In Section 4-6, the Box: “How Easy Money Created a Boom and Bust in Housing” has been changed from the title “How Monetary Policy Actually Worked in 2001–2004.” This box has been extended with a newer explanation of how the Fed’s policy may have created the so-called “mortgage market” sub prime mortgage market crisis in the years 2006 and 2007. He has updated the data in the figure “A Tale of Two Interest Rates.” A new subsection or B-head, “The LM Curve Can also be Shifted by Changes in the Demand for Money,” has been included.

In Section 4-10. IP Box: “Monetary and Fiscal Policy Paralysis in Japan ‘Lost Decade’” has been updated with newer data and diagrams. A footnote about the reference has been replaced.

A new subsection with the title “Infrastructure, Minneapolis, and the Monetary-Fiscal Policy Mix” has been included to reveal the role of government investment expenditures on national infrastructure and why they are important for long-run economic growth.

### Answers to Questions in Textbook

1. As a medium of exchange, money is used by people and businesses in transactions when they are spending income and paying for resources used in the production of output. Therefore, when income rises, the value of those transactions increases, resulting in a greater demand for money. Money is also used as a store of value because it can be easily exchanged for goods and services. However when the interest rate rises, people and businesses are willing to give up some of this convenience in order to earn a higher interest rate. So the demand for real cash balances declines as the interest rate rises.

2. When the economy is “off” the IS curve, planned expenditure will not equal output. If the economy is to the “left” of the IS curve, \( E_p > Y \), and there is a negative unplanned inventory change. Firms will increase output until \( E_p = Y \). As firms seek funds with which to increase inventory investment, they will bid up the interest rate. Thus, the movement will tend to be upward and to the right. If the economy is to the “right” of the IS curve, there is a positive unplanned inventory change and either output, the interest rate, or both will decline.

3. When the economy is “off” the LM curve, the demand for real money balances will not equal the supply of real balances in the economy. If the economy is to the left of the LM curve, the amount of money demanded, given the interest rate and income level, is less than the money supplied. Then, individuals will attempt to “get rid of” the excess money; this activity will cause bond prices to rise and interest rates to fall. This process will continue until interest rates fall enough to cause equality between the demand for real balances and the money supply. It is also possible that individuals will “get rid of” their excess money balances by spending them on goods and services. Then, the movement will be downward and to the right. The opposite movements will occur if the economy is to the right of the LM curve.

4. The crowding-out effect comes through rising interest rates. Thus, autonomous expenditure sensitive to the interest rate would decrease. Induced expenditure responds to changes in real output.

5. Some government expenditure, such as local bonding for school building construction and other state and local expenditure for capital improvements, is sensitive to changes in the interest rate and could be “crowded out” if the interest rate increases. The government debt seemed to encourage fiscal responsibility in Congress during the 1980s and 1990s. It is possible that the “normal” increase in government expenditure may be reduced in response to the interest burden on the federal budget. Whether one thinks this is a likely scenario, of course, depends on one’s view of the government budgetary process.
6. Along a given LM curve the money supply is unchanged. Thus, the velocity of money rises as income rises and falls as income falls. Velocity behaves this way because of the effects of the interest rate and income on the demand for money. A higher interest rate reduces the demand for real money balances and requires higher income to keep the demand for money equal to the fixed money supply. At a lower interest rate, a smaller income maintains equilibrium in the money market.

7. a. This situation is a point to the left of the IS and LM curves. Planned spending exceeds income at any point to the left of the IS curve. There is an excess supply of money at any point to the left of the LM curve. When planned spending exceeds income, firms have negative inventory investment, so they step up production and income rises. When there is an excess supply of money, people attempt to turn money into stock, bonds, and other income generating assets. These actions drive up the prices of those assets and drive down the interest rate.
   b. This situation is a point to the right of the IS curve and to the left of the LM curve. Unintended inventory investment is positive at any point to the right of the IS curve. The real demand for money is less than the supply of money at any point to the left of the LM curve. When unintended inventory investment is positive, firms cut output and income falls. When the demand for money is less than the supply of money, people attempt to turn money into stock, bonds, and other income generating assets. These actions drive up the prices of those assets and drive down the interest rate.
   c. This situation is a point to the left of the IS curve and to the right of the LM curve. Unintended inventory investment is negative at any point to the left of the IS curve. This causes firms to step up production and income rises. There is an excess demand for money at any point to the right of the LM curve. People attempt to turn stock, bonds, and other income generating assets into money. These actions drive down the prices of those assets and drive up the interest rate.
   d. This situation is a point to the right of the IS and the LM curves. Planned spending is less than income at any point to the right of the IS curve and firms have positive quantities of unwanted inventories. Therefore, they cut production and income falls. The real demand for money exceeds the supply of money at any point to the right of the LM curve. People attempt to turn stock, bonds, and other income generating assets into money. These actions drive down the prices of those assets and drive up the interest rate.

8. Monetary policy resulted in a sharp fall in mortgage interest rates in the first half of the current decade. As a result, more people were either able to buy a house for the first time or trade up to a larger house. That resulted in increases in both in housing construction and house prices. The rise in house prices triggered an additional round of housing construction, as people viewed a house or a condominium not simply as a residence, but also as a financial investment.

The boom came to an end when monetary policymakers reversed course in mid-2004. That reversal caused a rise in mortgage rates, resulting in a fall in the demand for housing and a cessation of the rise in house prices, creating a particular problem for those who had invested in real estate in anticipation of housing prices continuing to rise. In addition, low-income and people with poor credit histories found their mortgages rates adjusted upward due to the reversal of monetary policy, making it more difficult for them to continue to meet their mortgage obligations. These events resulted in banks first, foreclosing on borrowers who fell behind on their loans, and second, restricting lending for new mortgages. Home builders, recognizing the difficulties that homeowners and banks were having selling existing homes, responded by sharply reducing construction of new housing.

9. a. Shift (for a given Y, \((M^*/P) = (M/P)\) at a lower \(r\)).
   b. Rotate (the horizontal intercept is unchanged).
   c. Shift and rotate (both horizontal intercept and slope change).
   d. No effect on position or slope of LM curve.
e. Causes movement along $LM$ curve, but does not affect its position or slope.
f. Shift (for a given $M^s$, changes the real money supply).
g. Since the prices of goods and services and nominal amounts in checking accounts were adjusted in proportion to the amount a unit of each currency could be converted into the Euro, there would be no change in either the real demand for money or the real money supply. Therefore, there would be neither a shift nor a rotation of the $LM$ curve.
h. The switch from using checks to using debit cards to buy goods and services has no effect on the real demand for money. The switch from checks to debit cards merely affects how people access the funds they have in checking accounts when they buy goods and services. Therefore, there would be neither a shift nor a rotation of the $LM$ curve.
i. The switch from using checks to credit cards to buy goods and services has two effects on the real demand for money. First, the switch reduces the real demand for money at each combination of real income and the interest rate. That causes the $LM$ curve to shift to the right since it will take a higher level of real income to equate the real demand for and real supply of money, given the interest rate. Second, the switch reduces how much the real demand for money increases as real income rises, given the interest rate. That causes the $LM$ curve to rotate and become flatter because if the demand for money increases by a smaller amount when real income rises, it takes a smaller increase in the interest rate to restore equilibrium in the money market.

10. If government spending becomes negatively sensitive to changes in the interest rate, then autonomous spending declines by a larger amount for any given change in the interest rate. Therefore, the $IS$ curve becomes flatter and, other things being equal, any given fiscal expansion results in smaller increases in output and the interest rate. However, because the fiscal expansion causes a smaller increase the interest rate, it also means that less autonomous consumption and planned investment is crowded out by the fiscal expansion.

Likewise, if autonomous taxes become positively sensitive to changes in the interest rate, then disposable income declines when the interest rate rises. That means that autonomous spending becomes more sensitive to the interest rate. Therefore, the $IS$ curve becomes flatter and, other things being equal, any given fiscal expansion results in smaller increases in output and the interest rate. However, because the fiscal expansion causes a smaller increase the interest rate, it also means that less autonomous consumption and planned investment is crowded out by the fiscal expansion.

11. If private sector spending is highly sensitive to a change in the interest rate, then the $IS$ curve is relatively flat. The main effect of a fiscal expansion will be a higher interest rate that reduces private sector spending almost as much as the fiscal expansion increases autonomous spending. As a result, the fiscal expansion causes very little increase in output. In the case of a fiscal contraction, the effect of the lower interest rate on private sector spending almost offsets the effect of the fiscal contraction. As a result, fiscal policy is unable to have much of an impact on output.

On the other hand, monetary policy is quite capable of changing output if private sector spending is highly sensitive to a change in the interest rate. A policy of tight money will result in a sharp contraction of private sector spending as the interest rate rises. Easy money will provide a large stimulus to private sector spending as the interest rate falls.

12. If the demand for money is highly insensitive to a change in the interest rate, then as fiscal policy changes income and therefore the demand for money, it will take a large change in the interest rate to restore equilibrium in the money market. This results in a change in private sector spending that offsets most of the expansion or contraction of output caused by fiscal policy.
On the other hand, monetary policy is very powerful when the demand for money is highly insensitive to a change in the interest rate. Any excess supply or demand for money that is created by a change in monetary policy must be absorbed by the way in which income affects the demand for money. This leads to a relatively large change in the interest rate and results in relatively large increases in autonomous spending and real output.

13. An increase in autonomous taxes shifts the IS curve to the left. To maintain equilibrium in the commodity and money markets, both equilibrium income and the interest rate fall. Consumption falls as a decline in induced consumption dominates any boost the lower interest rate gives autonomous consumption. Planned investment rises because of the lower interest rate.

14. Smaller demand shocks mean that the shifts left and right of the IS curve become smaller, and for a given LM curve, there is less variation in both real income and the interest rate. Therefore, if the “Great Moderation” is due to smaller demand shocks, then the decline in the variation of real GDP is accompanied by a decrease in the variation of the interest rate as well.

On the other hand, if the “Great Moderation” is due to a better response by monetary policymakers to the same demand shocks as previously, then that means that they are responding more rapidly by (a) reducing the real money supply when a shock adds to demand and (b) increasing the real money supply when a shock reduces demand. In terms of the IS-LM model, the LM curve shifts left when the IS curve shifts right and the LM curve shifts right when the IS curve shifts left. Therefore, if the “Great Moderation” is due to a better response by monetary policymakers to the same demand shocks as previously, then the decline in the variation of real GDP is accompanied by an increase in the variation of the interest rate.

15. If the Fed is not worried about inflation but is concerned that unemployment is too high, the Fed is likely to take actions to ensure that the tax cut has its maximum impact on output. The Fed is likely to increase the money supply to prevent any rise in the interest rate that would otherwise result from the tax cut. The Fed’s actions are likely to resemble those shown in the top right frame of Figure 4-10.

16. If only the Fed is able to take action, then it will have to reduce the money supply and raise interest rates in order to reduce actual real GDP relative to natural real GDP. If, however, monetary and fiscal policymakers are able to agree on a “tight money, tight fiscal policy” mix, then it is possible to reduce real GDP relative to natural real GDP without any increase in the interest rate. The “tight money, tight fiscal policy” mix would have less of an impact on interest-rate sensitive private sector spending than a monetary policy that relied solely on higher interest rates to reduce inflationary pressures.

17. To reduce actual real GDP using monetary policy, the money supply should be lowered. This shifts the LM curve to the left, and raises the real interest rate required for equilibrium in the money market at any given level of national income. As the real interest rate rises, autonomous planned spending declines, with multiplied effects on real GDP as the economy moves leftward along the IS curve. Alternatively, actual real GDP can be reduced using fiscal policy by lowering government spending, raising taxes, or some combination of the two. These policy changes reduce autonomous planned spending, again with multiplied effects on real GDP, and shift the IS curve to the left.

18. The argument is incorrect. High levels of consumer and business confidence shift both the $A_p$ demand schedule and IS curve to the right. As a result, equilibrium occurs in the commodity and money markets at a higher level of income and a higher interest rate. However, it does not follow from this that raising the interest rate during a recession would increase either consumer and business confidence or income. Ceteris paribus, a monetary policy which raised the interest rate would shift the LM curve to the left and reduce income.
Answers to Problems in Textbook

1. a. The real demand for money at each combination of the interest rate and income is given in the following table:

<table>
<thead>
<tr>
<th>Income</th>
<th>11,940</th>
<th>12,000</th>
<th>12,060</th>
<th>12,120</th>
<th>12,180</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4</td>
<td>2,765</td>
<td>2,780</td>
<td>2,795</td>
<td>2,810</td>
<td>2,825</td>
</tr>
<tr>
<td>4.7</td>
<td>2,750</td>
<td>2,765</td>
<td>2,780</td>
<td>2,795</td>
<td>2,810</td>
</tr>
<tr>
<td>5.0</td>
<td>2,735</td>
<td>2,750</td>
<td>2,765</td>
<td>2,780</td>
<td>2,795</td>
</tr>
<tr>
<td>5.3</td>
<td>2,720</td>
<td>2,735</td>
<td>2,750</td>
<td>2,765</td>
<td>2,780</td>
</tr>
<tr>
<td>5.6</td>
<td>2,705</td>
<td>2,720</td>
<td>2,735</td>
<td>2,750</td>
<td>2,765</td>
</tr>
<tr>
<td>5.9</td>
<td>2,690</td>
<td>2,705</td>
<td>2,720</td>
<td>2,735</td>
<td>2,750</td>
</tr>
<tr>
<td>6.2</td>
<td>2,675</td>
<td>2,690</td>
<td>2,705</td>
<td>2,720</td>
<td>2,735</td>
</tr>
</tbody>
</table>

b. The horizontal axis of your graph should be labeled real money balances, and the vertical axis of your graph should be labeled interest rate. The points on demand for money curve when income equals 11,940 are: (2,675, 4.4); (2,750, 4.7); (2,735, 5.0); (2,720, 5.3); (2,705, 5.6); (2,690, 5.9); and (2,675, 6.2). The points on demand for money curve when income equals 12,180 are: (2,825, 4.4); (2,810, 4.7); (2,795, 5.0); (2,780, 5.3); (2,765, 5.6); (2,750, 5.9); and (2,735, 6.2).

c. The table in Part a shows that given that the real money supply equals 2,750, the real demand for money and the real supply of money are equal at the following combinations of real income and the interest rate: (11,940, 4.7); (12,000, 5.0); (12,060, 5.3); (12,120, 5.6); and (12,180, 5.9). The horizontal axis of your graph for the \( LM \) curve should be labeled real income, and the vertical axis of your graph should be labeled interest rate. The five points on \( LM_1 \) are listed in the first sentence of this part of the problem.

d. The table in Part a shows that given that the real money supply equals 2,780, the real demand for money and the real supply of money are equal at the following combinations of real income and the interest rate: (12,000, 4.4); (12,060, 4.7); (12,120, 5.0); and (12,180, 5.3). The four points on \( LM_1 \) are just listed in the previous sentence of this part of the problem.

e. The table in Part a shows that given that the real money supply equals 2,720, the real demand for money and the real supply of money are equal at the following combinations of real income and the interest rate: (11,940, 5.3); (12,000, 5.6); (12,060, 5.9); and (12,120, 6.2). The four points on \( LM_2 \) are just listed in the previous sentence of this part of the problem.

2. a. The marginal propensity to save, \( s = 1 - c = 1 - .6 = .4 \). The multiplier, \( k \), equals the inverse of the marginal propensity to save. Therefore, the multiplier equals \( 1/.4 = 2.5 \).

b. The equation for autonomous planned spending, \( A_p \), equals \( 2,180 - 20r - .6(1,800) + 2,400 - 60r + 2,000 - 300 = 5,200 - 80r \).

c. The equation for the \( IS \) curve is \( Y = kA_p \). Given the answers to Parts a and b of this problem, we have that the equation for the \( IS \) curve is \( Y = 2.5(5,200 - 80r) = 13,000 - 200r \). Given the interest rate equals 4.7, equilibrium income in the commodity market equals \( 13,000 - 200(4.7) = 12,060 \). Given the interest rate equals 5.0, equilibrium income in the commodity market equals \( 13,000 - 200(5.0) = 12,000 \). Given the interest rate equals 5.3, equilibrium income in the commodity market equals \( 13,000 - 200(5.3) = 11,940 \). Given the interest rate equals 5.6, equilibrium income in the commodity market equals \( 13,000 - 200(5.6) = 11,880 \), and given the interest rate equals 5.9, equilibrium income in the commodity market equals \( 13,000 - 200(5.9) = 11,820 \). Your graph of the \( IS \) curve has the label of real income on the horizontal axis and the label of interest rate on the vertical axis. The five points on your \( IS \) curve are: (12,060, 4.7); (12,000, 5.0); (11,940, 5.3); (11,880, 5.6); and (11,820, 5.9).
d. The commodity and money markets are both in equilibrium where the IS and LM curves intersect. At that point and only at that point, planned expenditure and income are equal, and the real demand for money and the real supply of money are equal. The only combination of real income and the interest rate that is on both the IS curve and LM curve is real income equal to 12,000 and the interest rate equal to 5.

e. If the goal of monetary policymakers is to increase real income to 12,060 which is also natural real GDP, then they must take steps to decrease the interest rate in order to increase equilibrium income in the commodity market. Specifically, Part c of this problem shows that for the commodity market to be in equilibrium at a real income of 12,060, the interest rate must be reduced to 4.7 percent. That decrease in the interest rate would result from an increase in the real money supply. Part d of Problem 1 shows that monetary policymakers must increase the money supply to 2,780 in order to have both the commodity and money markets in equilibrium at the real income and interest rate combination of 12,060 and 4.7, respectively.

3. a. Under Party A’s proposal, the new equation for autonomous planned spending, $A_p$, equals $2,180 - 20r - .6(1,920) + 2,400 - 60r + 2,120 - 300 = 5,248 - 80r$. The equation for the IS curve is $Y = kA_p$. Given the answers to Parts a and b of this problem, we have that the equation for the new IS curve is $Y = 2.5(5,248 - 80r) = 13,120 - 200r$. Given the interest rate equals 4.7, equilibrium income in the commodity market equals $13,120 - 200(4.7) = 12,180$. Given the interest rate equals 5.0, equilibrium income in the commodity market equals $13,120 - 200(5.0) = 12,120$. Given the interest rate equals 5.3, equilibrium income in the commodity market equals $13,120 - 200(5.3) = 12,060$. Given the interest rate equals 5.6, equilibrium income in the commodity market equals $13,120 - 200(5.6) = 12,000$, and given the interest rate equals 5.9, equilibrium income in the commodity market equals $13,120 - 200(5.9) = 11,940$. Your graph of the new IS curve has the label of real income on the horizontal axis and the label of interest rate on the vertical axis. The five points on your IS curve are: (12,180, 4.7); (12,120, 5.0); (12,060, 5.3); (12,000, 5.6); and (11,940, 5.9).

b. Again, the commodity and money markets are both in equilibrium where the new IS and LM curves intersect. The only combination of real income and the interest rate that is on both the new IS curve and LM curve is real income equal to 12,060 and the interest rate equal to 5.3.

c. Under Party B’s proposal, the new equation for autonomous planned spending, $A_p$, equals $2,180 - 20r - .6(1,720) + 2,400 - 60r + 2,000 - 300 = 5,248 - 80r$. Since the equation for autonomous planned spending under Party B’s proposal is the same as for Party A’s proposal, the IS curves under the two proposals are the same.

d. Since the IS curve for Party B’s proposal is the same as the for Party A’s proposal, the equilibrium level of income and the equilibrium interest rate are the same under the two proposals.

e. The overall level of output and the interest rate are the same under the two proposals. Furthermore, the amount of planned investment is the same under the two proposals, since they do not differ in terms of their effects on the interest rate. The two proposals differ in the amounts of consumption expenditures and government spending. Since taxes are higher under Party A’s proposal when compared to Party B’s proposal and real income is the same under two proposals, disposable income, $Y - T$, is less under Party A’s proposal, resulting in a lower level of consumption as well. On the other hand, government spending is higher under Party A’s proposal when compared to Party B’s proposal.
4. a. The new equation for autonomous planned spending, \( A_p \), equals 2,180 – 20r – 0.6(1,800) + 2,400 – 60r + 2,048 – 300 = 5,248 – 80r, given the 48 billion dollar increase in infrastructure spending. Since this is the same equation for autonomous planned spending as in Parts a and c of Problem 3, the new IS equation and points on the new IS curve are the same as in Parts a and c of Problem 3.

b. Because the new IS curve in the problem is the same as those in Parts a and c of Problem 3, the commodity and money markets are both in equilibrium at real income equal to 12,060 and the interest rate equal to 5.3.

c. If there were no rise in the interest rate as a result of the increase in infrastructure spending, the commodity market would be in equilibrium at real income equal to 12,120. Therefore, 12,120 = 3,790 + 2,400 – 0.85(200) + 1,500 – 30r + 1,700 + 500 = 3,790 – 40r. That would require the Fed to increase the real money supply to 2,780, since Part d of Problem 1 shows that real income equal to 12,120 and the interest rate equal to 5.3 is a point on LM. For the Fed to be willing to do this without risking a rise in the inflation rate, natural real GDP would have to be at least 12,060. If natural real GDP were less than 12,060 and if the Fed were to increase the real money supply enough to allow both the commodity and money markets to be in equilibrium at 12,060, then real GDP would exceed natural real GDP, which we know from Chapter 1 would put upward pressure on the inflation rate.

d. In order to prevent any crowding out from the increase in infrastructure spending, the Fed would have to take steps to prevent a rise in the interest rate when infrastructure spending increases. That would require the Fed to increase the real money supply to 2,780, since Part d of Problem 1 shows that real income equal to 12,120 and the interest rate equal to 5.3 is a point on LM. For the Fed to be willing to do this without risking a rise in the inflation rate, natural real GDP would have to be at least 12,060. If natural real GDP were less than 12,060 and if the Fed were to increase the real money supply enough to allow both the commodity and money markets to be in equilibrium at 12,060, then real GDP would exceed natural real GDP, which we know from Chapter 1 would put upward pressure on the inflation rate.

e. If natural real GDP equals 12,000 and the Fed does not want the increase in infrastructure spending to cause an increase in the inflation rate, then it would take action to prevent a rise in real income when infrastructure spending increases. In particular, the Fed would reduce the real money supply when infrastructure spending rises. From Part e of Problem 1, we know that the Fed would reduce money supply to 2,720, so that the new IS curve would intersect LM, where equilibrium real income equals 12,000 and the interest rate equals 5.6.

5. \( C_s = 260 – 10r \),

a. From the Appendix of Chapter 3, we know that the multiplier equals the inverse of the marginal leakage rate, where the marginal leakage rate equals \( s(1 – t) + t + nx \). In this problem, \( s = 0.15 \), \( t = 0.2 \), and \( nx = 0.08 \), so that the marginal leakage rate equals \( 0.15(1 – 0.2) + 0.2 + 0.08 = 0.12 + 0.2 + 0.08 = 0.4 \). Therefore, the multiplier, \( k \), equals \( 1/0.4 = 2.5 \).

b. \( A_p = C_s – cT_a + I_p + G + NX_a = 260 – 10r – 0.85(200) + 1,500 – 30r + 1,700 + 500 = 3,790 – 40r \).

c. The equation of the IS curve is \( Y = kA_p \). Therefore, the equation of the IS curve is \( Y = 2.5(3,790 – 40r) = 9,475 – 100r \).

d. The slope of the IS curve is \( r/Y \). The equation for the IS curve tells us that \( Y/r = -100 \). Therefore, \( r/Y = -1/100 = -0.01 \).

e. To obtain the equation for the LM curve, use either Equation (5) on page 126 in the Appendix (a) or set the real demand for money equal to the real supply of money to get \( 0.25Y – 25r = 2,125 \). Adding 25r to both sides yields \( 0.25Y = 2,125 + 25r \). Dividing both sides by 0.25 provides us with the LM equation \( Y = 8,500 + 100r \).

f. The slope of the LM curve is \( r/Y \). The equation for the LM curve tells us that \( Y/r = 100 \). Therefore, \( r/Y = 1/100 = 0.01 \).
6. a. The only combination of real income and the interest rate that is on both the IS curve and the LM curve is \( Y = 9,475 - 100r = 8,500 + 100r \). Adding 100r to both sides yields 200r = 975. Dividing both sides by 200 yields the equilibrium interest rate \( r = 4.875 \).

   h. To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( Y = 9,475 - 100(4.875) = 8,500 + 100(4.875) = 8,987.5 \).

b. If money supply increases by 100, but G remains same at 1,700, then new LM curve is \( Y = 8,900 + 100r \) instead of \( Y = 8,500 + 100r \). New equilibrium GDP is 9,187.5 and interest rate is 2.875.

7. To avoid the crowding out of the expansionary fiscal policy described in Part a of Problem 6, the Fed would have to increase the money supply enough to (a) keep the interest rate at 5, along the new IS curve, \( Y = 13,400 - 200r \) and (b) ensure that the money market is in equilibrium at this combination of the interest rate and real output. First, let us compute what the equilibrium level of income is in terms of the new IS curve by substituting 5 for \( r \) to obtain \( Y = 12,400 \). Now let’s compute the demand for money at \( Y = 12,400 \) and \( r = 5 \) to obtain \( M/P = 0.25(12,400) - 50(5) = 2,850 \). Therefore, the Fed must increase the money supply by 100 from 2,750 to 2,850 to avoid crowding out.

8. Suppose that the real demand for money in the economy changes to \( (M/P)^d = 0.25Y - 75r \) and the real money supply changes to \( M/P = 1,875 \), but that the structure of the commodity market is the same as in Problem 4.

   a. To obtain the equation for the new LM curve, again use either Equation (5) on page 126 in the Appendix or set the real demand for money equal to the real supply of money to get \( 0.2Y - 75r = 1,431.9 \). Adding 75r to both sides yields \( 0.2Y = 1,431.9 + 75r \). Dividing both sides by 0.2 provides us with the LM equation \( Y = 7,159.5 + 375r \). To compute the equilibrium interest rate, set the equation for the IS curve equal to the equation for the new LM curve to get \( 9,475 - 100r = 7,159.5 + 375r \). Adding 100r to both sides yields \( 475r = 2,315.5 \). Dividing both sides by 475 yields the equilibrium interest rate \( r = 4.875 \). To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( Y = 9,475 - 100(4.875) = 7,159.5 + 375(4.875) = 8,987.5 \). They are same as we got in Problems 5g and 5h.

   b. The slope of the LM curve is \( r/Y \). The equation for the LM curve tells us that \( Y/r = 375 \). Therefore, \( r/Y = 1/375 = 0.00267 \).

   c. When compared to the money demand curve listed in Problem 5, the demand for money has become more sensitive to a change in the interest rate. Each one percentage point rise in the interest rate now results in a decrease in the demand for money of 75 billion as opposed to 25 billion in Problem 1. The slope of the new LM curve is 0.00267, which is less than 0.01, the slope of Problem 5’s LM curve. This means that the new LM curve is flatter than that of Problem 5.

   A fiscal expansion results in an increase in income and therefore the demand for money. Since the demand for money is more responsive to a change in the interest rate, it takes less of an increase in the interest rate to restore equilibrium in the money market. Since there is a smaller increase in the interest rate, less real output and autonomous spending is crowded out by the fiscal expansion. So in terms of its effect on output, fiscal policy should be stronger in this problem than it was in Problem 5.
9. Suppose that autonomous consumption and planned investment in the economy described in Problem 4 change to \( C_a = 470 - 40r \) and \( I_p = 1,700 - 80r \). All other aspects of the structure of the commodity and the money markets are as described in Problem 4.

a. The new autonomous spending equation is \( A_p = 470 - 15r - 0.85(200) + 1,700 - 60r + 1,700 + 500 = 4,200 - 75r \). The equation of the IS curve is \( Y = 2.5(4,200 - 60r) = 10,500 - 187.5r \). To compute the equilibrium interest rate, set the equation for the new IS curve equal to the equation for the LM curve to get \( 10,500 - 187.5r = 8,500 + 100r \). Adding 187.5r to both sides yields \( 12,375 = 287.5r \). Dividing both sides by 287.5 yields the equilibrium interest rate \( r = 7.7168 \).

b. The slope of the IS curve is \( r/Y \). The equation for the IS curve tells us that \( Y/r = -187.5 \). Therefore, \( r/Y = -1/187.5 = -0.0053 \).

c. When compared to Problem 4, autonomous consumption and planned investment have become more responsive to a change in the interest rate. In this problem, a one percentage point increase in the interest rate results in a 75 billion decrease in autonomous consumption and planned investment, as opposed to only a 40 billion decrease in Problem 1. The slope of the new IS curve is \(-0.0053\), which is less in absolute value than \(-0.01\), the slope of Problem 4’s IS curve. This means that the new IS curve is flatter than that of Problem 4.

A fiscal expansion results in an increase in income and therefore the demand for money. That creates an excess demand for money and results in a rise in the interest rate. Since the autonomous spending is more responsive to a change in the interest rate, the increase in the interest rate needed to restore equilibrium in the money market results in a larger decrease in real output and autonomous spending. So in terms of its effect on income, fiscal policy should be weaker in this problem than it was in Problem 4.
10. a. In this problem, monetary policy should be stronger than it was in Problem 4. Since autonomous spending is more responsive to a decrease in the interest rate, the decrease in the interest rate needed to restore equilibrium in the money market when there is an increase in the money supply should result in larger increases in autonomous spending and real output.

d. The new autonomous spending equation is \( A_p = 4,200 - 75r + 160 = 4,360 - 75r \). The equation of the new IS curve is \( Y = 2.5(4,360 - 75r) = 10,900 - 187.5r \). To compute the equilibrium interest rate, set the equation for the new IS curve equal to the equation for the LM curve to get 10,900 - 187.5r = 8,500 + 100r. Adding 187.5r to both sides yields 287.5r = 2,400. Dividing both sides by 287.5 yields the equilibrium interest rate \( r = 8.3478 \). To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( \frac{10,900 - 187.5(8.3478)}{8,500 + 100(8.3478)} = 9,334.78 \).

e. The new LM equation is \( Y = 8,900 + 100r \). (See Problem 5b for the derivation.) To compute the equilibrium interest rate, set the equation for the IS curve equal to the equation for the new LM curve to get 10,500 - 187.5r = 8,900 + 100r. Adding 187.5r to both sides yields 287.5r = 1,600. Dividing both sides by 287.5 yields the equilibrium interest rate \( r = 5.5652 \). To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( Y = 10,500 - 187.5(5.5652) = 8,900 + 100(5.5652) = 9,546.52 \).

f. The same fiscal expansion results in smaller increases in income and the interest rate in Part d than in Problem 5a. The same increase in the money supply results in a larger increase in output and a smaller decrease in the interest rate in Part e than in Problem 5b. These are the exact predictions in Part c.

10. a. In this problem, \( s = 0.2, \ t = 0.2, \) and \( nx = 0.14 \), so that the marginal leakage rate equals 0.2 + 0.2 + 0.14 = 0.16 + 0.2 + 0.14 = 0.5. Therefore, the multiplier, \( k \), equals \( \frac{1}{0.5} = 2 \). The equation for autonomous spending is \( A_p = 260 - 10r - 0.8(200) + 1,900 - 40r + 1,800 + 700 = 4,500 - 50r \). The equation of the IS curve is \( Y = 2(4,500 - 50r) = 9,000 - 100r \).

b. To obtain the equation for the LM curve use either Equation (5) on page 126 in the Appendix or set the real demand for money equal to the real supply of money to get \( 0.25Y - 25r = 2,000 \). Adding 25r to both sides yields \( 0.25Y = 2,000 + 25r \). Dividing both sides by 0.25 provides us with the LM equation \( Y = 8,000 + 100r \).

c. To compute the equilibrium interest rate, set the equation for the IS curve equal to the equation for the LM curve to get \( 9,000 - 100r = 8,000 + 100r \). Adding 100r to and subtracting 8,000 from both sides yields \( 200r = 1,000 \). Dividing both sides by 200 yields the equilibrium interest rate \( r = 5 \). To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( Y = 9,000 - 100(5) = 8,000 + 100(5) = 8,500 \).

d. The new equation for autonomous spending is \( A_p = 4,500 - 50r - 40 - 60 = 4,400 - 50r \). The equation of the IS curve is \( Y = 2(4,400 - 50r) = 8,800 - 100r \). To compute the new equilibrium interest rate, set the equation for the new IS curve equal to the equation for the LM curve to get \( 8,800 - 100r = 8,000 + 100r \). Adding 100r to and subtracting 8,000 from both sides yields \( 200r = 800 \). Dividing both sides by 200 yields the equilibrium interest rate \( r = 4 \). To compute equilibrium real output, substitute the equilibrium interest rate into the equations for the IS and LM curves to get \( Y = 8,800 - 100(4) = 8,000 + 100(4) = 8,400 \).

e. In order to return output to natural real GDP, autonomous taxes would have to be cut enough to get autonomous spending to rise by 100 billion, the amount that it fell due to the declines in consumer and business confidence. Since \( 100 = A_p = -0.8 \ T_a \), \( T_a = 100/(-0.8) = -125 \).
f. The money supply would have to be increased enough so that \( Y = 8,500 \) is now equilibrium output in both the commodity and money markets, given the IS curve, \( Y = 8,800 - 100r \), so that \( 8,500 = 8,800 - 100r \). Adding 100\( r \) to and subtracting 8,500 from both sides yields 100\( r = 300 \) or \( r = 3 \). That is, the Fed would have to increase the money supply enough to reduce the interest rate to 3 percent to offset the effects of declines in consumer and business confidence on autonomous spending. To compute how much the money supply needs to be increased, let’s compute the demand for money at \( Y = 8,500 \) and \( r = 3 \). The demand for money equals \( 0.25(8,500) - 25(3) = 2,125 - 75 = 2,050 \). Therefore, for both the commodity and money markets to be in equilibrium at \( Y = 8,500 \) and \( r = 3 \), the Fed would have to increase the money supply by 50 billion from 2,000 to 2,050.

g. At \( r = 5 \), autonomous consumption equals \( 220 - 10(5) = 170 \), and planned investment equals \( 1,840 - 40(5) = 1,640 \). At \( r = 3 \), autonomous consumption equals \( 220 - 10(3) = 190 \), and planned investment equals \( 1,840 - 40(3) = 1,720 \). Note that planned investment is much larger if monetary policy as opposed to fiscal policy is used to restore real output to natural real GDP. That higher level of planned investment contributes to a more rapid rate of productivity growth, and therefore a higher rate of growth in real GDP over the long run.