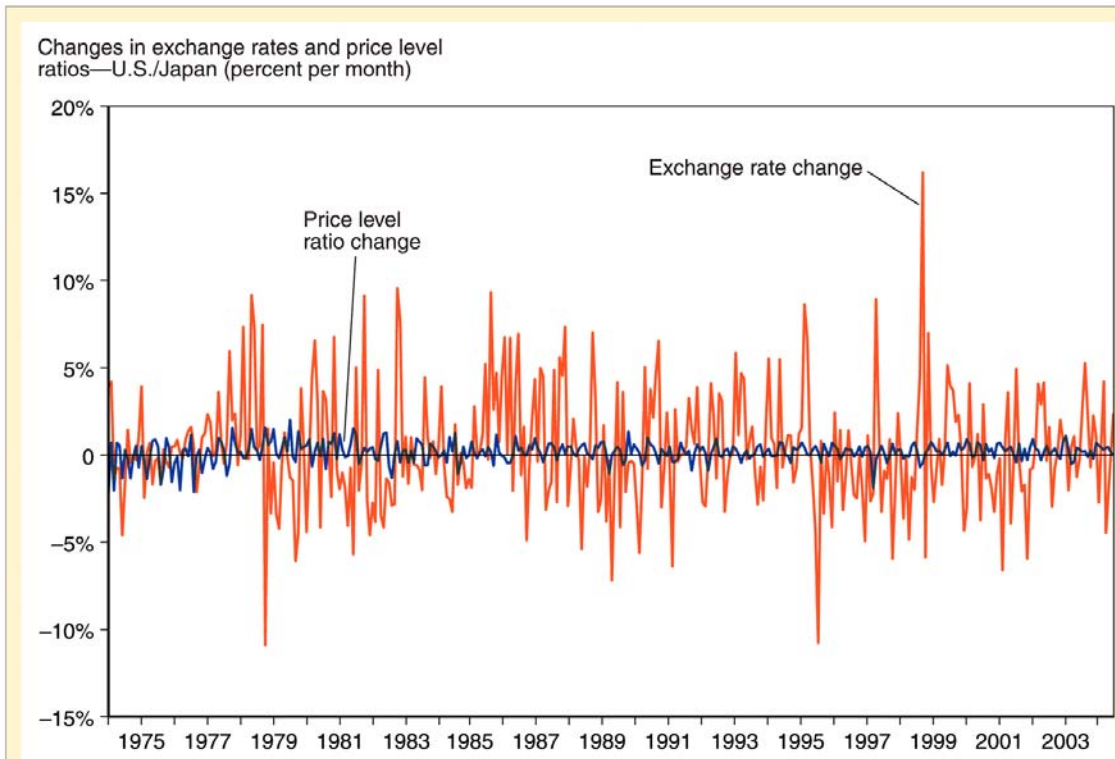


Figure 14-11

Month-to-Month Variability of the Dollar/Yen Exchange Rate and of the U.S./Japan Price Level Ratio, 1974–2004

The much greater month-to-month variability of the exchange rate suggests that price levels are relatively sticky in the short run.

Source: International Monetary Fund, *International Financial Statistics*.

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.

Summary

- Money demand on an individual level is determined by interest rates and the need for liquidity, the second of which is influenced by prices and income.
- Money demand on an aggregate level is determined by interest rates, the price level and national income.
 - ◆ Aggregate real money demand depends negatively on the interest rate and positively on real national income.
- Money supply equals money demand—or real money supply equals real money demand—at the equilibrium interest rate in the money market.

Summary (cont.)

- Short run scenario: changes in the money supply affect the domestic interest rate, as well as the exchange rate. (Think of a temporary money-supply increase.)
 - ◆ An increase in the domestic money supply
 - lowers the domestic interest rate,
 - lowering the rate of return on domestic deposits,
 - causing the domestic currency to depreciate.

Summary (cont.)

- Long run scenario: changes in the level of the money supply are matched by a proportional change in prices, and do not affect real income and interest rates. (Permanent money-supply increase.)
 - ◆ An increase in the money supply (when it is permanent):
 - causes expectations about the future to adjust,
 - causing the domestic currency to depreciate more sharply than when expectations do not change,
 - and causes prices to adjust proportionally in the long run,
 - causing the interest rate to return eventually to its initial level,
 - and causing a proportional long run depreciation in the exchange rate.

Summary (cont.)

- Expectations about the future adjust quickly, but prices adjust only in the long run, which results in overshooting of 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--even when people try rationally to predict the future on the basis of accurate economic information.