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国际经济学

理论与政策

第5版

International Economics

Theory and Policy

【Fifth Edition】

下册

Paul R.Krugman
Massachusetts Institute of Technology

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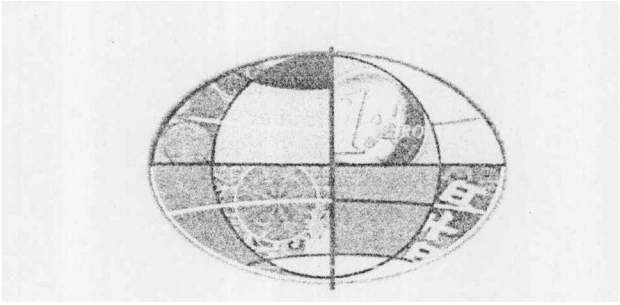

CHAPTER 14

MONEY, INTEREST RATES, AND EXCHANGE RATES

Current E$/€, interest rate, expected future exchange rate.

Chapter 13 showed how the exchange rate between currencies depends on two factors, the interest that can be earned on deposits of those currencies and the expected future exchange rate. To understand fully the determination of exchange rates, however, we have to learn how interest rates themselves are determined and how expectations of future exchange rates are formed. In the next three chapters we examine these topics by building an economic model that links exchange rates, interest rates, and other important macroeconomic variables such as the inflation rate and output.

The first step in building the model is to explain the effects of a country's money supply and of the demand for its money on its interest rate and exchange rate. Because exchange rates are the relative prices of national monies, factors that affect a country's money supply or demand are among the most powerful determinants of its currency's exchange rate against foreign currencies. It is therefore natural to begin a deeper study of exchange rate determination with a discussion of money supply and money demand.

Monetary developments influence the exchange rate *both* by changing interest rates *and* by changing people's expectations about future exchange rates. Expectations about future exchange rates are closely connected with expectations about the future money prices of countries' products; these price movements, in turn, depend on changes in money supply and demand. In examining monetary influences on the exchange rate, we therefore look at how monetary factors influence output prices along with interest rates. Expectations of future exchange rates depend on many factors other than money, however, and these nonmonetary factors are taken up in the next chapter.

Once the theories and determinants of money supply and demand are laid out, we use them to examine how equilibrium interest rates are determined by the equality of money supply and money demand. Then we combine our model of interest rate determination with the interest parity condition to study the effects of monetary shifts on the exchange rate, given the prices of goods and services, the level of output, and market expectations about

the future. Finally, we take a first look at the long-term effects of monetary changes on output prices and expected future exchange rates. ●

MONEY DEFINED: A BRIEF REVIEW

We are so accustomed to using money that we seldom notice the roles it plays in almost all of our everyday transactions. As with many other modern conveniences, we take money for granted until something goes wrong with it! In fact, the easiest way to appreciate the importance of money is to imagine what economic life would be like without it.

In this section we do just that. Our purpose in carrying out this "thought experiment" is to distinguish money from other assets and to describe the characteristics of money that lead people to hold it. These characteristics are central to an analysis of the demand for money.

Money as a Medium of Exchange

The most important function of money is to serve as a *medium of exchange,* a generally accepted means of payment. To see why a medium of exchange is necessary, imagine how time-consuming it would be for people to purchase goods and services in a world where the only type of trade possible was barter trade—the trade of goods or services for other goods or services.

Money eliminates the enormous search costs connected with a barter system because it is universally acceptable. It eliminates these search costs by enabling an individual to sell the goods and services she produces to people other than the producers of the goods and services she wishes to consume. A complex modern economy would cease functioning without some standardized and convenient means of payment.

Money as a Unit of Account

Money's second important role is as a *unit of account,* that is, as a widely recognized measure of value. It is in this role that we encountered money in Chapter 13: Prices of goods, services, and assets are typically expressed in terms of money. Exchange rates allow us to translate different countries' money prices into comparable terms.

The convention of quoting prices in money terms simplifies economic calculations by making it easy to compare the prices of different commodities. The international price comparisons in Chapter 13, which used exchange rates to compare the prices of different countries' outputs, are similar to the calculations you would have to do many times each day if different commodities' prices were not expressed in terms of a standardized unit of account. If the calculations in Chapter 13 gave you a headache, imagine what it would be like to have to calculate the relative prices of each good and service you consume in terms of several other goods and services. This thought experiment should give you a keener appreciation of using money as a unit of account.

Money as a Store of Value

Because money can be used to transfer purchasing power from the present into the future, it is also an asset, or a *store of value.* This attribute is essential for any medium of exchange

because no one would be willing to accept it in payment if its value in terms of goods and services evaporated immediately.

Money's usefulness as a medium of exchange, however, automatically makes it the most *liquid* of all assets. As you will recall from the last chapter, an asset is said to be liquid when it can be transformed into goods and services rapidly and without high transaction costs, such as brokers' fees. Since money is readily acceptable as a means of payment, money sets the standard against which the liquidity of other assets is judged.

What Is Money?

Currency and bank deposits on which checks may be written certainly qualify as money. These are widely accepted means of payment that can be transferred between owners at low cost. Households and firms hold currency and checking deposits as a convenient way of financing routine transactions as they arise. Assets such as real estate do not qualify as money because, unlike currency and checking deposits, they lack the essential property of liquidity.

When we speak of the **money supply** in this book, we are referring to the monetary aggregate the Federal Reserve calls M1, that is, the total amount of currency and checking deposits held by households and firms. In the United States at the end of 1997, the total money supply amounted to $1.076 trillion, equal to 13.3 percent of that year's GNP.[1]

The large deposits traded by participants in the foreign exchange market are not considered part of the money supply. These deposits are less liquid than money and are not used to finance routine transactions.

How the Money Supply Is Determined

An economy's money supply is controlled by its central bank. The central bank directly regulates the amount of currency in existence and also has indirect control over the amount of checking deposits issued by private banks. The procedures through which the central bank controls the money supply are complex, and we assume for now that the central bank simply sets the size of the money supply at the level it desires. We go into the money supply process in more detail, however, in Chapters 17 and 21.

THE DEMAND FOR MONEY BY INDIVIDUALS

Having discussed the functions of money and the definition of the money supply, we now examine the factors that determine the amount of money an individual desires to hold. The determinants of individual money demand can be derived from the theory of asset demand discussed in the last chapter.

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[1] A broader Federal Reserve measure of money supply, M2, includes time deposits, but these are less liquid than the assets included in M1 because the funds in them typically cannot be withdrawn early without penalty. An even broader measure, known as M3, is also tracked by the Fed. A decision on where to draw the line between money and near-money must be somewhat arbitrary and therefore controversial. For further discussion of this question, see Frederic S. Mishkin, *The Economics of Money, Banking and Financial Markets*, 5th ed., Chapter 3. New York: HarperCollins Publishers, 1998.

We saw in the last chapter that individuals base their demand for an asset on three characteristics:

1. The expected return the asset offers compared with the returns offered by other assets.
2. The riskiness of the asset's expected return.
3. The asset's liquidity.

While liquidity plays no important role in determining the relative demands for assets traded in the foreign exchange market, households and firms hold money *only* because of its liquidity. To understand how the economy's households and firms decide the amount of money they wish to hold, we must look more closely at how the three considerations listed above influence money demand.

Expected Return

Currency pays no interest. Checking deposits often do pay some interest, but they offer a rate of return that usually fails to keep pace with the higher return offered by less liquid forms of wealth. When you hold money, you therefore sacrifice the higher interest rate you could earn by holding your wealth in a government bond, a large time deposit, or some other relatively illiquid asset. It is this last rate of interest we have in mind when we refer to "the" interest rate. Since the interest paid on currency is zero while that paid on "checkable" deposits tends to be relatively constant, the difference in rates of return between money in general and less-liquid alternative assets is reflected by the market interest rate: The higher the interest rate, the more you sacrifice by holding wealth in the form of money.[2]

Suppose, for example, that the interest rate you could earn from a U.S. Treasury bill is 10 percent per year. If you use $10,000 of your wealth to buy a Treasury bill, you will be paid $11,000 by Uncle Sam at the end of a year, but if you choose instead to keep the $10,000 as cash in a safe-deposit box, you give up the $1000 interest you could have earned by buying the Treasury bill. You thus sacrifice a 10 percent rate of return by holding your $10,000 as money.

The theory of asset demand developed in the last chapter shows how changes in the rate of interest affect the demand for money. The theory states that, other things equal, people prefer assets offering higher expected returns. Because an increase in the interest rate is a rise in the rate of return on less liquid assets relative to the rate of return on money, individuals will want to hold more of their wealth in nonmoney assets that pay the market interest rate and less of their wealth in the form of money if the interest rate rises. We conclude that ***all else equal, a rise in the interest rate causes the demand for money to fall.***

We can also describe the influence of the interest rate on money demand in terms of the economic concept of *opportunity cost*—the amount you sacrifice by taking one course of

[2]Many of the illiquid assets that individuals can choose from do not pay their returns in the form of interest. Stocks, for example, pay returns in the form of dividends and capital gains. The family summer house on Cape Cod pays a return in the form of capital gains and the pleasure of vacations at the beach. The assumption behind our analysis of money demand is that once allowance is made for risk, all assets other than money offer an expected rate of return (measured in terms of money) equal to the interest rate. This assumption allows us to use the interest rate to summarize the return an individual forgoes by holding money rather than an illiquid asset.

action rather than another. The interest rate measures the opportunity cost of holding money rather than interest-bearing bonds. A rise in the interest rate therefore raises the cost of holding money and causes money demand to fall.

Risk

Risk is not an important factor in money demand. It is risky to hold money because an unexpected increase in the prices of goods and services could reduce the value of your money in terms of the commodities you consume. Since interest-paying assets such as government bonds have face values fixed in terms of money, however, the same unexpected increase in prices would reduce the real value of those assets by the same percentage. Because any change in the riskiness of money causes an equal change in the riskiness of bonds, changes in the risk of holding money need not cause individuals to reduce their demand for money and increase their demand for interest-paying assets.

Liquidity

The main benefit of holding money comes from its liquidity. Households and firms hold money because it is the easiest way of financing their everyday purchases. Some large purchases can be financed through the sale of a substantial illiquid asset. An art collector, for example, could sell one of her Picassos to buy a house. To finance a continuing stream of smaller expenditures at various times and for various amounts, however, households and firms have to hold some money.

An individual's need for liquidity rises when the average daily value of his transactions rises. A student who takes the bus every day, for example, does not need to hold as much cash as a business executive who takes taxis during rush hour. We conclude that *a rise in the average value of transactions carried out by a household or firm causes its demand for money to rise.*

AGGREGATE MONEY DEMAND

Our discussion of how individual households and firms determine their demands for money can now be applied to derive the determinants of **aggregate money demand,** the total demand for money by all households and firms in the economy. Aggregate money demand is just the sum of all the economy's individual money demands.

Three main factors determine aggregate money demand:

1. *The interest rate.* A rise in the interest rate causes each individual in the economy to reduce her demand for money. All else equal, aggregate money demand therefore falls when the interest rate rises.
2. *The price level.* The economy's **price level** is the price of a broad reference basket of goods and services in terms of currency. If the price level rises, individual households and firms must spend more money than before to purchase their usual weekly baskets of goods and services. To maintain the same level of liquidity as before the price level increase, they will therefore have to hold more money.

3. *Real national income.* When real national income (GNP) rises, more goods and services are being sold in the economy. This increase in the real value of transactions raises the demand for money, given the price level.

If P is the price level, R is the interest rate, and Y is real GNP, the aggregate demand for money, M^d, can be expressed as

$$M^d = P \times L(R, Y), \tag{14-1}$$

where the value of $L(R, Y)$ falls when R rises, and rises when Y rises.[3] To see why we have specified that aggregate money demand is *proportional* to the price level, imagine that all prices doubled but the interest rate and everyone's *real* incomes remained unchanged. The money value of each individual's average daily transactions would then simply double, as would the amount of money each wished to hold.

We usually write the aggregate money demand relation (14-1) in the equivalent form

$$M^d/P = L(R, Y), \tag{14-2}$$

and call $L(R, Y)$ aggregate *real* money demand. This way of expressing money demand shows that the aggregate demand for liquidity, $L(R, Y)$, is not a demand for a certain number of currency units but is instead a demand to hold a certain amount of purchasing power in liquid form. The ratio M^d/P—that is, desired money holdings measured in terms of a typical reference basket of commodities—equals the amount of purchasing power people would like to hold in liquid form. For example, if people wished to hold \$1000 in cash at a price level of \$100 per commodity basket, their real money holdings would be equivalent to \$1000/(\$100 per basket) = 10 baskets. If the price level doubled (to \$200 per basket), the purchasing power of their \$1000 in cash would be halved, since it would now be worth only 5 baskets.

Figure 14-1 shows how aggregate real money demand is affected by the interest rate for a fixed level of real income, Y. The aggregate real money demand schedule $L(R, Y)$ slopes downward because a fall in the interest rate raises the desired real money holdings of each household and firm in the economy.

For a given level of real GNP, changes in interest rates cause movements *along* the $L(R, Y)$ schedule. Changes in real GNP, however, cause the schedule itself to shift. Figure 14-2 shows how a rise in real GNP from Y^1 to Y^2 affects the position of the aggregate real money demand schedule. Because a rise in real GNP raises aggregate real money demand for a given interest rate, the schedule $L(R, Y^2)$ lies to the right of $L(R, Y^1)$ when Y^2 is greater than Y^1.

THE EQUILIBRIUM INTEREST RATE: THE INTERACTION OF MONEY SUPPLY AND DEMAND

As you might expect from other economics courses you've taken, the money market is in equilibrium when the money supply set by the central bank equals aggregate money demand. In this section we see how the interest rate is determined by money market equilibrium,

[3]Naturally, $L(R, Y)$ rises when R falls, and falls when Y falls.

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.

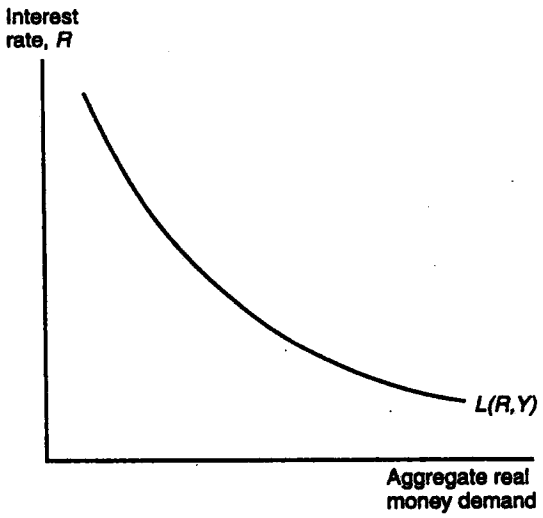
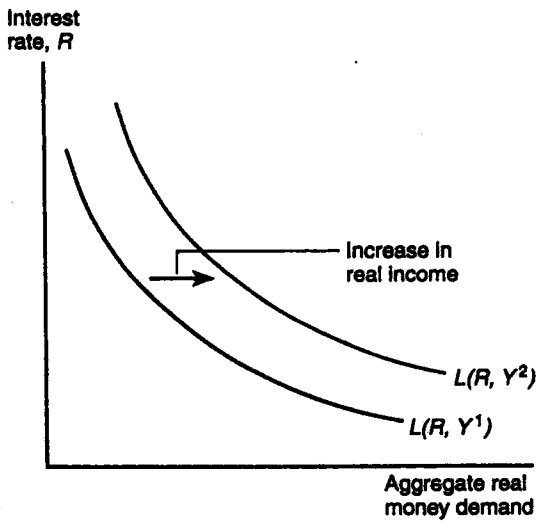


Figure 14-2 Effect on the Aggregate Real Money Demand Schedule of a Rise in Real Income

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.



given the price level and output, both of which are temporarily assumed to be unaffected by monetary changes.

Equilibrium in the Money Market

If M^s is the money supply, the condition for equilibrium in the money market is

$$M^s = M^d. \tag{14-3}$$

After dividing both sides of this equality by the price level, we can express the money market equilibrium condition in terms of aggregate real money demand as

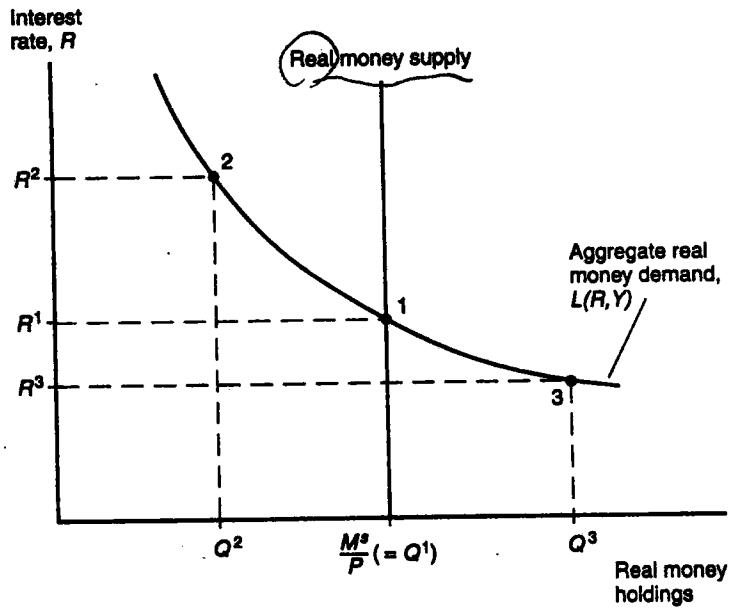
$$M^s/P = L(R, Y). \tag{14-4}$$

Given the price level, P, and output, Y, the equilibrium interest rate is the one at which aggregate real money demand equals the real money supply.

In Figure 14-3, the aggregate real money demand schedule intersects the real money supply schedule at point 1 to give an equilibrium interest rate of R^1. The money supply schedule is vertical at M^s/P because M^s is set by the central bank while P is taken as given.

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.



Let's see why the interest rate tends to settle at its equilibrium level by considering what happens if the market is initially at point 2, with an interest rate, R^2, that is above R^1.

At point 2 the demand for real money holdings falls short of the supply by $Q^1 - Q^2$, so there is an excess supply of money. If individuals are holding more money than they desire given the interest rate of R^2, they will attempt to reduce their liquidity by using some money to purchase interest-bearing assets. In other words, individuals will attempt to get rid of their excess money by lending it to others. Since there is an aggregate excess supply of money at R^2, however, not everyone can succeed in doing this: there are more people who would like to lend money to reduce their liquidity than there are people who would like to borrow it to increase theirs. Those who cannot unload their extra money try to tempt potential borrowers by lowering the interest rate they charge for loans below R^2. The downward pressure on the interest rate continues until the rate reaches R^1. At this interest rate, anyone wishing to lend money can do so because the aggregate excess supply of money has disappeared; that is, supply once again equals demand. Once the market reaches point 1, there is therefore no further tendency for the interest rate to drop.[4]

Similarly, if the interest rate is initially at a level R^3 below R^1, it will tend to rise. As Figure 14-3 shows, there is excess demand for money equal to $Q^3 - Q^1$ at point 3. Individuals therefore attempt to sell interest-bearing assets such as bonds to increase their money holdings (that is, they sell bonds for cash). At point 3, however, not everyone can succeed in selling enough interest-bearing assets to satisfy his or her demand for money. Thus, people bid for money by offering to borrow at progressively higher interest rates and push the interest rate upward toward R^1. Only when the market has reached point 1 and the excess demand for money has been eliminated does the interest rate stop rising.

We can summarize our findings as follows: *The market always moves toward an interest rate at which the real money supply equals aggregate real money demand. If there is initially an excess supply of money, the interest rate falls, and if there is initially an excess demand, it rises.*

Interest Rates and the Money Supply

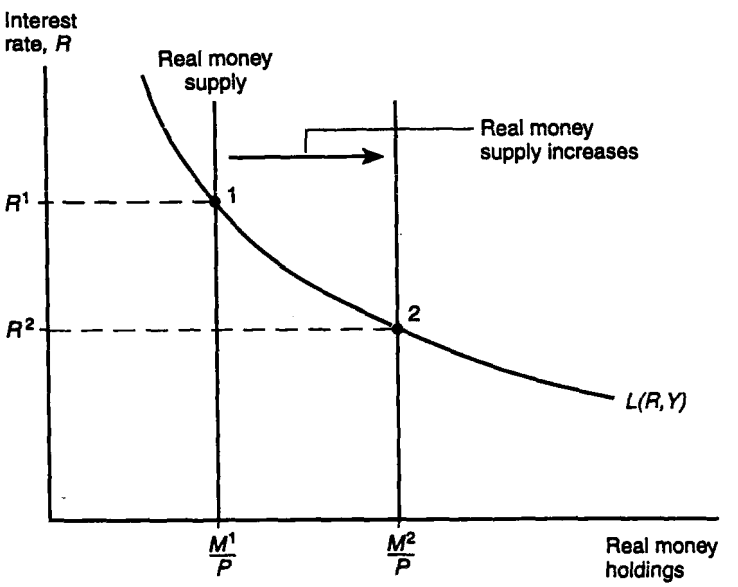
The effect of increasing the money supply at a given price level is illustrated in Figure 14-4. Initially the money market is in equilibrium at point 1, with a money supply M^1 and an interest rate R^1. Since we are holding P constant, a rise in the money supply to M^2 increases the real money supply from M^1/P to M^2/P. With a real money supply of M^2/P, point 2 is the new equilibrium and R^2 is the new, lower interest rate that induces people to hold the increased available real money supply.

The process through which the interest rate falls is by now familiar. After M^s is increased by the central bank, there is initially an excess real supply of money at the old equilibrium interest rate, R^1, which previously balanced the market. Since people are holding more money than they desire, they use their surplus funds to bid for assets that pay interest. The economy as a whole cannot reduce its money holdings, so interest rates are driven down as

[4]Another way to view this process is as follows: We saw in the last chapter that an asset's rate of return falls when its current price rises relative to its future value. When there is an excess supply of money, the current money prices of illiquid assets that pay interest will be bid up as individuals attempt to reduce their money holdings. This rise in current asset prices lowers the rate of return on nonmoney assets, and since this rate of return is equal to the interest rate (after adjustment for risk), the interest rate also must fall.

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).



unwilling money holders compete to lend their excess cash balances. At point 2 in Figure 14-4, the interest rate has fallen sufficiently to induce an increase in real money demand equal to the increase in the real money supply.

By running the above policy experiment in reverse, we can see how a reduction of the money supply forces interest rates upward. A fall in M^s causes an excess demand for money at the interest rate that previously balanced supply and demand. People attempt to sell interest-bearing assets—that is, to borrow—to rebuild their depleted real money holdings. Since they cannot all be successful when there is excess money demand, the interest rate is pushed upward until everyone is content to hold the smaller real money stock.

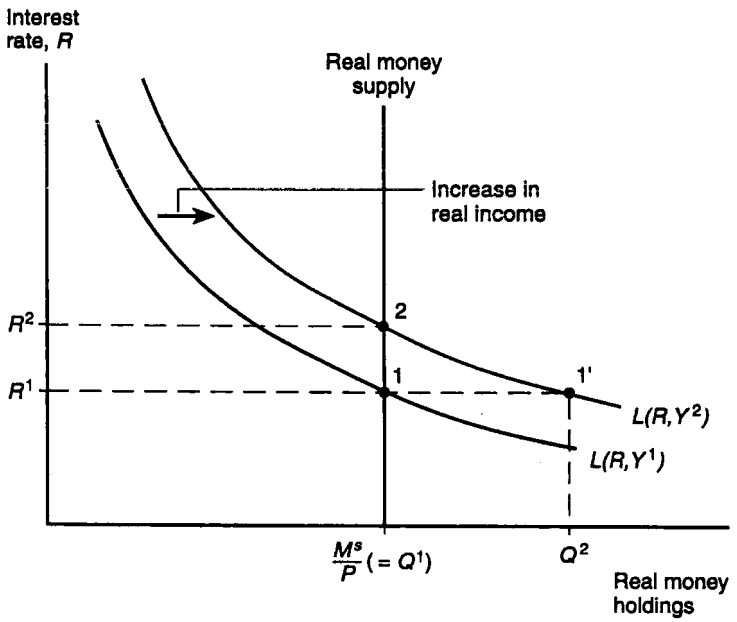
We conclude that *an increase in the money supply lowers the interest rate, while a fall in the money supply raises the interest rate, given the price level and output.*

Output and the Interest Rate

Figure 14-5 shows the effect on the interest rate of a rise in the level of output from Y^1 to Y^2, given the money supply and the price level. As we saw earlier, an increase in output causes the entire aggregate real money demand schedule to shift to the right, moving the equilibrium away from point 1. At the old equilibrium interest rate, R^1, there is an excess demand for money equal to $Q^2 - Q^1$ (point 1'). Since the real money supply is given, the interest rate is bid up until it reaches the higher new equilibrium level R^2 (point 2). A fall in output has opposite effects, causing the aggregate real money demand schedule to shift to the left and therefore causing the equilibrium interest rate to fall.

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).



We conclude that *an increase in real output raises the interest rate, while a fall in real output lowers the interest rate, given the price level and the money supply.*

THE MONEY SUPPLY AND THE EXCHANGE RATE IN THE SHORT RUN

In Chapter 13 we learned about the interest parity condition, which predicts how interest rate movements influence the exchange rate, given expectations about the exchange rate's future level. Now that we know how shifts in a country's money supply affect the interest rate on nonmoney assets denominated in its currency, we can see how monetary changes affect the exchange rate. We will discover that an increase in a country's money supply causes its currency to depreciate in the foreign exchange market, while a reduction in the money supply causes its currency to appreciate.

In this section we continue to take the price level (along with real output) as given, and for that reason we label the analysis of this section **short run**. The **long run** analysis of an economic event allows for the complete adjustment of the price level (which may take a long time) and for full employment of all factors of production. Later in this chapter we examine the long-run effects of money supply changes on the price level, the exchange rate, and other macroeconomic variables. Our long-run analysis will show how the money supply influences exchange rate expectations, which we also continue to take as given for now.

price, exchange rate expectations are taken as given

Linking Money, the Interest Rate, and the Exchange Rate

To analyze the relation between money and the exchange rate in the short run in Figure 14-6, we combine two diagrams that we have already studied separately. Let's assume once again that we are looking at the dollar/euro exchange rate, that is, the price of euros in terms of dollars.

The first diagram (introduced as Figure 13-4) shows equilibrium in the foreign exchange market and how it is determined given interest rates and expectations about future exchange rates. This diagram appears as the top part of Figure 14-6. The dollar interest rate, $R_{\$}^1$, which is determined in the money market, defines the vertical schedule.

As you will remember from Chapter 13, the downward-sloping expected euro return schedule shows the expected return on euro deposits, measured in dollars. The schedule slopes downward because of the effect of current exchange rate changes on expectations of future depreciation: A strengthening of the dollar today (a fall in $E_{\$/€}$) relative to its *given* expected future level makes euro deposits more attractive by leading people to anticipate a sharper dollar depreciation in the future.

At the intersection of the two schedules (point 1'), the expected rates of return on dollar and euro deposits are equal, and therefore interest parity holds. $E_{\$/€}^1$ is the equilibrium exchange rate.

The second diagram we need to examine the relation between money and the exchange rate was introduced as Figure 14-3. This figure shows how a country's equilibrium interest is determined in its money market and it appears as the bottom part of Figure 14-6. For convenience, however, the figure has been rotated clockwise by 90 degrees so that dollar interest rates are measured from 0 on the horizontal axis and the U.S. real money supply is measured from 0 on the descending vertical axis. Money market equilibrium is shown at point 1, where the dollar interest rate $R_{\$}^1$ induces people to demand real balances equal to the U.S. real money supply, M_{US}^s/P_{US}.

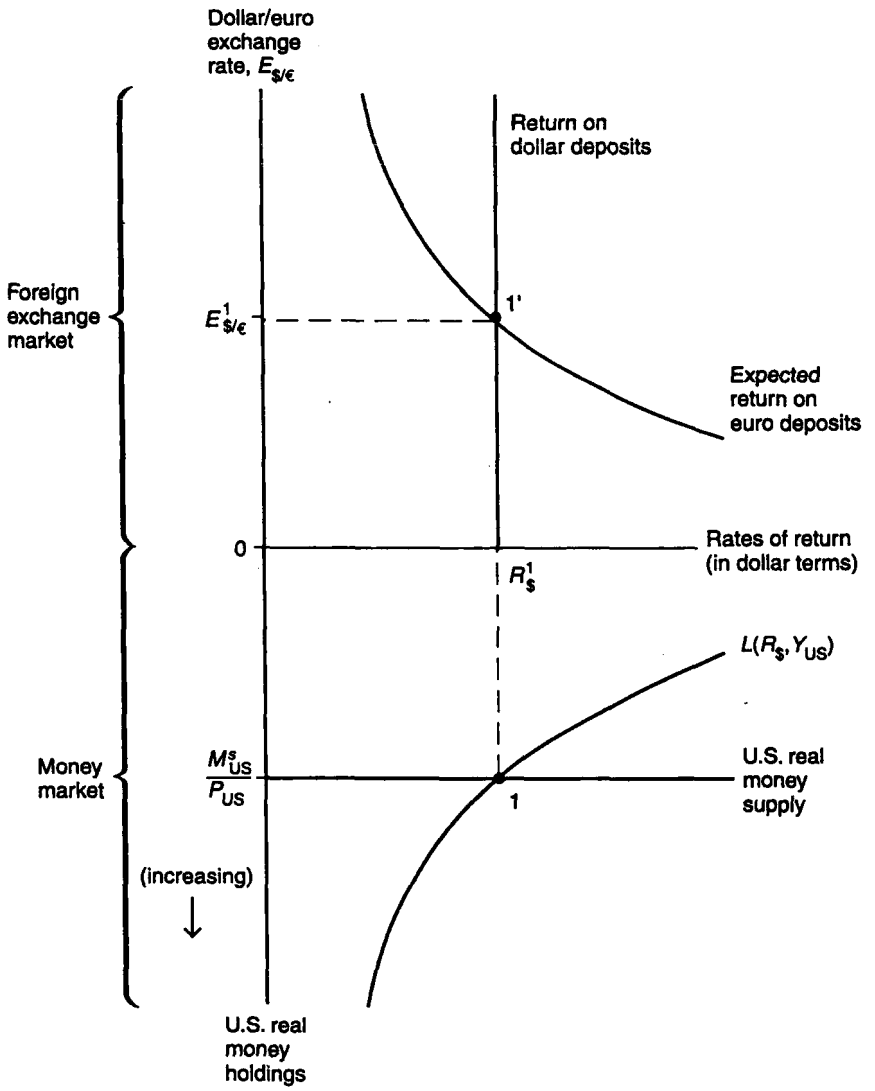
Figure 14-6 emphasizes the link between the U.S. money market (bottom) and the foreign exchange market (top)—the U.S. money market determines the dollar interest rate, which in turn affects the exchange rate that maintains interest parity. (Of course, there is a similar link between the European money market and the foreign exchange market that operates through changes in the euro interest rate.)

Figure 14-7 illustrates these linkages. The U.S. and European central banks, the Federal Reserve System and the European System of Central Banks (ESCB), determine the U.S. and European money supplies, M_{US}^s and M_E^s. Given the price levels and national incomes of the two countries, equilibrium in national money markets leads to the dollar and euro interest rates $R_{\$}$ and $R_{€}$. These interest rates feed into the foreign exchange market where, given expectations about the future dollar/euro exchange rate, the current rate $E_{\$/€}$ is determined by the interest parity condition.

U.S. Money Supply and the Dollar/Euro Exchange Rate

We now use our model of asset market linkages (the links between the money and foreign exchange markets) to ask how the dollar/euro exchange rate changes when the Federal Reserve changes the U.S. money supply M_{US}^s. The effects of this change are summarized in Figure 14-8.

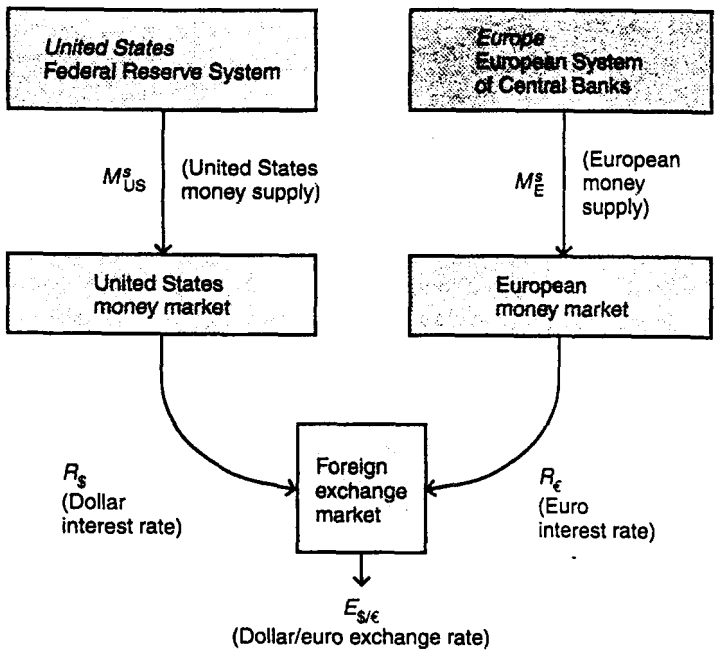
Figure 14-6 Simultaneous Equilibrium in the U.S. Money Market and the Foreign-Exchange Market



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

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.



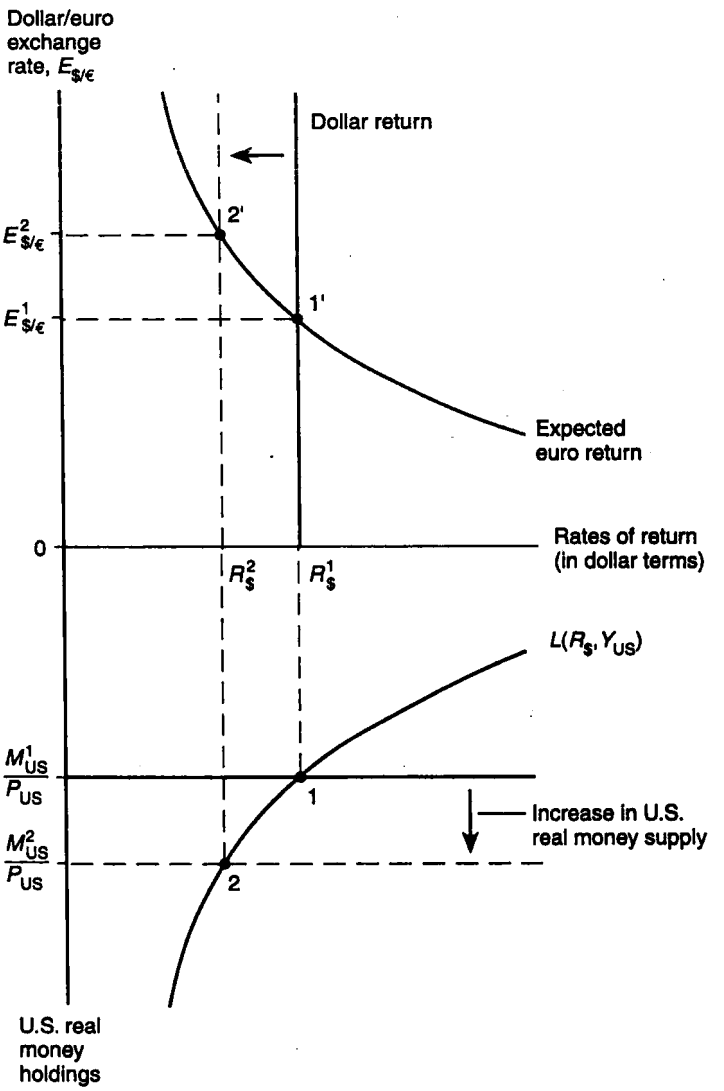
At the initial money supply M^1_{US}, the money market is in equilibrium at point 1 with an interest rate $R^1_\$$. Given the euro interest rate and the expected future exchange rate, a dollar interest rate of $R^1_\$$ implies that foreign exchange market equilibrium occurs at point 1′, with an exchange rate equal to $E^1_{\$/€}$.

What happens when the Federal Reserve raises the U.S. money supply from M^1_{US} to M^2_{US}? This increase sets in train the following sequence of events: (1) At the initial interest rate $R^1_\$$ there is an excess supply of money in the U.S. money market, so the dollar interest rate falls to $R^2_\$$ as the money market reaches its new equilibrium position (point 2). (2) Given the initial exchange rate $E^1_{\$/€}$ and the new, lower interest rate on dollars, $R^2_\$$, the expected return on euro deposits is greater than that on dollar deposits. Holders of dollar deposits therefore try to sell them for euro deposits, which are momentarily more attractive. (3) The dollar depreciates to $E^2_{\$/€}$, as holders of dollar deposits bid for euro deposits. The foreign exchange market is once again in equilibrium at point 2′ because the exchange rate's move to $E^2_{\$/€}$ causes a fall in the dollar's expected future depreciation rate sufficient to offset the fall in the dollar interest rate.

We conclude that *an increase in a country's money supply causes its currency to depreciate in the foreign exchange market.* By running Figure 14-8 in reverse, you can see that *a reduction in a country's money supply causes its currency to appreciate in the foreign exchange market.*

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^1_{US} to M^2_{US}, 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').



Europe's Money Supply and the Dollar/Euro Exchange Rate

The conclusions we have reached also apply when the ESCB changes Europe's money supply. An increase in M^s_E causes a depreciation of the euro (that is, an appreciation of the