Questions for Review

1. The Keynesian-cross model tells us that fiscal policy has a multiplied effect on income. The reason is that according to the consumption function, higher income causes higher consumption. For example, an increase in government purchases of ΔG raises expenditure and, therefore, income by ΔG. This increase in income causes consumption to rise by $MPC \times \Delta G$, where MPC is the marginal propensity to consume. This increase in consumption raises expenditure and income even further. This feedback from consumption to income continues indefinitely. Therefore, in the Keynesian-cross model, increasing government spending by one dollar causes an increase in income that is greater than one dollar: it increases by $1/(1 - MPC)$.

2. The theory of liquidity preference explains how the supply and demand for real money balances determine the interest rate. A simple version of this theory assumes that there is a fixed supply of money, which the Fed chooses. The price level P is also fixed in this model, so that the supply of real balances is fixed. The demand for real money balances depends on the interest rate, which is the opportunity cost of holding money. At a high interest rate, people hold less money because the opportunity cost is high. By holding money, they forgo the interest on interest-bearing deposits. In contrast, at a low interest rate, people hold more money because the opportunity cost is low. Figure 10–1 graphs the supply and demand for real money balances. Based on this theory of liquidity preference, the interest rate adjusts to equilibrate the supply and demand for real money balances.
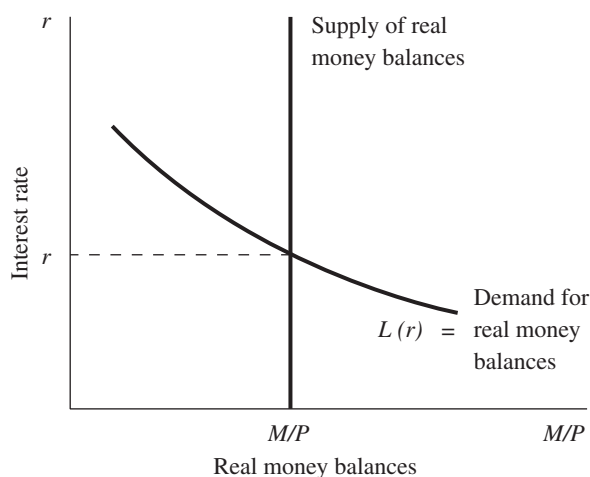

Figure 10–1

Why does an increase in the money supply lower the interest rate? Consider what happens when the Fed increases the money supply from M_1 to M_2. Because the price level P is fixed, this increase in the money supply shifts the supply of real money balances M/P to the right, as in Figure 10–2.
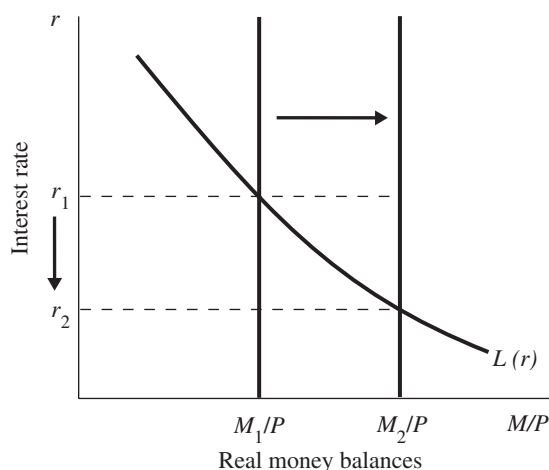

Figure 10–2

The interest rate must adjust to equilibrate supply and demand. At the old interest rate r_1, supply exceeds demand. People holding the excess supply of money try to convert some of it into interest-bearing bank deposits or bonds. Banks and bond issuers, who prefer to pay lower interest rates, respond to this excess supply of money by lowering the interest rate. The interest rate falls until a new equilibrium is reached at r_2.

3. The *IS* curve summarizes the relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. Investment is negatively related to the interest rate. As illustrated in Figure 10–3, if the interest rate rises from r_1 to r_2, the level of planned investment falls from I_1 to I_2.
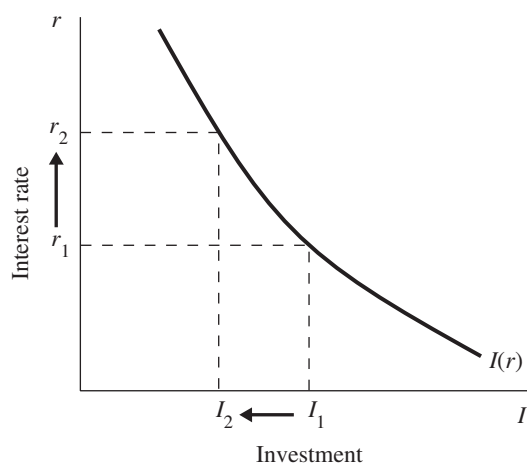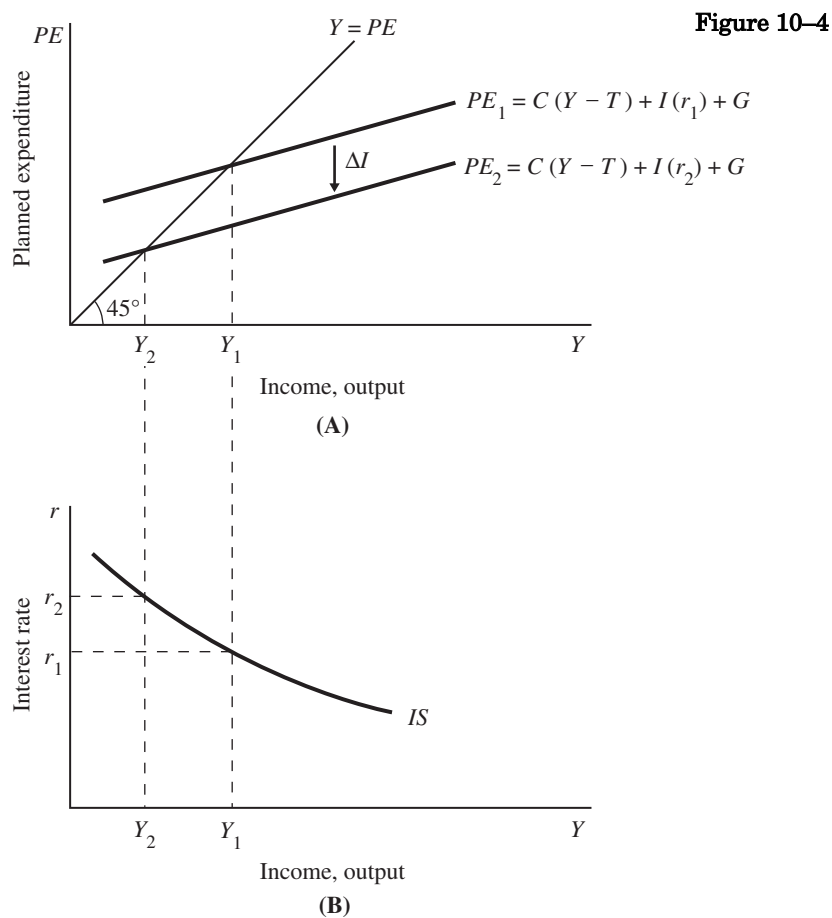

Figure 10–3

The Keynesian cross tells us that a reduction in planned investment shifts the expenditure function downward and reduces national income, as in Figure 10–4(A).

Figure 10–4

Thus, as shown in Figure 10–4(B), a higher interest rate results in a lower level of national income: the *IS* curve slopes downward.

4. The *LM* curve summarizes the relationship between the level of income and the inter-est rate that arises from equilibrium in the market for real money balances. It tells us the interest rate that equilibrates the money market for any given level of income. The theory of liquidity preference explains why the *LM* curve slopes upward. This theory assumes that the demand for real money balances $L(r, Y)$ depends negatively on the interest rate (because the interest rate is the opportunity cost of holding money) and positively on the level of income. The price level is fixed in the short run, so the Fed determines the fixed supply of real money balances M/P. As illustrated in Figure 10–5(A), the interest rate equilibrates the supply and demand for real money balances for a given level of income.

Figure 10–5

Real money balances
(A)

Income, output
(B)
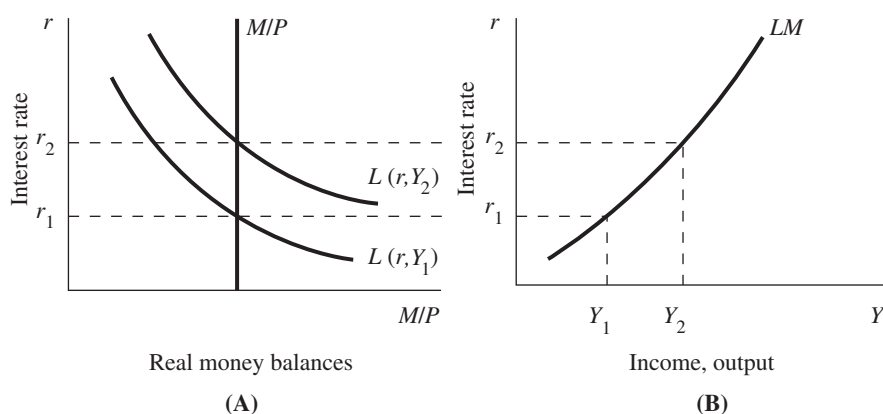
Now consider what happens to the interest rate when the level of income increas-es from Y_1 to Y_2. The increase in income shifts the money demand curve upward. At the old interest rate r_1, the demand for real money balances now exceeds the supply. The interest rate must rise to equilibrate supply and demand. Therefore, as shown in Figure 10–5(B), a higher level of income leads to a higher interest rate: The *LM* curve slopes upward.

Problems and Applications

1. a.   The Keynesian cross illustrates an economy's planned expenditure function, $PE = C(Y - T) + I + G$, and the equilibrium condition that actual expenditure equals planned expenditure, $Y = PE$, as shown in Figure 10–6.
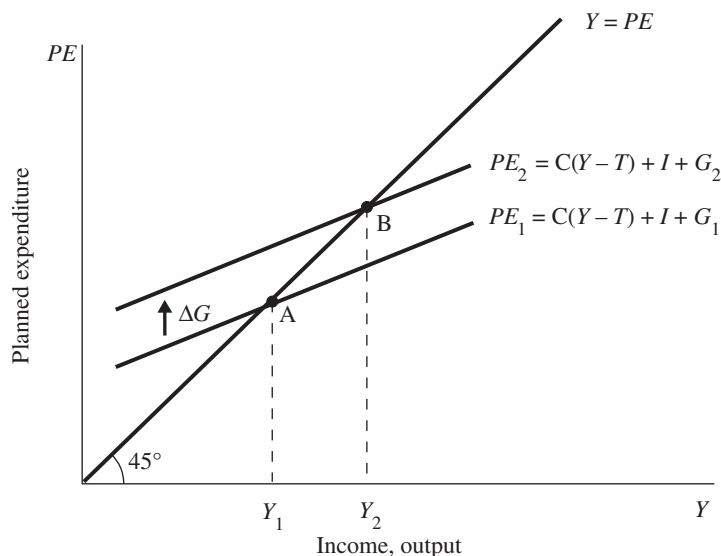

Figure 10–6

An increase in government purchases from G_1 to G_2 shifts the planned expenditure function upward. The new equilibrium is at point B. The change in equilibrium GDP, Y, equals the product of the government-purchases multiplier and the change in government spending: $\Delta Y = [1/(1 - MPC)]\Delta G$. Because we know that the marginal propensity to consume MPC is less than one, this expression tells us that a one-dollar increase in G leads to an increase in Y that is greater than one dollar.

   b.   An increase in taxes ΔT reduces disposable income $Y - T$ by ΔT and, therefore, reduces consumption by $MPC \times \Delta T$. For any given level of income Y, planned expenditure falls. In the Keynesian cross, the tax increase shifts the planned-expenditure function down by $MPC \times \Delta T$, as in Figure 10–7.
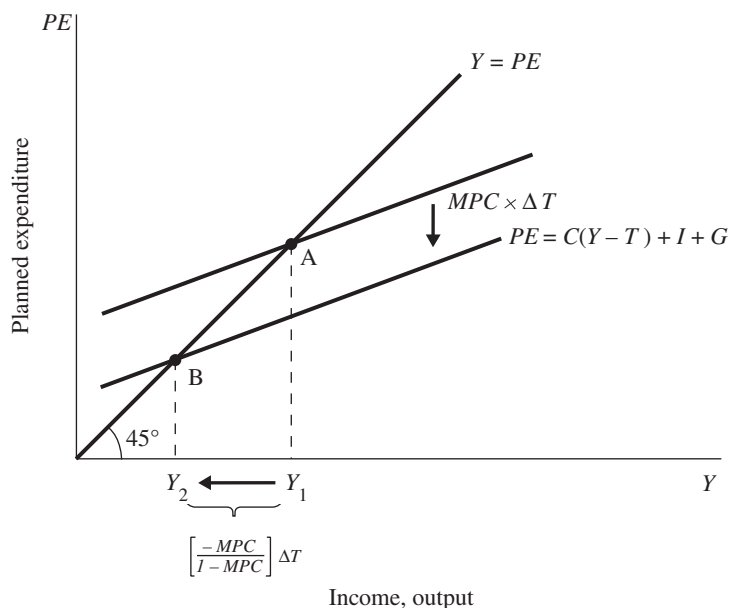

Figure 10–7

The amount by which equilibrium GDP falls is given by the product of the tax multiplier and the increase in taxes:

$$\Delta Y = [\,-MPC/(1-MPC)]\Delta T.$$

c.   We can calculate the effect of an equal increase in government expenditure and taxes by adding the two multiplier effects that we used in parts (a) and (b):

$$\Delta Y = [(1/(1-MPC))\Delta G] - [(MPC/(1-MPC))\Delta T].$$

<div style="text-align:center">

Government   Tax
Spending   Multiplier
Multiplier

</div>

Because government purchases and taxes increase by the same amount, we know that $\Delta G = \Delta T$. Therefore, we can rewrite the above equation as:

$$\Delta Y = [(1/(1-MPC)) - (MPC/(1-MPC))]\Delta G$$

$$= \Delta G.$$

This expression tells us that an equal increase in government purchases and taxes increases Y by the amount that G increases. That is, the balanced-budget multiplier is exactly 1.
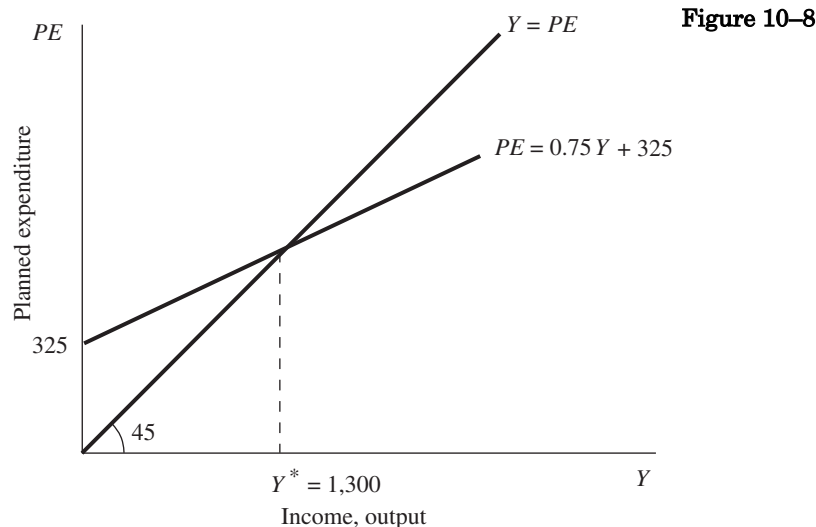
2. a.   Total planned expenditure is

$$PE = C(Y-T) + I + G.$$

Plugging in the consumption function and the values for investment I, government purchases G, and taxes T given in the question, total planned expenditure PE is

$$PE = 200 + 0.75(Y-100) + 100 + 100$$

$$= 0.75Y + 325.$$

This equation is graphed in Figure 10–8.

Figure 10–8

b.   To find the equilibrium level of income, combine the planned-expenditure equation derived in part (a) with the equilibrium condition $Y = PE$:

$$Y = 0.75Y + 325$$

$$Y = 1,300.$$

The equilibrium level of income is 1,300, as indicated in Figure 10–8.

c.   If government purchases increase to 125, then planned expenditure changes to $PE = 0.75Y + 350$. Equilibrium income increases to $Y = 1,400$. Therefore, an

increase in government purchases of 25 (i.e., 125 − 100 = 25) increases income by 100. This is what we expect to find, because the formula for the government-purchases multiplier is 1/(1 − *MPC*), the *MPC* is 0.75, and the government-purchases multiplier therefore has a numerical value of 4.

d. An income level of 1,600 represents an increase of 300 over the original level of income. The government-purchases multiplier is 1/(1 − *MPC*): the *MPC* in this example equals 0.75, so the government-purchases multiplier is 4. This means that government purchases must increase by 75 (to a level of 175) for income to increase by 300.

3. a. When taxes do not depend on income, a one-dollar increase in income means that disposable income increases by one dollar. Consumption increases by the marginal propensity to consume *MPC*. When taxes do depend on income, a one-dollar increase in income means that disposable income increases by only (1 − *t*) dollars. Consumption increases by the product of the *MPC* and the change in disposable income, or (1 − *t*)*MPC*. This is less than the *MPC*. The key point is that disposable income changes by less than total income, so the effect on consumption is smaller.

b. When taxes are fixed, we know that Δ*Y*/Δ*G* = 1/(1 − *MPC*). We found this by considering an increase in government purchases of Δ*G*; the initial effect of this change is to increase income by Δ*G*. This in turn increases consumption by an amount equal to the marginal propensity to consume times the change in income, *MPC* × Δ*G*. This increase in consumption raises expenditure and income even further. The process continues indefinitely, and we derive the multiplier above.

When taxes depend on income, we know that the increase of Δ*G* increases total income by Δ*G*; disposable income, however, increases by only (1 − *t*)Δ*G*—less than dollar for dollar. Consumption then increases by an amount (1 − *t*)*MPC* × Δ*G*. Expenditure and income increase by this amount, which in turn causes consumption to increase even more. The process continues, and the total change in output is

$$\Delta Y = \Delta G \{1 + (1 - t)MPC + [(1 - t)MPC]^2 + [(1 - t)MPC]^3 + ...\}$$

$$= \Delta G [1/(1 - (1 - t)MPC)].$$

Thus, the government-purchases multiplier becomes 1/(1 − (1 − *t*)*MPC*) rather than 1/(1 − *MPC*). This means a much smaller multiplier. For example, if the marginal propensity to consume *MPC* is 3/4 and the tax rate *t* is 1/3, then the multiplier falls from 1/(1 − 3/4), or 4, to 1/(1 − (1 − 1/3)(3/4)), or 2.

c. In this chapter, we derived the *IS* curve algebraically and used it to gain insight into the relationship between the interest rate and output. To determine how this tax system alters the slope of the *IS* curve, we can derive the *IS* curve for the case in which taxes depend on income. Begin with the national income accounts identity:

$$Y = C + I + G.$$

The consumption function is

$$C = a + b(Y - \overline{T} - tY).$$

Note that in this consumption function taxes are a function of income. The investment function is the same as in the chapter:

$$I = c - dr.$$

Substitute the consumption and investment functions into the national income accounts identity to obtain:

$$Y = [a + b(Y - \overline{T} - tY)] + c - dr + G.$$

Solving for *r*:

$$r = \frac{a - b\overline{T} + c + G}{d} + Y\left[\frac{b(1 - t) - 1}{d}\right].$$

The slope of the *IS* curve is therefore:

$$\frac{\Delta r}{\Delta y} = \frac{b(1-t)-1}{d}.$$

Recall that *t* is a number that is less than 1. As *t* becomes a bigger number, the slope of the *IS* curve increases in absolute value terms and the curve becomes steeper. Suppose, for example, that *b* is 0.80, *t* is 0.1, and *d* is 0.5. The slope of the *IS* curve is –0.56. If the tax rate increases to 0.2, then the slope becomes –0.72. Intuitively, if the tax rate is higher, then any given reduction in the interest rate has a smaller effect on real output *Y* because the multiplier will be smaller.

4. a. If society becomes more thrifty—meaning that for any given level of income people save more and consume less—then the planned-expenditure function shifts downward, as in Figure 10–9 (note that $C_2 < C_1$). Equilibrium income falls from Y_1 to Y_2.
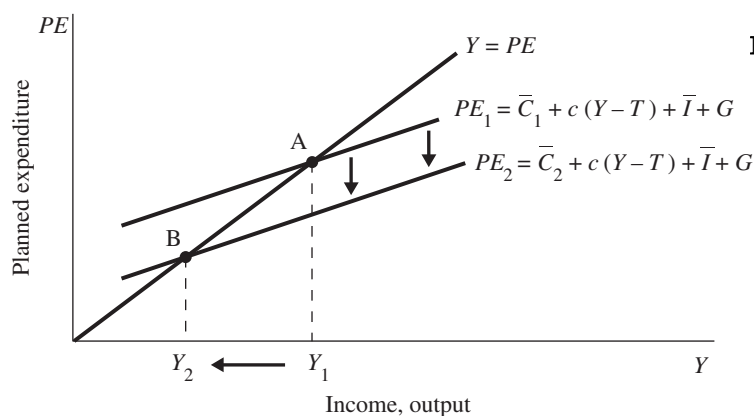

Figure 10–9

b. Equilibrium saving remains unchanged. The national accounts identity tells us that saving equals investment, or *S = I*. In the Keynesian-cross model, we assumed that desired investment is fixed. This assumption implies that investment is the same in the new equilibrium as it was in the old. We can conclude that saving is exactly the same in both equilibria.

c. The paradox of thrift is that even though thriftiness increases, saving is unaffected. Increased thriftiness leads only to a fall in income. For an individual, we usually consider thriftiness a virtue. From the perspective of the entire economy as represented by the Keynesian-cross model, however, thriftiness is a vice.

d. In the classical model of Chapter 3, the paradox of thrift does not arise. In that model, output is fixed by the factors of production and the production technology, and the interest rate adjusts to equilibrate saving and investment, where investment depends on the interest rate. An increase in thriftiness decreases consumption and increases saving for any level of output; since output is fixed, the saving schedule shifts to the right, as in Figure 10–10. At the new equilibrium, the interest rate is lower, and investment and saving are higher.
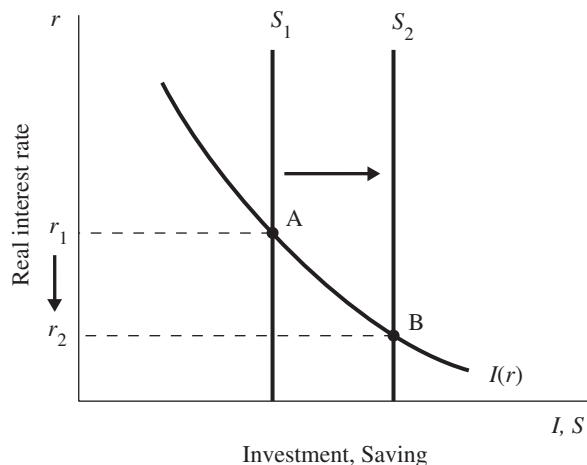
Figure 10–10

Thus, in the classical model, the paradox of thrift does not exist.

5. a.   The downward sloping line in Figure 10–11 represents the money demand function $(M/P)^d = 1,000 - 100r$. With $M = 1,000$ and $P = 2$, the real money supply $(M/P)^s = 500$. The real money supply is independent of the interest rate and is, therefore, represented by the vertical line in Figure 10–11.
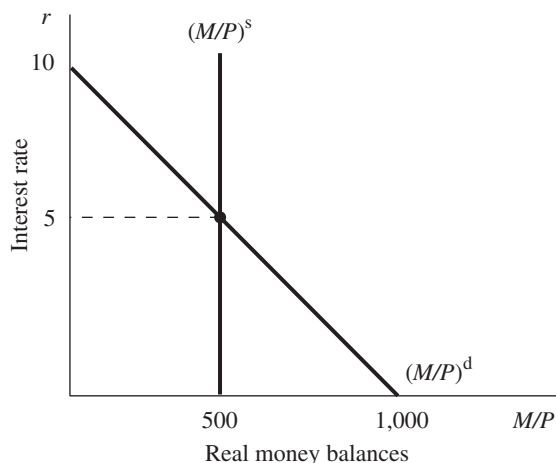

Figure 10–11

   b.   We can solve for the equilibrium interest rate by setting the supply and demand for real balances equal to each other:

$$500 = 1,000 - 100r$$

$$r = 5.$$

Therefore, the equilibrium real interest rate equals 5 percent.

   c.   If the price level remains fixed at 2 and the supply of money is raised from 1,000 to 1,200, then the new supply of real balances $(M/P)^s$ equals 600. We can solve for the new equilibrium interest rate by setting the new $(M/P)^s$ equal to $(M/P)^d$:

$$600 = 1,000 - 100r$$

$$100r = 400$$

$$r = 4.$$

Thus, increasing the money supply from 1,000 to 1,200 causes the equilibrium interest rate to fall from 5 percent to 4 percent.

d. To determine at what level the Fed should set the money supply to raise the interest rate to 7 percent, set $(M/P)^s$ equal to $(M/P)^d$:

$$M/P = 1,000 - 100r.$$

Setting the price level at 2 and substituting $r = 7$, we find:

$$M/2 = 1,000 - 100 \times 7$$

$$M = 600.$$

For the Fed to raise the interest rate from 5 percent to 7 percent, it must reduce the nominal money supply from 1,000 to 600.