All Markets Together: The AS-AD Model—Liquidity Traps and Supply Shocks

CHAPTER
11

The Core: The Medium Run

We looked at the basics of the AS-AD model in the previous chapter. We found equilibrium in all three markets: goods markets, financial markets, and labour markets. This chapter looks at two important complications.

- When we had small shocks to aggregate demand in Chapter 10, output would, in time, return to its natural level. Monetary policy could also be used to speed the return of output to the natural level. We show in this chapter that a very large negative shock to aggregate demand will place the economy in a liquidity trap. In this case output will not return to its natural level regardless of how long we wait. An expansion of the money supply cannot return the economy to full employment.

- We introduce the possibility of a supply shock, a macroeconomic event that reduces the level of natural output.

Are these complications to the basic AS-AD framework necessary? Three important economies experienced a liquidity trap in the last 100 years: North America in the Great Depression of the 1930s, the prolonged Japanese slump of the 1990s, and the United States in 2009 as part of the world economic crisis of 2009. Although these events are rare, the reduction in output in a liquidity trap is large and long. Studying why these events occur, how to avoid them, and what to do when they occur is important.

A large shock to aggregate supply occurred when the real price of oil increased sharply in the 1970s. The shock led to both inflation and unemployment, a very unpleasant combination. Understanding how such an outcome could occur is worthwhile.
The Liquidity Trap and the Risk of Deflation

The first step in understanding the liquidity trap returns us to the IS-LM model in Figure 11–1. The figure depicts an IS curve and an LM curve starting at the natural level of output and interest rate $i$, the point labeled $A$. There is a large negative shock to demand that shifts the IS curve to $IS'$. In section 11–2 and the Focus boxes in this chapter, we analyze the source of such a large shock. Suffice it to say that a very large decline in consumer confidence, a very large decline in business confidence, or the combination of the two are sufficient to generate such a large shift. For now, we just accept that there is such a large shock and consider its consequences.

With such a large shock, even if the interest rate falls to zero, Figure 11–1 shows that the IS curve intersects the horizontal axis at point $C$, at a level of output much lower than the natural rate of output, $Y_n$. The economy is in the liquidity trap. Why does it have this name?

The Limits of Monetary Policy: The Liquidity Trap

To answer this question, we must first go back first to our characterization of the demand and the supply of money in Chapter 4. There we drew the demand for money, for a given level of income, as a decreasing function of the interest rate. The lower the interest rate, the larger the demand for money—equivalently, the smaller the demand for bonds. What we did not ask in Chapter 4 is what happens to the demand for money when the interest rate becomes equal to zero. The answer: Once people hold enough money for transaction purposes, they are then indifferent between holding the rest of their financial wealth in the form of money or in the form of bonds. The reason they are indifferent is that both money and bonds pay the same interest rate, namely zero. Thus, the demand for money is as shown in Figure 11–2.

- As the interest rate decreases, people want to hold more money (and thus less bonds): The demand for money increases.
- As the interest rate becomes equal to zero, people want to hold an amount of money at least equal to the distance $OB$: this is what they need for transaction purposes. But they are willing to hold even more money (and therefore hold less bonds) because they are indifferent between money and bonds. Therefore, the demand for money becomes horizontal beyond point $B$. 

In short, the liquidity trap occurs when the IS curve crosses the horizontal axis at an interest rate of zero to the left of the natural level of output.

If you look at Figure 4–1, you will see that we avoided the issue by not drawing the demand for money for interest rates close to zero.
Now consider the effects of an increase in the money supply.

- Consider the case where the money supply is $M_s$, so the interest rate consistent with financial market equilibrium is positive and equal to $i$. (This is the case we considered in Chapter 4.) Starting from that equilibrium, an increase in the money supply—a shift of the $M_s$ line to the right—leads to a decrease in the interest rate.

- Now consider the case where the money supply is $M_s/2$, so the equilibrium is at point $B$; or the case where the money supply is $M_s/3$, so the equilibrium is given at point $C$. In either case, the initial interest rate is zero. An increase in the money supply from $B$ to $C$ has no effect on the interest rate. Think of it this way:

  Suppose the central bank increases the money supply. It does so through an open market operation in which it buys bonds and pays for them by creating money. As the interest rate is zero, people are indifferent to how much money or bonds they hold, so they are willing to hold less bonds and more money at the same interest rate, namely zero. The money supply increases, but with no effect on the interest rate—which remains equal to zero.

  In short: Once the interest rate is equal to zero, expansionary monetary policy becomes powerless. Or to use the words of Keynes, who was the first to point out the problem, the increase in money falls into a liquidity trap: People are willing to hold more money (more liquidity) at the same interest rate.

  The derivation of the $LM$ curve when one takes into account the possibility of a liquidity trap is shown in the two panels of Figure 11–3. Recall that the $LM$ curve gives, for a given real money stock, the relation between the interest rate and the level of income implied by equilibrium in financial markets. To derive the $LM$ curve, Figure 11–3(a) looks at equilibrium in the financial markets for a given value of the real money stock and draws three money demand curves, each corresponding to a different level of income:

  - $M^d$ shows the demand for money for a given level of income $Y$. The equilibrium is given by point $A$, with interest rate equal to $i$. This combination of income $Y$ and interest rate $i$ gives us the first point on the $LM$ curve, point $A$ in Figure 11–3(b).
  
  - $M'^d$ shows the demand for money for a lower level of income, $Y' < Y$. Lower income means fewer transactions and, therefore, a lower demand for money at any interest rate.
In this case, the equilibrium is given by point $A'$, with interest rate equal to $i'$. This combination of income $Y'$ and interest rate $i'$ gives us the second point on the $LM$ curve, point $A'$ in Figure 11–3(b).

- $M^d^m$ gives the demand for money for a still lower level of income $Y'' < Y'$. In this case, the equilibrium is given by point $A''$ in Figure 11–3(a), with interest rate equal to zero. Point $A''$ in Figure 11–3(b) corresponds to $A'$ in Figure 11–3(a).

- What happens if income decreases below $Y''$, shifting the demand for money further to the left in Figure 11–3(a)? The intersection between the money supply curve and the money demand curve takes place on the horizontal portion of the money demand curve. The interest rate remains equal to zero.

Let’s summarize: In the presence of a liquidity trap, the $LM$ curve is given by Figure 11–3(b). For values of income greater than $Y''$, the $LM$ curve is upward sloping—just as it was in Chapter 5 when we first characterized the $LM$ curve. For values of income less than $Y''$, it is flat at $i = 0$. Intuitively: The interest rate cannot go below zero.

Having derived the $LM$ curve in the presence of a liquidity trap, we can look at the properties of the $IS$–$LM$ model modified in this way. Figure 11–4 contains the same large shift in the $IS$ curve to the left from $IS$ to $IS'$ that we introduced in Figure 11–1. If there is no response from the central bank and the real money supply remains the same, the $LM$ curve does not shift. Goods markets and financial markets would be in equilibrium at point $B$. There is a very low level of income $Y'$ and low rate of interest $i'$.

The question is: Can monetary policy help the economy return to the natural level of output, $Y_n$? Suppose the central bank increases the money supply, shifting the $LM$ curve from $LM$ to $LM'$. The equilibrium does move from point $B$ to point $C$ and output does increase from $Y''$ to $Y'$. However, as we discussed in Figures 11–2 and 11–3, a further increase in the money supply will not increase output. Once the interest rate is zero, it remains at zero and output remains at $Y''$ at point $C$.

In words: When the interest rate is equal to zero, the economy falls into a liquidity trap: The central bank can increase liquidity—that is, increase the money supply. But this liquidity falls into a trap: The additional money is willingly held by people at an unchanged interest rate, namely zero. Since the interest rate remains at zero, the demand for goods does not change. There is nothing further an expansion of the money supply can do to increase output.

The lesson is that with a very large decrease in aggregate demand—that is, a very large shift in the $IS$ curve to the left—the decline in output can be so large that the economy falls...
The Risk of Deflation

In the presence of a liquidity trap, the process of adjustment in the AS–AD model fails to return the economy to the natural level of output. Recall from Chapter 10 how the mechanism typically works:

- A decrease in output below its natural level leads to a decrease in the price level.
- This leads to an increase in the real money stock, which in turn leads to a decrease in the interest rate.
- The decrease in the interest rate leads then to an increase in spending, which in turn leads to an increase in output.

The process goes on until output has returned to its natural level. The process can be made faster by using either monetary policy (that is, by increasing the money stock, which leads to a larger decrease in the interest rate) or fiscal policy, which increases demand directly. At the core of the adjustment is the aggregate demand relation (equation (10.2) in Chapter 10):

\[ Y = Y\left(\frac{M}{P}, G, T\right) \]

Now think about what happens when the economy is in the liquidity trap, with the interest rate equal to zero. In this case, an increase in the real money stock, \( \frac{M}{P} \), whether it comes from an increase in \( M \) or from a decrease in \( P \), has no effect on the interest rate, which remains equal to zero. So not only does monetary policy not affect spending, but the adjustment mechanism that returns output to its natural level in the AS–AD model also does not work: The decrease in the price level leads to a higher real money stock but does not lead to a lower interest rate and does not lead to higher spending.

Let’s formally introduce this in our AS–AD model. If the economy is in the liquidity trap, the aggregate demand relation takes the following form:

\[ Y = Y(G, T) \]  \hspace{1cm} (11.1)  

As before, increases in government spending or decreases in taxes increase demand. But in the liquidity trap, aggregate demand no longer depends on the real money stock.
What may then happen to the economy is represented in Figure 11–5, using the AS–AD model. Aggregate supply is still represented by an upward sloping curve in the figure: The higher the level of output, the higher the price level, given the expected price level. Conversely, and more relevantly for our case, the lower the output, the lower the price level.

The aggregate demand relation is now vertical over the range of prices through A, B and C. The curve is drawn for the liquidity trap case. For given values of \( G, T \), aggregate demand does not depend on the real money stock and thus does not depend on the price level. Suppose that the initial aggregate supply and demand curves are given by \( AS \) and \( AD \) respectively, so the initial equilibrium is at point \( A \), with output \( Y \) below the natural level \( Y_n \). In other words, output is low, and the economy is in the liquidity trap. As output is below its natural level, the aggregate supply curve shifts down over time. (Recall the mechanism: Low output implies high unemployment, which puts downward pressure on wages, and in turn on prices.) The equilibrium moves over time from \( A \) to \( B \) to \( C \): The price level keeps decreasing, but this does not lead to an increase in output.

A constant decrease in the price level is called deflation. You can think of deflation as a series of years of negative inflation as prices fall when the economy moves from point \( A \) to point \( B \) to point \( C \) in Figure 11–5. Although it is not included in the modified aggregate demand relation (11.1), there are reasons to believe the expected deflation would further reduce aggregate demand, that is, shift the aggregate demand curve in Figure 11–5 further to the left and shift the IS curves in Figures 11–1 and 11–4 further to the left. Why might this happen? Imagine you are a consumer waiting to buy a new car or appliance. If you thought the price level was going to fall by 10% between now and next year, you might decide to wait to buy the new car at a lower price.

11-2  |  The Most Recent Liquidity Trap: The United States in 2009

For an economy to enter a liquidity trap, an exceptionally large decrease in aggregate demand must occur. The most prominent examples of liquidity traps and the major declines in economic output are labelled depressions, prolonged periods of low economic activity. The Focus box “The Great Depression in North America” explores the depression of the 1930s, a liquidity trap. The distinction between a recession and a depression is subjective; the latter is longer and more severe than the former in terms of lower output and higher unemployment. In this section, we join theory and empirical evidence to explore how the major decline in...
The Great Depression in North America

We hope Table 1 is the most depressing economic data you will ever see! It presents, for Canada and the United States, the unemployment rate, the output growth rate, the price level, and the nominal money supply for the years from 1929 to 1942. There was a dramatic fall in aggregate demand in 1929 in the United States and, with the United States as Canada’s biggest export market, demand and output fell in Canada as well. The Great Depression in Canada was, as is usually the case for Canadian slumps, primarily a slump in the foreign countries that are our export markets. But the size of the fall in output in the Great Depression was unprecedented.

Output in the United States fell every year between 1929 and 1932: four consecutive years! The total fall in output was about 30 percentage points of the level of output in 1928. In Canada, output fell from 1930 to 1933. The unemployment rate peaked in the United States at 24.9% and at 19.5% in Canada in 1933. The Great Depression was an economic disaster.

Were the 1930s a liquidity trap? Interest rates in America throughout the 1930s were near zero. If you use the nominal money supply and the price levels in Table 1 to calculate the real money supply in each year, you would find that in America the real money supply increased from 1929 to 1932 while output continued to fall over these years. In Canada, where output fell by 30% between 1929 and 1933, the real money supply fell by only 5%. The real money supply in both countries increased steadily from 1933 onwards with only a very slow decline in unemployment. The ineffectiveness of monetary policy at raising the level of output and returning the economy to full employment appears to be amply demonstrated by the Great Depression.

The tough times in North America went on for a long time. Output did not recover its 1929 level in the United States until 1936, falling in 1937 and finally regaining its 1928 level in 1938. Canadian output followed a similar pattern. The unemployment rate remained high in both countries until 1942. Canada entered the Second World War in September 1939; the United States entered the Second World War in late 1941. Wartime demand for men and material led to the decline in the unemployment rate and the very large increases in output in both countries. The end of the Great Depression certainly coincided with the onset of World War II or, in our IS-LM language, a very expansionary fiscal policy.

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Output Growth Rate (%)</th>
<th>Price Level</th>
<th>Nominal Money Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>2.9</td>
<td>3.2</td>
<td>0.9</td>
<td>-9.8</td>
</tr>
<tr>
<td>1930</td>
<td>9.1</td>
<td>8.7</td>
<td>-3.3</td>
<td>-7.6</td>
</tr>
<tr>
<td>1931</td>
<td>11.6</td>
<td>15.9</td>
<td>-11.2</td>
<td>-14.7</td>
</tr>
<tr>
<td>1932</td>
<td>17.6</td>
<td>23.6</td>
<td>-9.3</td>
<td>-1.8</td>
</tr>
<tr>
<td>1933</td>
<td>19.3</td>
<td>24.9</td>
<td>-7.2</td>
<td>9.1</td>
</tr>
<tr>
<td>1934</td>
<td>14.5</td>
<td>21.7</td>
<td>10.4</td>
<td>9.9</td>
</tr>
<tr>
<td>1935</td>
<td>14.2</td>
<td>20.1</td>
<td>7.2</td>
<td>13.9</td>
</tr>
<tr>
<td>1936</td>
<td>12.8</td>
<td>16.9</td>
<td>4.6</td>
<td>5.3</td>
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<tr>
<td>1937</td>
<td>9.1</td>
<td>14.3</td>
<td>8.8</td>
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<tr>
<td>1938</td>
<td>11.4</td>
<td>19.0</td>
<td>1.4</td>
<td>8.6</td>
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<tr>
<td>1939</td>
<td>11.4</td>
<td>17.2</td>
<td>7.5</td>
<td>8.5</td>
</tr>
<tr>
<td>1940</td>
<td>9.2</td>
<td>14.6</td>
<td>13.3</td>
<td>16.1</td>
</tr>
<tr>
<td>1941</td>
<td>4.4</td>
<td>9.9</td>
<td>13.3</td>
<td>12.9</td>
</tr>
<tr>
<td>1942</td>
<td>3.0</td>
<td>4.7</td>
<td>17.6</td>
<td>13.2</td>
</tr>
</tbody>
</table>


There is a series of made-for-television movies that follow the adventures of a young girl named Booky who lives in Toronto in the Great Depression. Type “Case-Shiller” on the Internet if you want to find the index and see its recent evolution. Canada has a similar house price index found at www.housepriceindex.ca/

House prices in America interacted with a fragile financial system to generate the large decline in aggregate demand that led the American (and world) economy into the major recession and the liquidity trap in 2009.

Housing Prices and Subprime Mortgages

From 2000 to 2006, house prices in the United States roughly doubled. In 2006, as housing prices started to decline in the United States, most economists forecast this decline would lead to a decrease in aggregate demand and a slowdown in growth. Only a few economists anticipated that it would lead to a major macroeconomic crisis and a liquidity trap. These economists had not anticipated the effect of the decline of housing prices on the financial system, the focus of this section.

Figure 11–6 shows the evolution of an index of U.S. housing prices from 2000 on. The index is known as the Case-Shiller index, named for the two economists who have constructed it. The index is normalized to equal 100 in January 2000. You can see the large increase in prices in the early 2000s, followed by a large and rapid decrease from 2006 to 2008. From 2010 to 2012, the average value of the index was around 130.

The period of time from 2008 to 2009 is often called the World Economic Crisis.

A description of the Great Depression through the eyes of those who suffered through it is given by Barry Broadfoot’s Ten Lost Years 1929–1939 (Toronto: McClelland and Stewart, 1997). This book, which has been turned into both a play and a video, is a moving account of the Great Depression in Canada.
Chapter 19.

present discounted values in about this when we discuss houses. You will learn more an increase in the price of interest rates would lead to by taking a mortgage, low income, no job, no assets.

Some of these loans became known as NINJA loans (for no income, no job, no assets).

Some economists were worried even as prices were going up. Robert Shiller, one of the two economists behind the Case-Shiller index, was among them, warning that the price increase was a bubble that would most likely burst.

Was the sharp increase in house prices from 2000 to 2006 justified? In retrospect, and given the ensuing collapse, surely not. But, at the time, when prices were increasing, economists were not so sure. Some increase in prices was clearly justified:

- The 2000s were a period of unusually low interest rates. As a result, mortgage rates were also low, increasing the demand for housing and thus pushing up the price.
- Other factors were also at work. Mortgage lenders became increasingly willing to make loans to more risky borrowers. These mortgages, known as subprime mortgages, or subprimes for short, had existed since the mid-1990s but became more prevalent in the 2000s. By 2006, about 20% of all U.S. mortgages were subprimes. Was it necessarily bad? Again, at the time, this was seen by most economists as a positive development: It allowed more people to buy homes, and, under the assumption that housing prices would continue to increase so the value of the mortgage would decrease over time relative to the price of the house, it looked safe both for lenders and for borrowers. Judging from the past, the assumption that housing prices would not decrease also seemed reasonable: As you can see from Figure 11–6, house prices had not decreased during the 2000–2001 recession in the United States.

In retrospect, again, these developments were much less benign than most economists thought. First, housing prices could go down, as became evident from 2006 on. When this happened, many borrowers found themselves in a situation where the mortgage they owed now exceeded the value of their house (when the value of the mortgage exceeds the value of the house, the mortgage is said to be underwater). Second, it became clear that, in many cases, the mortgages were in fact much riskier than either the lender pretended or the borrower understood. In many cases, borrowers had taken mortgages with low initial interest rates and thus low initial interest payments, probably not fully realizing that payments would increase sharply over time. Even if house prices had not declined, many of these borrowers would have been unable to meet their mortgage payments.

Thus, as house prices fell so quickly and many borrowers defaulted, many banks found themselves faced with large losses. In mid-2008, losses on mortgages were estimated to be around $300 billion. This is obviously a large number, but relative to the size of the U.S. economy, it is not a very large number: $300 billion is only about 2% of U.S. GDP. One might have thought that the U.S. financial system could absorb the shock and that the adverse effect on output would be limited.

This was not to be. While the trigger of the crisis was indeed the decline in housing prices, its effects were enormously amplified. Even those economists who had anticipated the housing price decline did not realize how strong the amplification mechanisms would be. To understand them, we must return to the role of banks.

The Role of Banks

In Chapter 4, we looked at the role of banks in the determination of the money supply. Their important characteristic in that context was that banks issued money, or, more precisely, that they had chequable deposits as liabilities. Here, we shall focus on their more general role as financial intermediaries, institutions that receive funds from those who wish to save and use those funds to make loans to those who wish to borrow.

Figure 11–7 shows a (much simplified) bank balance sheet. The bank has assets of 100, liabilities of 80, and capital of 20. You can think of the owners of the bank as having directly invested 20 of their own funds, borrowed 80 and bought various assets for 100. As we saw in Chapter 4, the liabilities may be chequable deposits, or borrowing from investors and other banks. The assets may be reserves (central bank money), loans to consumers, loans to firms, loans to other banks, mortgages, government bonds, or other forms of securities. In Chapter 4, we ignored capital. But, for our purposes, introducing capital is important here. Suppose that a bank did not hold any capital. Then, if, for any reason, the assets it held went down in value and the liabilities remained the same, liabilities would exceed assets, and the bank would be
bankrupt—that is, unable to pay off its depositors. It is thus essential for the bank to hold enough capital to limit the risk of bankruptcy.

How can things go wrong even if the bank holds some capital, as in our example? First, the assets may decline in value by so much that the capital the bank holds is not enough to cover its losses. In our example, this will happen if the value of the assets decreases below 80. The bank will become insolvent. This is not, however, the only way the bank can get in trouble. Suppose that some of the investors who have loaned to the bank (made a deposit in the bank) want their funds back right away. If the bank can sell some of its assets, it can get the funds and pay the depositors. But it may be difficult for the bank to sell the assets quickly: Calling back loans is difficult; some securities may be hard to sell. The problem of the bank in this case is not solvency, but illiquidity. The bank is still solvent, but it is illiquid. The more liquid its liabilities, or the less liquid its assets, the more likely the bank is to find itself in trouble.

What happened in this crisis when American house prices fell was a combination of all these factors. Banks had too little capital. Liabilities, both deposits and other securities issued by banks, were very liquid. Assets were often very illiquid. The outcome was a combination of both solvency and liquidity problems, which quickly paralyzed the financial system. We now look at three specific aspects of the crisis that affected banks (and other financial intermediaries) in more detail.

**Leverage**

Consider two banks. As in Figure 11–7, bank A has assets of 100, liabilities of 80, and capital of 20. Its capital ratio is defined as the ratio of capital to assets and is thus equal to 20%. Its leverage ratio is defined as the ratio of assets to capital (the inverse of the capital ratio) and is thus equal to 5. Bank B has assets of 100, liabilities of 95, and capital of 5. Thus, its capital ratio is equal to 5%, and its leverage ratio to 20.

Now suppose that some of the assets in each of the two banks go bad. For example, some borrowers cannot repay their loans. Suppose, as a result, that for both banks, the value of the assets decreases from 100 to 90. Bank A now has assets of 90, liabilities of 80, and capital of 90 \(- 80 = 10\). Bank B has assets of 90, liabilities of 95, and thus negative capital of 90 \(- 95 = -5\). Its liabilities exceed its assets: In other words, it is bankrupt. This is indeed what happened in 2008 and 2009, both in the United States and in other countries. Many banks had such a high leverage ratio that even limited losses on assets related to mortgages greatly increased the risk of bankruptcy.

Why was leverage so high? The example suggests a simple answer: Higher leverage means higher expected profit, or, more precisely, a higher rate of return on capital invested. Suppose, for example, that assets pay an expected rate of return of 5%, and liabilities pay an expected rate of return of 4%. Then the owners of bank A have an expected rate of return on their capital of \((100 \times 5\% - 80 \times 4\%)/20 = 9\%\), and the owners of bank B have an expected rate of return of \((100 \times 5\% - 95 \times 4\%)/5 = 24\%\), more than twice as high. But, as the example we just saw also makes clear, leverage also increases risk: The higher the leverage, the more likely the bank is to go bankrupt. What happened throughout the 2000s is that banks all over the world, but particularly in the United States, decided to get a higher return and thus to take on more risk as well through increases in leverage.

Why did banks opt to take on more risk? This is the subject of much discussion. There appears to be a number of reasons: First, banks probably underestimated the risk they were taking: Times were good, and, in good times, banks, just like people, tend to underestimate

| Assets 100 | Liabilities 80 |
| Capital 20 | |

**Figure 11–7** Bank Assets, Capital, and Liabilities
concentrated in Alberta. banks held assets heavily that prove the rule. These the 1980s, are the exceptions and Canadian Commercial, in two Alberta banks, Northland provinces. The failure of the are national with assets in all United States has always been that banks in Canada between Canada and the One crucial difference

FOCUS

Increasing Bank Leverage in the United States—the SIV

SIV stands for structured investment vehicle. Think of it as a virtual bank created by an actual bank. On the liability side, it borrows from investors, typically in the form of short-term debt. On the asset side, it holds various forms of securities. To reassure the investors that they will get repaid, the SIV typically has a guarantee from the actual bank that, if needed, the bank will provide funds to the SIV.

While the first SIV was set up by Citigroup in 1988, SIVs rapidly grew in size in the 2000s. You may ask why banks did not simply do all these things on their own balance sheet. This had obvious drawbacks. A local bank, with local loans and mortgages on its books, was very much exposed to the local economic situation. When, for example, oil prices had come down sharply in the mid-1980s and both Texas and Alberta fell into a serious recession, local banks went bankrupt. Had banks in Texas or Alberta had a more diversified portfolio of mortgages, say mortgages from many parts of the country, these banks might have avoided bankruptcy.

This is the idea behind securitization. Securitization is the creation of securities based on a bundle of assets (for example, a bundle of loans, or a bundle of mortgages). For instance, a mortgage-backed security, or MBS, is a title to the returns from a bundle of mortgages, with the number of underlying mortgages often in the tens of thousands. The advantage is that many investors who would not want to hold individual mortgages will be willing to buy and hold these securities. This increase in the supply of funds from investors is, in turn, likely to decrease the cost of borrowing.

One can think of further forms of securitization. For example, instead of issuing identical claims to the returns on the underlying bundle of assets, one can issue different types of securities. For example, one can issue two types of securities: senior securities, which have first claims on the returns from the bundle, and junior securities, which come after and pay only if something is left after the senior securities have been paid. Senior securities will appeal to investors who want little risk; junior securities will appeal to investors who are willing to take

the risk of bad times. Second, the compensation and bonus system gave incentives to managers to pursue high expected returns without fully taking the risk of bankruptcy into account. Third, while financial regulation required banks to keep their capital ratio above some minimum, many banks found new ways of avoiding the regulation, by creating new financial structures such as SIVs. What these are and how banks used them is explained in the Focus box “Increasing Bank Leverage in the United States—the SIV.”

Complexity

Another important development of the 1990s and the 2000s was the growth of securitization. Traditionally, the financial intermediaries that made loans or issued mortgages kept them on their own balance sheet. This had obvious drawbacks. A local bank, with local loans and mortgages on its books, was very much exposed to the local economic situation. When, for example, oil prices had come down sharply in the mid-1980s and both Texas and Alberta fell into a serious recession, local banks went bankrupt. Had banks in Texas or Alberta had a more diversified portfolio of mortgages, say mortgages from many parts of the country, these banks might have avoided bankruptcy.

This is the idea behind securitization. Securitization is the creation of securities based on a bundle of assets (for example, a bundle of loans, or a bundle of mortgages). For instance, a mortgage-backed security, or MBS, is a title to the returns from a bundle of mortgages, with the number of underlying mortgages often in the tens of thousands. The advantage is that many investors who would not want to hold individual mortgages will be willing to buy and hold these securities. This increase in the supply of funds from investors is, in turn, likely to decrease the cost of borrowing.

One can think of further forms of securitization. For example, instead of issuing identical claims to the returns on the underlying bundle of assets, one can issue different types of securities. For example, one can issue two types of securities: senior securities, which have first claims on the returns from the bundle, and junior securities, which come after and pay only if something is left after the senior securities have been paid. Senior securities will appeal to investors who want little risk; junior securities will appeal to investors who are willing to take

value. Investors became reluctant to lend to the SIVs out of fear that they might be insolvent. The banks that had created the SIVs had to honour their obligations by paying investors, but had limited capital to do so. It became clear that banks had in effect created a shadow banking system, and that leverage of the banking system as a whole (i.e., including the shadow banking part) was much higher than had been perceived. Small losses could lead to bankruptcies. As of October 2008, no SIVs were left; they had either closed, or all their assets and liabilities had been transferred to the banks that had created them.

For a variety of reasons, including tighter bank regulation in Canada and the refusal of the federal government to allow two large bank mergers (BMO with RBC, TD with CIBC) in 1998, the large Canadian banks did not set up SIVs or participate as widely in the banking changes of the 2000s. Canadian banks did not hold a large number of assets backed by sub-prime U.S. mortgages. These decisions have given Canada a partly deserved and a partly accidental reputation in the rest of the world for sound banking.
more risk. Such securities, known as collateralized debt obligations, or CDOs, were first issued in the late 1980s but, again, grew in importance in the 1990s and 2000s. Securitization would seem like a good idea: a way of diversifying risk and getting a larger group of investors involved in lending to households or firms. And, indeed, it is. But it also came with a large cost, which became clear only during the crisis. It was a risk that rating agencies, those firms that assess the risk of various securities, had largely missed: When underlying mortgages went bad, assessing the value of the underlying bundles in the MBSs, or, even more so, of the underlying MBSs in the CDOs, was extremely hard to do. These assets came to be known as toxic assets. It led investors to assume the worst and be very reluctant either to hold them or to continue lending to those institutions that did hold them.

Liquidity
Yet another development of the 1990s and 2000s was the development of other sources of finance than chequable deposits by banks (the 80 dollars they borrowed in our example above). Increasingly, they relied on borrowing from other banks or other investors, in the form of short-term debt, to finance the purchase of their assets, a process known as wholesale funding. SIVs, the financial entities set up by banks that we saw earlier, were entirely funded through such wholesale funding.

Wholesale funding again would seem like a good idea, giving banks more flexibility in the amount of funds they can use to make loans or buy assets. But it has a cost, which again became clear during the crisis. If investors or other banks, worried about the value of the assets held by the bank, decide to stop lending to the bank, the bank may find itself short of funds and be forced to sell some of its assets. If these assets are complex and hard to sell, it may have to sell them at very low prices, often referred to as fire sale prices.

This is the modern equivalent of bank runs, when people ran to the bank to take their money out. Deposit insurance has largely eliminated that risk. There is relatively little concern that small depositors will perceive their deposits to be threatened. Again see the Focus box “Bank Runs and Bank Collapses” in Chapter 4. However, the bank’s liabilities that are short-term deposits in amounts much larger than any covered by deposit insurance can still be withdrawn if the owners of the large deposits perceive the bank’s solvency is threatened. This is the present-day analogue to an old-fashioned bank run.

We now have all the elements in place we need to explain what happened when housing prices declined, why this led to a major financial crisis, and why it ultimately led to the liquidity trap in the United States in 2009.

Amplification Mechanisms
As the crisis worsened, solvency and liquidity concerns increased sharply, each reinforcing the other.

- When housing prices declined, and some mortgages went bad, high leverage implied a sharp decline in the capital of banks. This in turn forced them to sell some of their assets. Because these assets were often hard to value, they had to be sold at fire sale prices. This, in turn, decreased the value of similar assets remaining on the bank’s balance sheet, or on the balance sheet of other banks, leading to a further decline in capital ratio and forcing further sales of assets and further declines in prices.

- The complexity of the securities (MBSs, CDOs) and of the true balance sheets of banks (banks and their SIVs) made it very difficult to assess the solvency of banks and their risk of bankruptcy. Thus, investors became very reluctant to continue to lend to them, and wholesale funding came to a stop, forcing further asset sales and price declines. Banks even became very reluctant to lend to each other. This is shown in Figure 11–8, which shows the difference between the riskless rate (measured by the rate of three-month government bonds), which you can think of as the rate determined by monetary policy, and the rate at which banks are willing to lend to each other (known as the Libor rate). This difference is known as the TED spread.
If banks perceived no risk in lending to each other, the TED spread would be equal to zero. And, indeed, until mid-2007, it was very close to zero. Note, however, how it became larger in the second half of 2007 and then increased sharply in September 2008. Why was there a sharp increase in September 2008? Because, on September 15, 2008, Lehman Brothers, a major bank with more than $600 billion in assets, declared bankruptcy, leading financial participants to conclude that many, if not most, other banks and financial institutions in the United States and indeed in other countries (non-U.S. banks owned some of the mortgage-backed securities) were indeed at risk.

By mid-September 2008, both mechanisms were in full force. The financial system had become paralyzed: Banks had essentially stopped lending to each other or to anyone else. A financial crisis turned into a macroeconomic crisis, a collapse in aggregate demand.

In section 11-1 we made the argument that to move to a liquidity trap required a very large decline in aggregate demand, a shift to the left in the IS curve that was so dramatic that, even at a zero rate of interest, aggregate demand and output would be far below the natural level of output. GDP in the United States fell by 0.3% in 2008 and a further 3.1% in 2009. The unemployment rate jumped from 5.8% in 2008 to 9.3% in 2009 and it continued to rise into 2010. Interest rates in the United States were reduced to zero by the end of 2008 as shown in Figure 11–9. In spite of...
the reduction in interest rates to zero, sales of houses and cars collapsed. Other investment also fell dramatically, partly as aggregate demand fell and partly as business confidence fell. The United States was caught in the liquidity trap.

11-3 | Policy Choices in a Liquidity Trap and a Banking Collapse

The making of policy in a liquidity trap and banking crisis is difficult. First we look at the role of fiscal policy, the conventional method of increasing aggregate demand and escaping from a liquidity trap. Second, we look at the set of policies used to deal with a banking system that is threatened with collapse.

Fiscal Policy as the Way Out of the Liquidity Trap

An expansion of the real or nominal money supply does not increase aggregate demand when the economy is in the liquidity trap. A reasonable question: Could fiscal policy work? Look at Figure 11–10. The liquidity trap equilibrium is at point A, well below the natural level of output. The interest rate is at zero and the LM curve through point A is associated with a real money supply \((M/P)\). Remember it would not matter if the money supply were increased from point A since the interest rate is already zero.

An expansionary fiscal policy shifts the IS curve to \(IS'\). If the money supply remained at \((M/P)\), the level associated with \(LM\), then interest rates would rise to \(i_B\). The fiscal expansion would increase output and be partly successful. The fiscal multiplier is positive. The fiscal expansion would be much more successful if, while the government deficit increased, the central bank acted to maintain the interest rate at zero. In Figure 11–10 this is shown by shifting the LM curve to \(LM'\), associated with a larger real money supply, \((M/P')\). Such an expansion of the money supply is called accommodative; it accommodates the fiscal expansion so the fiscal expansion has the largest possible effect. In fact, if monetary policy is fully accommodative, and the interest rate remains at zero, then the fiscal policy multipliers are the multipliers calculated in Chapter 3.

Examples of Fiscal Policy in the Liquidity Trap

We have already seen that in 2009, when the world economic crisis occurred, Canada practised a combination of an expansionary fiscal policy and accommodative monetary policy. This is exactly as drawn in Figure 11–10. In January 2009, the plan was to increase the Canadian federal deficit from 0% of GDP to about 2% of GDP. Interest rates were kept at or near zero in order to allow the fiscal expansion to have the largest possible effect. What about our neighbours to the south?

\[ \text{See section 3-3.} \]

\[ \text{See the Focus box “Canada’s Macroeconomic Policy Response to the World Economic Crisis” in Chapter 10. In fact, the federal deficit increased to more than 3% of GDP.} \]

\[ \text{F I G U R E 11–10} \]

**Fiscal Policy in a Liquidity Trap**

If the economy is in the liquidity trap and output at the zero rate of interest is well below the natural level of output, expansionary fiscal policy could be used to increase the level of output.
President Obama was first elected in November 2008. The American Congress passed the American Recovery and Reinvestment Act in February 2009. This act contained substantial spending increases and tax cuts over 2009 and 2010, a total of $780 billion. As usual, it is better to measure fiscal stimulus as a percentage of GDP. By that measure, the American federal deficit increased from 3.2% of GDP in 2008 to 10.1% of GDP in 2009 and 9.0% of GDP in 2010. Some of the increase in the deficit was the result of large declines in tax revenues as GDP fell in the crisis. But part of the increases in the deficits in 2009 and 2010 were due to stimulative fiscal policy. The policy of the Federal Reserve was, as we saw in Figure 11–9, to fully accommodate the expansionary fiscal policy and keep interest rates at zero. Although no one claims the expansionary fiscal policies successfully prevented the large decline in output from 2008 to 2009, most economists argue that the 2009 recession would have been worse without these policies, policies in fact carried out around the world.

The Limits of Fiscal Policy: High Debt

Does fiscal policy have limits? In Figure 11–10, the government is running a deficit. If people or firms do not eventually become more optimistic and increase spending, or if exports do not eventually recover, the government must continue to run deficits to sustain higher demand and output. Continuing large deficits lead, however, to steadily higher public debt. In advanced countries, the ratio of government debt to GDP has increased from 46% in 2006 to 70% in 2011. High debt implies that, sooner or later, either taxes will have to increase, or spending will have to decrease, or the government will be unable to repay the debt. And when investors become worried about repayment of the debt, they start asking for higher interest rates on government bonds, making it even harder for the government to repay the debt. These worries are already leading to higher interest rates on government bonds in a number of European countries. They have not yet led to higher interest rates on government bonds in the United States. But the risk that interest rates might rise in the future is forcing the U.S. government to look for ways to begin to reduce its budget deficit now. This may eventually limit the contribution of fiscal policy to demand and to a recovery from a liquidity trap. The experience of Japan in a liquidity trap, outlined in the Focus box “Japan, the Liquidity Trap, and Fiscal Policy,” has been studied quite extensively. Japan’s experience is discouraging. Very expansionary fiscal policy in Japan over a number of years has not restored vigorous economic activity.

FOCUS Japan, the Liquidity Trap, and Fiscal Policy

Japan, through the 1990s and into the first decade of the 21st century, appears to be another example of an economy in a liquidity trap. The similarities between Japan, the 2009 American crisis, and the Great Depression are striking and, if we are honest, disturbing.

The Japanese stock market, which had boomed earlier, suddenly crashed. The Nikkei index, a broad index of Japanese stock prices, had gone up from 7000 in 1980 to 35,000 at the beginning of 1990. Then, within two years, it went down to 16,000 and continued to decline after that, reaching a trough of 7000 in 2003. (In July 2013, the Nikkei index is around 14,000.) This decline in stock prices was followed by a decline in spending, and, in response to the decline in spending, the Japanese central bank cut the interest rate. As you can see from Figure 1, by the mid-1990s, the interest rate was down to less than 1%, and it has remained below 1% since.

With little room left for using monetary policy, fiscal policy was used to sustain demand. Figure 2 shows the evolution of government spending and revenues as a percentage of GDP since 1990. You can see the dramatic increase in spending since the early 1990s. Much of the increased spending has taken the form of public works projects, and a joke circulating in Japan is that, by the time the Japanese economy has recovered, the entire shoreline of the Japanese archipelago will be covered in concrete. The result of this strong fiscal expansion, however, has been a sharp increase in debt. The ratio of government debt to GDP, which stood at 13% of GDP in 1991, is now above 120%. Meanwhile, the Japanese economy is still in a slump: GDP growth, which averaged 4.4% in the 1980s, was down to 1.4% in the 1990s, and 0.9% in the 2000s.

Several lessons appear from the Japanese experience. What has happened in Japan since 1990 is a tough warning to
other advanced countries that it may take a long time to recover from a slump associated with a collapse in asset prices. It is also noteworthy that Japan was able to run large government deficits for many years. The fiscal reckoning associated with the increase in deficits and debt may take many, many years to come about.
Policies in a Banking Crisis

We saw that the 2009 recession in the United States was amplified by the collapse of some financial institutions and the near collapse of others. Some banks went bankrupt (were insolvent) as the value of their liabilities simply exceeded the value of their assets. Other banks experienced severe liquidity problems as potential lenders to those banks were unable to assess whether that bank was insolvent or merely illiquid. The Federal Reserve and the American Treasury took a variety of short-term steps to prevent a complete collapse of financial markets.

● In order to prevent a run by depositors, federal deposit insurance in the United States was increased from $100,000 to $250,000 per account. Recall, however, that much of banks’ funding came not from deposits but from the issuance of short-term debt to investors. In order to allow the banks to continue to fund themselves through wholesale funding, the Treasury also offered a program guaranteeing new debt issues by banks.

● The Federal Reserve provided widespread liquidity to the financial system. We have seen that, if investors wanted to take their funds back, the banks had no alternative but to sell some of their assets, often at fire sale prices. In many cases, this would have meant bankruptcy. To avoid this, the Fed put in place a number of liquidity facilities to make it easier to borrow from the Fed. It allowed not only banks, but also other financial institutions, to borrow from the Fed. Finally, it increased the set of assets that financial institutions could use as collateral when borrowing from the Fed (collateral refers to the asset a borrower pledges when borrowing from a lender. If the borrower defaults, the asset then goes to the lender). Together, these facilities allowed banks and financial institutions to pay back investors without having to sell their assets. It also decreased the incentives of investors to ask for their funds, as these facilities decreased the risk that banks would go bankrupt.

● The U.S. government introduced a program, called the Troubled Asset Relief Program, or TARP, aimed at cleaning up banks. The initial goal of the $700 billion program, introduced in October 2008, was to remove the complex assets from the balance sheet of banks, thus decreasing uncertainty, reassuring investors, and making it easier to assess the health of each bank. The United States Treasury (the U.S. government), however, faced the same problems as private investors. If these complex assets were going to be exchanged for, say, Treasury bills, at what price should the exchange be done? Within a few weeks, it became clear that the task of assessing the value of each of these assets was extremely hard and would take a long time, and the initial goal was abandoned. The new goal became to increase the capital of banks. This was done by the U.S. government buying shares issued by banks and thus providing funds to most large U.S. banks. By increasing their capital ratio, and thus decreasing leverage, the goal of the program was to allow the banks to avoid bankruptcy and, over time, return to normal. As of the end of September 2009, total spending under TARP was $360 billion, of which $200 billion was spent through the purchase of shares in banks. At the time of writing, most banks have bought back their shares and have reimbursed the government. The final cost of TARP is expected to be small, perhaps even zero.

Most economists would argue that these steps were needed and were successful at preventing bank runs and a complete collapse of the financial systems. Almost everyone agrees that the 2009 crisis, bad as it was, would have been much worse without the active fiscal policy to increase aggregate demand and the various policies used to prevent banking sector collapse. The Great Depression did not re-occur.

Supply Shocks: An Increase in the Price of Oil

We close our study of the AS-AD model in this chapter by looking at shocks that shift the aggregate supply curve. For both analytical and historical reasons, a very large movement in the real price of oil is the obvious candidate to shift the aggregate supply curve.
Figure 11–11 plots two series. One is the dollar price of oil—that is, the price of a barrel of oil in dollars—since 1970. It is measured on the vertical axis on the left. This is the series you observe more or less every day as part of world financial reporting. Oil prices are quoted in U.S. dollars because oil is a world commodity. What matters, however, for economic decisions is not the dollar price, but the real price of oil—that is, the dollar price of oil divided by the price level. The second series in the figure shows the real price of oil, constructed as the dollar price of oil divided by the U.S. Consumer Price Index. Note that the real price is an index; it is normalized to equal 100 in 1970. It is measured on the vertical axis on the right.

One striking feature of Figure 11–11 is the large increase in the real price of oil in the 2000s: In 10 years, from 1998 to 2008, the index for the real price went from about 100 to more than 500, a more than five-fold increase. But as the figure also shows, there were similar but more abrupt increases in the price of oil in the 1970s. Oil prices doubled in two years from 1973 to 1975. Oil prices doubled again from 1977 to 1980.

What was behind these large increases in oil prices? In the 1970s, the main factors were the formation of OPEC (Organization of the Petroleum Exporting Countries), a cartel of oil producers that was able to act as a monopoly and increase prices, and disruptions due to wars and revolutions in the Middle East. In the 2000s, the main factor was quite different, namely the fast growth of emerging economies, in particular China, which led to a rapid increase in the world demand for oil and, by implication, a steady increase in real oil prices. Whether coming from changes in supply in the 1970s or from changes in the demand from emerging countries in the 2000s, the implication for the world economy was the same: more expensive oil, more expensive energy.

In thinking about the macroeconomic effects of such large oil price increases, it is clear that we face a serious problem in using the model we have developed so far: The price of oil appears neither in our aggregate supply relation nor in our aggregate demand relation! The reason is that, until now, we have assumed that output was produced using only labour. One way to extend our model would be to recognize explicitly that output is produced using labour and other inputs (including energy), and then figure out what effect an increase in the price of oil has on the price set by firms and on the relation between output and employment. An easier way, and the way we shall go here, is simply to capture the increase in the price of oil by an increase in m—the markup of the price over the nominal wage. The justification is
straightforward: Given wages, an increase in the price of oil increases the cost of production, forcing firms to increase prices.

Having made this assumption, we can then track the dynamic effects of an increase in the markup on output and the price level. It will be easiest here to work backward in time, first asking what happens in the medium run, and then working out the dynamics of adjustment from the short run to the medium run.

**Effects on the Natural Rate of Unemployment**

Let’s start by asking what happens to the natural rate of unemployment when the real price of oil increases (for simplicity, we shall drop “real” in what follows). Figure 11–12 reproduces the characterization of labour-market equilibrium from Figure 9–4 in Chapter 9.

The wage-setting curve is downward sloping. The price-setting relation is represented by the horizontal line at \( \frac{W}{P} = \frac{1}{1 + m} \). The initial equilibrium is at point \( A \), and the initial natural unemployment rate is \( u_n \). An increase in the markup leads to a downward shift of the price-setting line, from \( PS \) to \( PS' \): The higher the markup, the lower the real wage implied by price setting. The equilibrium moves from \( A \) to \( A' \). The real wage is lower. The natural unemployment rate is higher: Getting workers to accept the lower real wage requires an increase in unemployment.

The increase in the natural rate of unemployment leads in turn to a decrease in the natural level of employment. If we assume that the relation between employment and output is unchanged—that is, that each unit of output still requires one worker in addition to the energy input—then the decrease in the natural level of employment leads to a decrease in the natural level of output. Putting things together: An increase in the price of oil leads to a decrease in the natural level of output.

**The Dynamics of Adjustment**

Let’s now turn to dynamics. Suppose that before the increase in the price of oil, the aggregate demand curve and the aggregate supply curve are given by \( AD \) and \( AS \), respectively, so the economy is at point \( A \) in Figure 11–13, with output at the natural level of output, \( Y_n \), and by implication \( P = P^e \).

We have just established that the increase in the price of oil decreases the natural level of output. Call this lower level \( Y_n' \). We now want to know what happens in the short run and how the economy moves from \( Y_n \) to \( Y_n' \).
To think about the short run, recall that the aggregate supply relation is given by

\[ P = P^e (1 + m) F \left( 1 - \frac{Y}{L}, z \right) \]

Recall that we capture the effect of an increase in the price of oil by an increase in the markup \( m \). So, in the short run (given \( P^e \)), the increase in the price of oil shows up as an increase in the markup \( m \). This increase in the markup leads firms to increase their prices, leading to an increase in the price level \( P \) at any level of output \( Y \). The aggregate supply curve shifts up.

We can be more specific about the size of the shift, and knowing the size of this shift will be useful in what follows. We know from section 10-1 that the aggregate supply curve always goes through the point such that output equals the natural level of output and the price level equals the expected price level. Before the increase in the price of oil, the aggregate supply curve in Figure 11–13 goes through point \( A \), where output equals \( Y_n \) and the price level is equal to \( P^e \). After the increase in the price of oil, the new aggregate supply curve goes through point \( A' \), where output equals the new lower natural level of output \( Y'_n \) and the price level equals the expected price level, \( P^e \). The aggregate supply curve shifts left from \( AS \) to \( AS' \).

Does the aggregate demand curve shift as a result of the increase in the price of oil? The answer is: maybe. There are many channels through which demand might be affected at a given price level: The higher price of oil may lead firms to change their investment plans, cancelling some investment projects and/or shifting to less energy-intensive equipment. The high price of oil may increase business investment in the capital needed to produce more oil. The increase in the price of oil also redistributes income from oil buyers to oil producers. Oil producers may spend less than oil buyers, leading to a decrease in consumption demand. Let’s take the easy way out: Because some of the effects shift the aggregate demand curve to the right and others shift the aggregate demand curve to the left, let’s simply assume that the effects cancel each other out and that aggregate demand does not shift.

Under this assumption, in the short run, only the \( AS \) shifts. The economy therefore moves along the \( AD \) curve, from \( A \) to \( A' \). Output decreases from \( Y_n \) to \( Y' \). The increase in the price of oil leads firms to increase their prices. This increase in the price level then decreases demand and output.

What happens over time? Although output has fallen, the natural level of output has fallen even more: At point \( A' \), output \( Y' \) is still above the new natural level of output \( Y'_n \), so
the aggregate supply curve continues to shift up. The economy therefore moves over time along the aggregate demand curve, from \( A' \) to \( A'' \). At point \( A'' \), output \( Y'' \) is equal to the new lower natural level of output \( Y'_n \), and the price level is higher than before the oil shock: Shifts in aggregate supply affect output not only in the short run but in the medium run as well.

To summarize: Permanent increases in the price of oil decrease output and increase prices in the short run. If the increase in the price of oil is temporary, then output is lower not only in the short run, but also in the medium run.

These effects were very strong in the 1970s. Inflation rose to over 10%. The unemployment rate was over 8% in consecutive years. This nasty combination was called **stagflation**, high unemployment (stagnant growth) and high inflation.

An interesting question is why, with a similar run-up in real oil prices from the year 2000 to 2008, we did not also observe stagflation. There are two hypotheses. One hypothesis is that at the same time oil prices were rising from 2000 to 2008, the bargaining power of workers in developed countries was falling. This would reduce real wages. In Figure 11–12, the wage-setting curve would shift left and the increase in the natural rate of unemployment would be mitigated. Note however that real wages would still fall.

The second hypothesis is that monetary policy in the period from 2000 to 2008 was better managed. In the 1970s, as prices rose, people began to expect higher prices and, as shown in Figure 11–13, the \( AS \) curve shifted left as \( P^e \) increased. If central banks around the world had convinced the public that prices would not rise, then \( P^e \) would not increase and the \( AS \) curve might shift less. In the extreme case—refer back to Figure 11–13—suppose that \( P^e \) does not change. There would be a single shift in the \( AS \) curve from \( AS \) to \( AS' \). Monetary policy would have to reduce the money supply and shift \( AD \) to the right to pass through B (not shown on the diagram). The oil price increase would still cause a decline in output but without the increase in inflation—you would only have the stagnation part of **stagflation**.

Did output decline in the oil-consuming countries of the world as oil prices rose through the 2000s? There was no recession. Table 11–1 shows there was a substantial reduction in the rate of economic growth in the developed world as oil prices rose. Economic growth fell by one percentage point per year in the five years of rising oil prices compared to the five years of stable oil prices. The rise in oil prices would be the one shock that would have affected all of the advanced economies at the same time. This table does not prove that rising oil prices slowed economic growth. It certainly suggests this hypothesis is not to be immediately rejected.

## Conclusions

We are partway through our analysis of the medium run. Although we have introduced the price level into our analysis, most discussion of the price level, as we saw in Chapter 2, focuses on inflation. Inflation is the annual percentage change in the price level. In the next two chapters, we take up the analysis of variation in inflation. We use the same structure. Chapter 12 looks at the basic model and the straightforward issues. Chapter 13 addresses two important extensions. Chapter 14 takes us into the open economy to close our analysis of the medium run.

### Table 11–1: Average Economic Growth, 1995–2005

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<td>Advanced Economies</td>
<td>3.2</td>
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*Averages of annual growth rate of real GDP over the years listed.

*Source: World Economic Outlook Database, International Monetary Fund*
A large fall in aggregate demand can create a situation where, even at a zero rate of interest, the level of aggregate demand and output is much lower than the natural level of output. This situation is called a liquidity trap.

A liquidity trap means that increases in the real money supply will not increase lower interest rates nor increase aggregate demand.

If output is far below the natural level and prices begin to fall, expectations of deflation may occur. Expected deflation may further reduce aggregate demand and output.

The Great Depression of the 1930s was a decade of output lower than the natural level, zero interest rates, and both actual and expected deflation. The Great Depression was an economy in a liquidity trap.

The U.S. and world economic crisis of 2009 exhibits many of the characteristics of a liquidity trap.

There was a large reduction in aggregate demand triggered by a decrease in U.S. house prices.

The effect of lower house prices was considerably amplified by the effects on the banking system. Banks became bankrupt as well as illiquid. Banks stopped making loans.

Although monetary policy was immediately employed to reduce interest rates to zero, output remained far below the natural level.

Expansionary fiscal policy was used to increase aggregate demand. All countries, including the United States and Canada, increased their budget deficits.

A suite of policies was used by governments and central banks around the world to prevent complete collapse of the banking system in the world economic crisis of 2009. These included direct purchases of bank shares, lending to banks and government guarantees on bond issues by banks as well as on bank deposits. Problems in appropriate regulation of banks, particularly off-balance sheet activities of banks, played a significant role in the financial system collapse.

Japan experienced slow growth and a liquidity trap through the 1990s and into the 2000s. Very expansionary fiscal policy was not completely successful in restoring economic growth.

An increase in the price of oil leads, in both the short run and in the medium run, to a decrease in output. In the short run, it leads to an increase in the price level, which decreases the real money stock and leads to a contraction of demand and output. In the medium run, an increase in the price of oil decreases the real wage paid by firms, increases the natural rate of unemployment, and therefore decreases the natural level of output. These effects were observed in the 1970s. Although oil prices rose steeply in the 2000s, there appeared to be little effect on prices or inflation and a much smaller effect on output than the effect observed in the 1970s.
QUESTIONS AND PROBLEMS

1. TRUE/FALSE/UNCERTAIN
Using information in this chapter, label each of the following statements true, false, or uncertain. Explain briefly.

a. The interest rate is zero in a liquidity trap.
b. Liquidity traps occur whenever aggregate demand falls.
c. An increase in a bank’s leverage ratio tends to increase both the expected rate of return on the bank’s capital and the risk of the bank going bankrupt.
d. Since the financial crisis ultimately led to a global recession, the policy measures (adopted in many countries) that provided substantial liquidity to financial institutions and that recapitalized banks (through the purchase of shares by governments) failed.
e. The fiscal stimulus programs adopted by many countries in response to the financial crisis of 2009 helped offset the decline in aggregate demand and reduce the size of the recession.
f. The fiscal stimulus program adopted by many countries in response to the financial crisis did not lead to a large increase in the debt-to-GDP ratio.
g. Fiscal and monetary policy successfully saved Japan from a decade of slow growth following its financial crisis in the early 1990s.
h. A supply shock will cause a temporary but not a permanent reduction in output.

2. TRADITIONAL MONETARY AND FISCAL POLICY IN A LIQUIDITY TRAP — THE IS-LM VIEW
Consider an economy described by Figure 11–4, with output lower than the natural level of output and the nominal interest rate at zero.

a. Redraw Figure 11–4. Is output at point B less than the natural rate of output? What does this imply for the unemployment rate?
b. If the central bank increases the money supply, what will happen to the IS-LM diagram you drew in part (a)? Will equilibrium output move closer to the natural level?
c. Given your answer to part (b), what fiscal policy options are available to the government to try to increase output? How does your answer relate to the policy decisions of the Obama administration and the U.S. Congress in February 2009? How does your answer relate to the policy decisions of the Canadian federal government in January 2009 (see Chapter 10)?

3. TRADITIONAL MONETARY AND FISCAL POLICY IN A LIQUIDITY TRAP — THE AS-AD VIEW
Consider an economy described by Figure 11–5, with output lower than the natural level of output and the nominal interest rate at zero.

a. Draw Figure 11–5 and explain why the AD curve is vertical.
b. If the central bank increases the money supply, what will happen to the AS-AD diagram you drew in part (a)? Will equilibrium output move closer to the natural level?
c. Given your answers to part (b), what fiscal policy options are available to the government to try to increase output? How does your answer relate to the policy decisions of the Obama administration and the U.S. Congress in February 2009? How does your answer relate to the policy decisions of the Canadian federal government in January 2009 (see Chapter 10)?

4. MODERN BANK RUNS
Consider a simple bank that has assets of 100, capital of 20, and chequing deposits of 80. Recall from Chapter 4 that chequing deposits are liabilities of a bank.

a. Set up the bank’s balance sheet.
b. Now suppose that the perceived value of the bank’s assets falls by 10. What is the new value of the bank’s capital?
c. Suppose the deposits are insured by the government. Despite the decline in the value of bank capital, is there any immediate reason for depositors to withdraw their funds from the bank? Would your answer change if the perceived value of the bank’s assets fell by 15? 20? 25? Explain.

d. Now consider a different sort of bank, still with assets of 100 and capital of 20, but now with their liabilities as short-term credits (think of one-month term deposits) of 80 instead of chequeable deposits. Short-term credit must be repaid or rolled over (borrowed again) when it comes due.

e. Assuming that the bank cannot raise additional capital, how can it raise the funds necessary to repay its debt
coming due? If many banks are in this position at the same time (and if banks hold similar kinds of assets), what will likely happen to the value of the assets of these banks? How will this affect the willingness of lenders to provide short-term credit?

5. THE TROUBLED ASSET RELIEF PROGRAM (TARP) IN THE UNITED STATES

Consider a bank that has assets of 100, capital of 20, and short-term credit of 80. Part of the bank’s assets are securitized assets whose value depends on the price of houses. These assets have a value of 50. The remaining assets are loans.

a. Set up the bank’s balance sheet.

Suppose that as a result of a housing price decline, the value of the bank’s securitized assets falls by an uncertain amount, so that these assets are now worth somewhere between 25 and 45. Call the securitized assets “troubled assets.” The value of the other assets remains at 50. As a result of the uncertainty about the value of the bank’s assets, lenders are reluctant to provide any short-term credit to the bank.

b. Given the uncertainty about the value of the bank’s assets, what is the range in the value of the bank’s capital?

As a response to this problem, the government considers purchasing the troubled assets, with the intention of reselling them again when the markets stabilize. (This is the original version of TARP.)

c. If the government pays 25 for the troubled assets, what will be the value of the bank’s capital? How much would the government have to pay for the troubled assets to ensure that the bank’s capital does not have a negative value? If the government pays 45 for the troubled assets, but the true value turns out to be much lower, who bears the cost of this mistaken valuation? Explain.

Suppose, instead of buying the troubled assets, the government provides capital to the bank by buying ownership shares, with the intention of reselling the shares again when the markets stabilize. (This is what TARP ultimately became.) The government exchanges treasury bonds (which become assets for the bank) for ownership shares.

d. Suppose the government exchanges 25 of government bonds for ownership shares. Assuming the worst-case scenario (so that the troubled assets are worth only 25), set up the new balance sheet of the bank. (Remember that the firm now has three assets: 50 of untroubled assets, 25 of troubled assets, and 25 of government bonds.) What is the total value of the bank’s capital? Will the bank be insolvent?

e. Given your answers and the material in the text, why might recapitalization be a better policy than buying the troubled assets?

6. THE TED SPREAD

The text described the fluctuations in the TED spread that occurred during the financial crisis. Do an Internet search and find the recent history of the TED spread. You can find this information easily from various sources.

a. Consult Figure 11–8 to compare the current value of the TED spread to its value before and during the financial crisis. How does the current value of the TED spread compare to its highest values during the crisis? How does the current value of the TED spread compare to its value at the beginning of 2007? (Note that the TED spread is often quoted in basis points. One hundred basis points equals one percentage point.)

b. Has the TED spread been relatively stable in recent months? In what range of values has the spread fluctuated?

c. What do you conclude about the willingness of banks to lend to one another now as compared to the beginning of 2007 or the fall of 2008?

7. SUPPLY SHOCKS AND DEMAND MANAGEMENT

Assume that the economy starts at the natural level of output. Now suppose there is an increase in the price of oil.

a. In an AS-AD diagram, show what happens to output and the price level in the short run and the medium run.

b. What happens to the unemployment rate in the short run? in the medium run?

Suppose that the central bank decides to respond immediately to the increase in the price of oil. In particular, suppose that the central bank wants to prevent the unemployment rate from changing in the short run after the increase in the price of oil. Assume that the central bank changes the money supply once—immediately after the increase in the price of oil—and then does not change the money supply again.

c. What should the central bank do to prevent the unemployment rate from changing in the short run? Show how the central bank’s action affects the AS-AD diagram in the short run and the medium run.
d. How do output and the price level in the short run and the medium run compare to your answers from part (a)?

e. How do the short-run and medium-run unemployment rates compare to your answers from part (b)?

FURTHER READING

- There are many good books on the crisis: among them Michael Lewis’s *The Big Short* (W.W. Norton, 2010) and Gillian Tett’s *Fool’s Gold* (Free Press, 2009). Both books show how the financial system became increasingly risky until it finally collapsed. Both read like detective novels, with a lot of action and fascinating characters.

- *In Fed We Trust* (Crown Business, 2009), written in 2009 by David Wessel, the economics editor of *The Wall Street Journal*, describes how the Fed reacted to the crisis. It also makes for fascinating reading.