Blanchard
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9

The Crisis

When, in late 2006, U.S. housing prices started to decline, most economists forecast that this would affect housing investment and consumption adversely, and thus slow down growth. A few forecast that it might lead to a mild recession. Very few anticipated that it might lead to the largest economic crisis since the Great Depression. But it did.

What happened, and what few had anticipated, is that the decline in housing prices triggered a major financial crisis. The financial system was much more fragile than had been perceived, and within a few months, many banks and other financial institutions found themselves either bankrupt or near bankruptcy. As a result, banks became unable or unwilling to lend. The interest rates at which consumers and firms could borrow increased dramatically, leading to a fall in spending, and a fall in output.

As the extent of the economic crisis became clear, policy makers responded with financial, monetary, and fiscal measures: Central banks decreased the interest rates under their control. Governments embarked on major fiscal expansions. It is likely that these policies avoided what would have been an even larger decline in output.

Over time, however, both monetary and fiscal policies have run into sharp limits. The interest rates directly controlled by central banks are close to zero and cannot decline further: Many economies are in a "liquidity trap." The fiscal expansions, and the drop in government revenues from lower output, have led to large and worrisome increases in public debt. These limits make it harder to use policy to help the economy recover. While growth has turned positive since 2010, the recovery is slow, and unemployment is forecast to remain high for a long time.

We had a first look at the sequence of events in Chapter 1. Now that we have developed some of the basic tools, we can look at the events in more detail in this chapter. We focus on the United States in this chapter. Later on, when we have developed tools to look at the open economy, we shall look at the crisis in the rest of the world.

This chapter has three sections.

Section 9-1 looks at the start of the crisis, the decline in housing prices, and its effects on the financial system.

Section 9-2 examines the macroeconomic effects of the housing and financial crises, the evolution of output, and the policy responses.

Section 9-3 turns to the recovery.

In the process of analyzing the crisis, you will see how we use the *IS–LM* and the *AS–AD* models we developed in the previous chapters. We shall need to extend both, but you will see how we can build on them, and how they help organize both facts and thoughts.

9-1 From a Housing Problem to a Financial Crisis

When, in 2006, housing prices started declining in the United States, most economists forecast that this 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. What most had not anticipated was the effect of the decline of housing prices on the financial system. This is the focus of this section.

Housing Prices and Subprime Mortgages

Type "Case-Shiller" on the Internet if you want to find the index and see its recent evolution. You can also see what has happened to prices in the city in which you live.

Figure 9-1 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 the early 2000s, followed by a large decrease since then. From a value of 100 in 2000, the index increased to 226 in mid 2006. Starting in 2006, however, the index first stabilized and declined slightly in 2006, then, from 2007, starting declining rapidly. By the end of 2008, at the start of the financial crisis, the index was down to 162. It continued to decline and, at the time of this writing, it is roughly stable, at around 150.

Was the sharp price increase 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:

Even if people did not finance the purchase of a house by taking a mortgage, low interest rates would lead to an increase in the price of houses. More on this when we discuss present discounted values in Chapter 14.

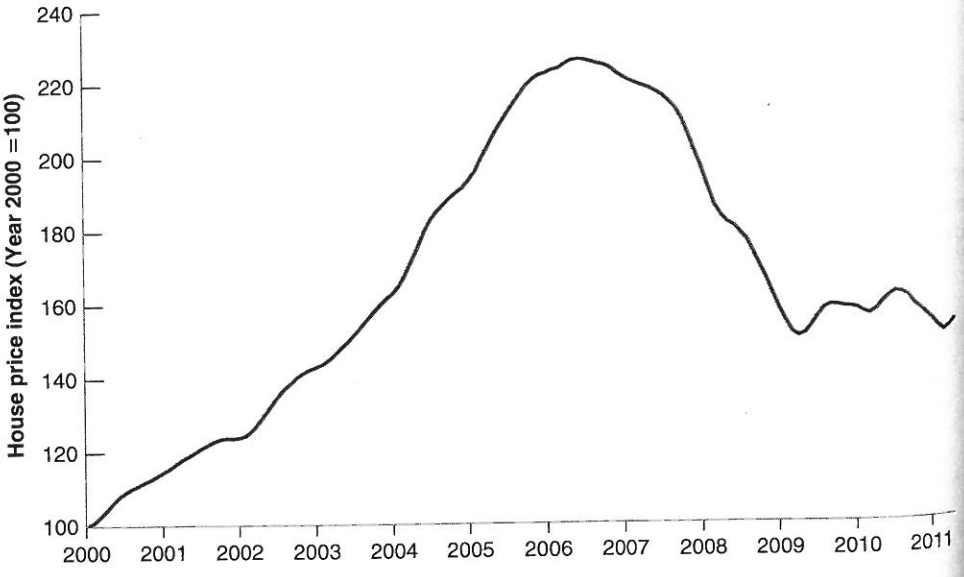
- The 2000s were a period of unusually low interest rates. As a result, mortgage rates were also low, increasing the demand for housing and thus pushing up the price.
- Other factors were also at work. **Mortgage lenders** became increasingly willing to make loans to more risky borrowers. These mortgages, 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

Figure 9-1

U.S. Housing Prices since 2000

Housing prices increased sharply from 2000 to 2006, only to decline since then.

Source: Case-Shiller Home Price Indices, http://www.standardandpoors.com/indices/main/en/us



for borrowers. Judging from the past, the assumption that housing prices would not decrease also seemed reasonable: As you can see from Figure 9-1, housing prices had not decreased during the 2000–2001 recession.

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 crash.

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.

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

Some mortgages offered very low interest rates at the beginning. The low rates were known as "teaser rates." The rates then increased sharply after a few months or a few years.

Thus, as house prices turned around 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 dollars. This is obviously a large number, but, relative to the size of the U.S. economy, it is not a very large one: 300 billion dollars 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 they issued money, or, more precisely, that they had checkable 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.

See Section 4-3.

Figure 9-2 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 has 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 checkable 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. It is thus essential for the bank to hold enough capital to limit the risk of bankruptcy.

One wishes that the balance sheets of banks were this simple and transparent. Had it been the case, the crisis would have been much more limited.

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

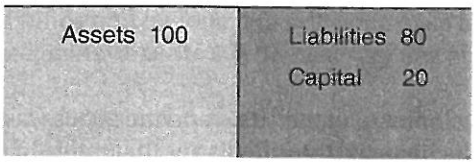


Figure 9-2

Bank Assets, Capital, and Liabilities

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 that 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.

See the Focus box "Bank Runs, Deposit Insurance, and Wholesale Funding" in Chapter 4.

What happened in this crisis is 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 9-2, 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 during the crisis: Many banks had such a high leverage ratio that even limited losses on assets greatly increased the risk of bankruptcy.

Why was leverage so high? The example suggests a simple answer: Higher leverage means higher expected profit. 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 $(100 \times 5\% - 95 \times 4\%)/5 = 24\%$, so 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 decided to get a higher return and thus to take on more risk as well.

Some liabilities may actually pay a zero rate of return. Recall from Chapter 4 that a large part of these liabilities is checking deposits, which typically pay at most a low interest rate.

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 the risk of bad times. Second, the compensation and bonus system also gave incentives to managers to go for 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, 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 Leverage and Alphabet Soup".

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 Texas was in recession, many local banks went bankrupt. Had they 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-based security**, or **MBS** for short, 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 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 went even further, with the creation of CDOs using previously created CDOs, or CDO^2. This could go on and on!

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 checkable 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, which 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**.

We now have all the elements we need to explain what happened when housing prices declined, and why this led to a major financial crisis.

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. But, now, it is the investors who lend to the bank in the form of short-term securities, not depositors, who can decide to take their money out. See the Focus box "Bank Runs, Deposit Insurance, and Wholesale Funding" in Chapter 4.

FOCUS

Increasing Leverage and Alphabet Soup: SIVs, AIG, and CDSs

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 had 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 rather than create a separate vehicle. The main reason was to be able to increase leverage. If the banks had done these operations themselves, the operations would have appeared on their balance sheet and been subject to regulatory capital requirements, forcing them to hold enough capital to limit the risk of bankruptcy. But, it turns out, doing these operations through an SIV did not require banks to put capital down. For that reason, through setting up an SIV, banks could increase leverage and increase expected profits, and they did.

When housing prices started declining, and many mortgages turned bad, the securities held by the SIVs decreased in value. Investors became reluctant to lend to the SIVs, out of fear that they may be insolvent. The banks that had created the SIVs had to honor 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.

AIG stands for American International Group. It is an insurance company that, in the 2000s, had what looked like a good idea at the time. It would sell not only regular insurance, but also insurance against default risk, through the sale of credit default swaps, or CDSs for short. If a bank was worried about default on a security it held in its portfolio, it could buy a CDS from AIG that promised to pay the bank in case of default on the security. For this, AIG charged the bank a price supposed to reflect the probability of such a default. For banks, it was an attractive deal, because by buying insurance, the securities they held became riskless and thus decreased the capital that banks had to hold (the less risky the asset, the smaller the amount of capital required by regulation). AIG, being an insurance company rather than a bank, did not have to hold capital against the promises it was making.

When housing prices started declining and mortgages began to default, AIG had to make good on many of its promises. AIG, however, did not have the funds to make the payments on the CDSs they had issued. Thus, suddenly, banks realized that, without the insurance payout, their assets were much riskier than they had assumed, and that they did not have the capital needed to sustain losses. Again, leverage of the financial system (including now the banks, the SIVs, and CDS issuers such as AIG) was much higher than had been perceived. As we shall see below, the U.S. government decided it had to provide funds to AIG to make payments on the CDSs. The alternative would have led to default of AIG, but also the potential default of many banks holding CDSs. As of the end of 2009, the government had advanced more than $180 billion to AIG, which AIG used to pay the banks as promised. Since then, AIG has been steadily reimbursing the U.S. government and is expected to fully repay the loan.

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 sell them at fire sale prices. This, in turn, decreased the value of similar assets remaining on their 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

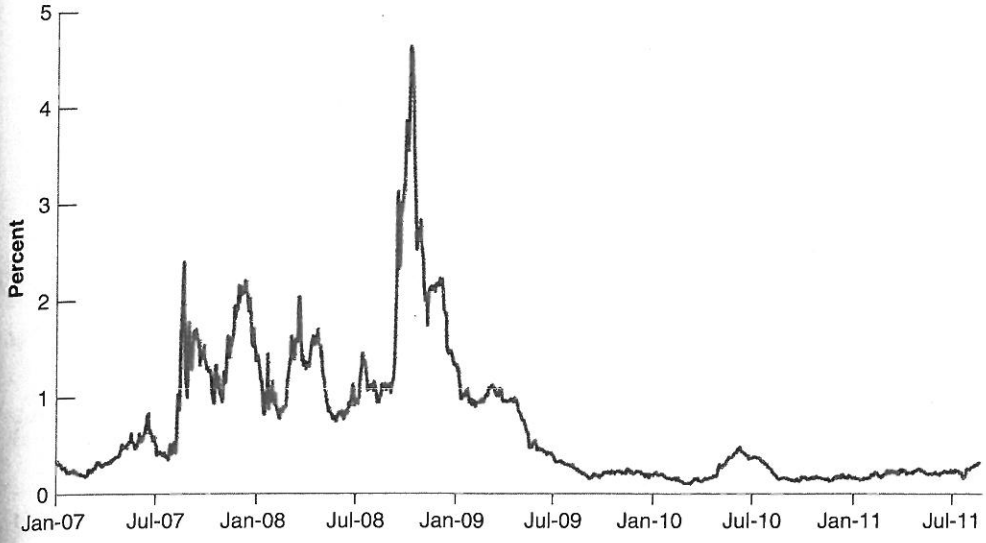


Figure 9-3

The Ted Spread since 2007

The rate spread, which reflects the risk banks perceive in lending to each other, went sharply up in September 2008.

Source: Bloomberg L.P.

and price declines. Even banks became very reluctant to lend to each other. This is shown in Figure 9-3, 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 then? 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 were indeed at risk.

By mid-September 2008, both mechanisms were in full force. The financial system had become paralyzed: Banks had basically stopped lending to each other or to anyone else. Quickly, what had been largely a financial crisis turned into a macroeconomic crisis.

9-2 The Use and Limits of Policy

The immediate effects of the financial crisis on the macro economy were two-fold: first, a large increase in the interest rates at which people and firms could borrow; second, a dramatic decrease in confidence.

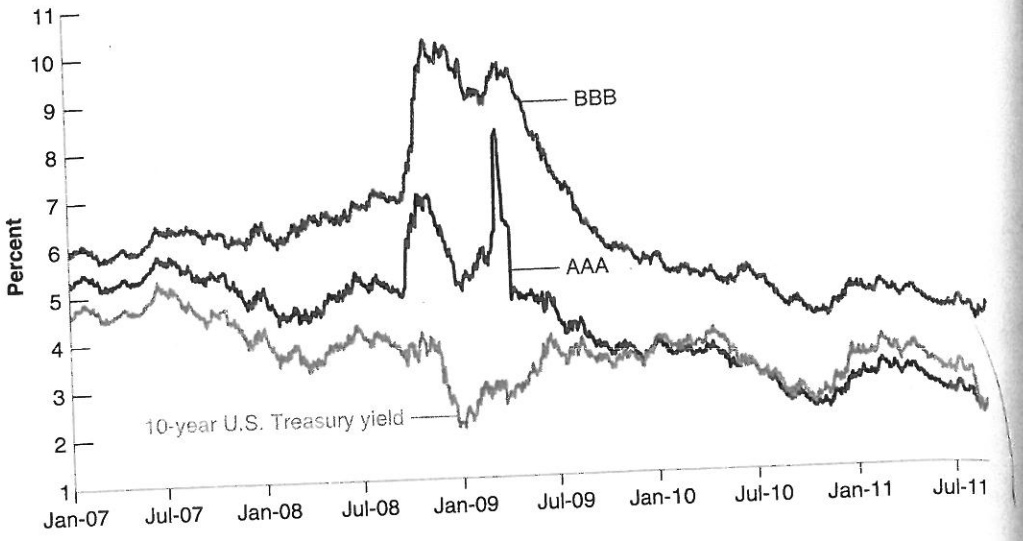
- Figure 9-4 shows the effect of the financial crisis on different interest rates. The first interest rate is the rate on 10-year U.S. government bonds. The second and third are the rates charged by the bond markets to two different types of firms, corresponding to different risk ratings. Firms with a **AAA (triple A)** rating are considered the safest, firms with a **BBB (triple B)** are considered less safe. In normal times, AAA firms can borrow at a rate close to the rate on government bonds; BBB firms borrow at a higher rate, but the difference is typically small, on the order of 1%. You can see that this was indeed the case at the start of 2007. But, as you can also see, the difference increased from mid-2007 on, and, while the rate on government bonds remained very low, the rates on both AAA and BBB bonds jumped

Figure 9-4

Yields on 10-Year U.S. Government Treasury, AAA, and BBB Corporate Bonds, since 2007

In September 2008, the financial crisis led to a sharp increase in the rates at which firms could borrow.

Source: Bloomberg L.P.



in September 2008 to very high levels. Suddenly, borrowing became extremely expensive for most firms. And for the many firms too small to issue bonds and thus depending on bank credit, it became nearly impossible to borrow at all.

In short, the interest rate charged to borrowers became very high (in some cases borrowers were completely shut out from borrowing) relative to the interest rate controlled by monetary policy.

Figure 9-5 shows the effects of the financial crisis on expectations. The events of September 2008 triggered wide anxiety among consumers and firms. Thoughts of another Great Depression and, more generally, confusion and fear about what was happening in the financial system, led to a large drop in confidence. The evolution of consumer confidence and business confidence indexes for the United States are shown in Figure 9-5. Both indexes are normalized to equal 100 in January 2007. Note how consumer confidence, which had started declining in mid-2007, took a sharp drop in the fall of 2008 and reached a low of 22 in early 2009, a level far below previous historical lows. The result of lower confidence and lower housing and stock prices was a sharp decrease in consumption.

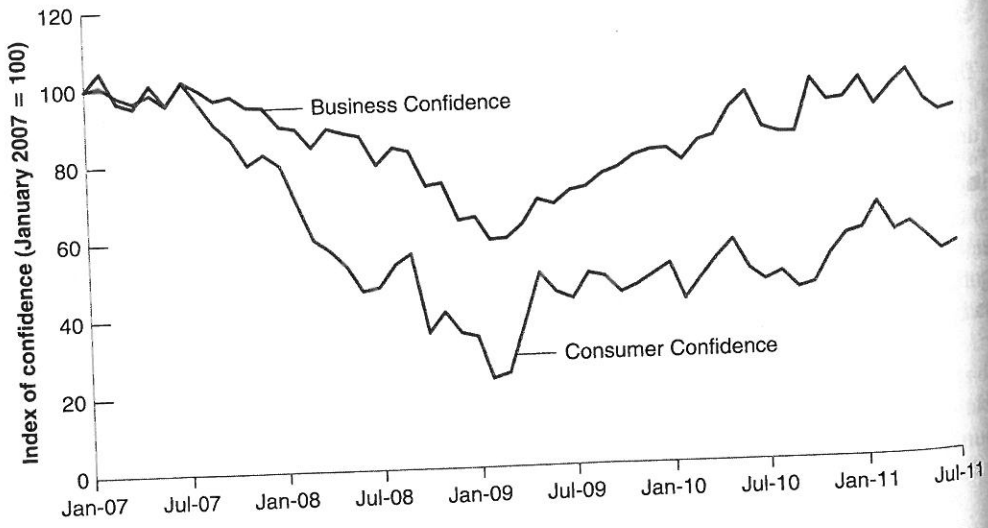
See the Focus box "The Lehman Bankruptcy, Fears of Another Great Depression, and Shifts in the Consumption Function" in Chapter 3.

Figure 9-5

U.S. Consumer and Business Confidence, since 2007

The financial crisis led to a sharp drop in confidence, which bottomed in early 2009.

Source: Bloomberg L.P.



Initial Policy Responses

The high cost of borrowing, lower stock prices, and lower confidence all combined to decrease the demand for goods. In terms of the *IS–LM* model, there was a sharp adverse shift of the *IS* curve. In the face of this large decrease in demand, policy makers did not remain passive.

The most urgent measures were aimed at strengthening the financial system:

- In order to prevent a run by depositors, federal deposit insurance 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 Federal government 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 than 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 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 Treasury, 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 government acquiring shares and thus providing funds to most of the largest 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 the 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.
- All these measures were aimed at providing liquidity to financial institutions, avoiding unnecessary bankruptcies, and allowing the financial system to function again. Worried, however, that some markets were slow to recover, the Fed directly intervened by purchasing private securities in these markets. In particular, given the importance of the housing sector in the crisis, it bought mortgage-backed securities. At the time of writing, the Fed is still the main buyer of these securities.

Fiscal and monetary policies were used aggressively as well.

- Figure 9-6 shows the evolution of the T-bill rate from January 2006 on. Starting in the summer of 2007, the Fed began to worry about a slowdown in growth and

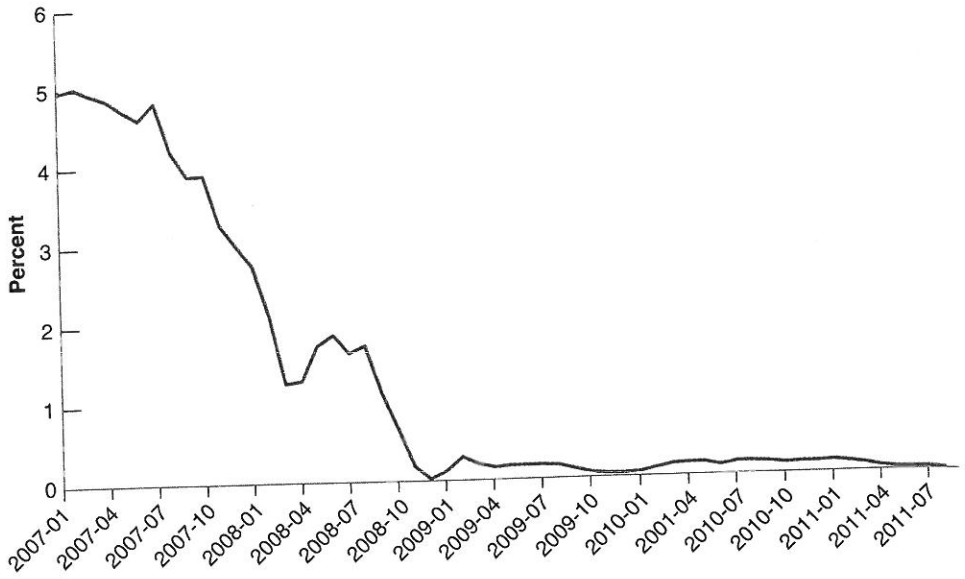
The specific interest rate used in the figure is the rate on T-bills with a maturity of three months, called the three-month T-bill rate. The interest rate is expressed as an annual rate.

Figure 9-6

The T-Bill Rate, since 2007

From mid-2007 to December 2008, the Fed decreased the T-bill rate from 5% to zero.

Source: Series TB3MS Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/



started decreasing the T-bill rate. By September 2008, the rate stood at 1.7%, down from about 5% in July 2007. And, when it became clear in the fall of 2008 that demand was falling quickly, the Fed decreased the rate further. By December 2008, the rate was down to zero, and still is equal to zero at the time of this writing.

For technical reasons, the T-bill rate has not been quite equal to zero, but has typically been slightly positive. For all practical purposes, this has the same effect as a zero rate. ▶ ■

When the size of the adverse shock became clear, the U.S. government turned to fiscal policy, using a combination of reductions in taxes and increases in spending. When the Obama administration assumed office in 2009, its first priority was to design a fiscal program that would increase demand and reduce the size of the recession. Such a fiscal program, called the **American Recovery and Reinvestment Act**, was passed in February 2009. It called for $780 billion in new measures, in the form of both tax reductions and spending increases, over 2009 and 2010. The U.S. budget deficit increased from 1.7% of GDP in 2007 to a very high 9.0% in 2010. The increase was largely the mechanical effect of the crisis, as the decrease in output led automatically to a decrease in tax revenues and to an increase in transfer programs such as unemployment benefits. But it was also the result of the specific measures in the fiscal program aimed at increasing either private or public spending.

Figure 1-4 in Chapter 1 showed the path of the U.S. budget deficits since 1990. ▶ You can see how unusually large these deficits are.

Still, this combination of financial, fiscal, and monetary measures was not enough to avoid a large decrease in output, with U.S. GDP falling by 3.5% in 2009 and recovering only slowly thereafter. One would hope that fiscal and monetary policies could help strengthen the recovery. But, as we shall see now, both face sharp limits.

The Limits of Monetary Policy: The Liquidity Trap

Since December 2008, the Fed has kept the T-bill rate at zero. Could it do more? More generally, what happens if the interest rate is equal to zero and the central bank further increases the supply of money?

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

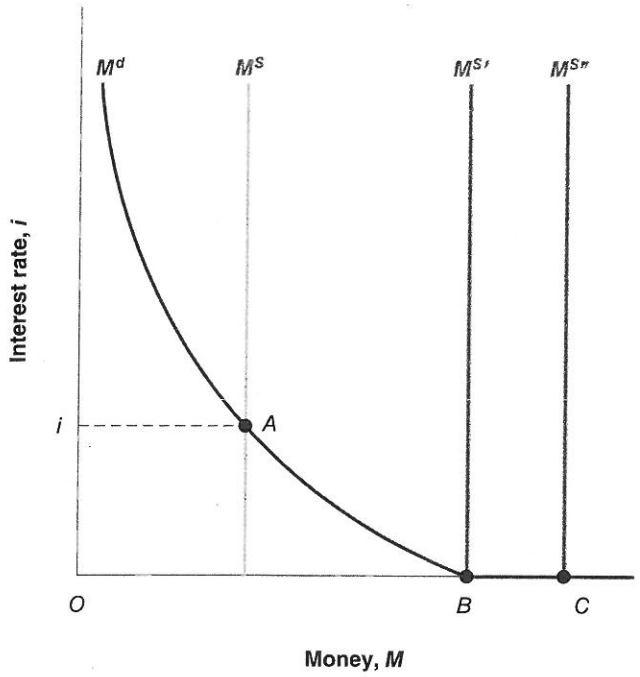


Figure 9-7

Money Demand, Money Supply, and the Liquidity Trap

When the interest rate is equal to zero, and once people have enough money for transaction purposes, they become indifferent between holding money and holding bonds. The demand for money becomes horizontal. This implies that, when the interest rate is equal to zero, further increases in the money supply have no effect on the interest rate.

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 9-7:

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.

- 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*.

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 $M^{s'}$, so the equilibrium is at point *B*; or the case where the money supply is $M^{s''}$, so the equilibrium is given at point *C*. In either case, the initial interest rate is zero. And, in either case, an increase in the money supply 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.

From Chapter 4: The central bank changes the money stock through open market operations, in which it buys or sells bonds in exchange for money.

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 9-8. 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 9-8(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 9-8(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 9-8(b).
- $M^{d''}$ 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 9-8(a), with interest rate equal to zero. Point A'' in Figure 9-8(b) corresponds to A'' in Figure 9-9(a).
- What happens if income decreases below Y'', shifting the demand for money further to the left in Figure 9-8(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.

So far, the derivation of the *LM* curve is exactly the same as in Chapter 5. It is only when income is lower than Y'', that things become different.

Let's summarize: In the presence of a liquidity trap, the *LM* curve is given by Figure 9-8(b). For values of income greater than Y'', it 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.

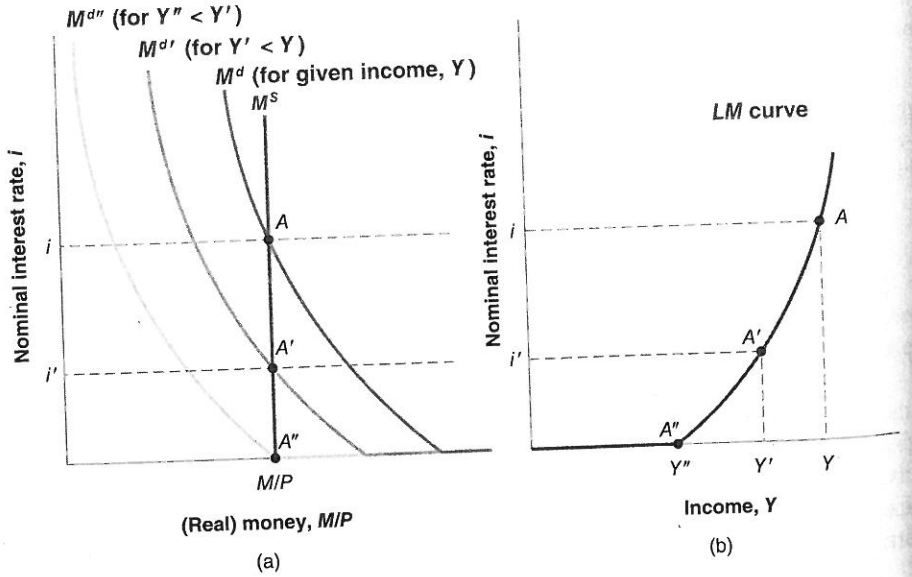


Figure 9-8

The Derivation of the LM Curve in the Presence of a Liquidity Trap

For low levels of output, the *LM* curve is a flat segment, with an interest rate equal to zero. For higher levels of output, it is upward sloping: An increase in income leads to an increase in the interest rate.

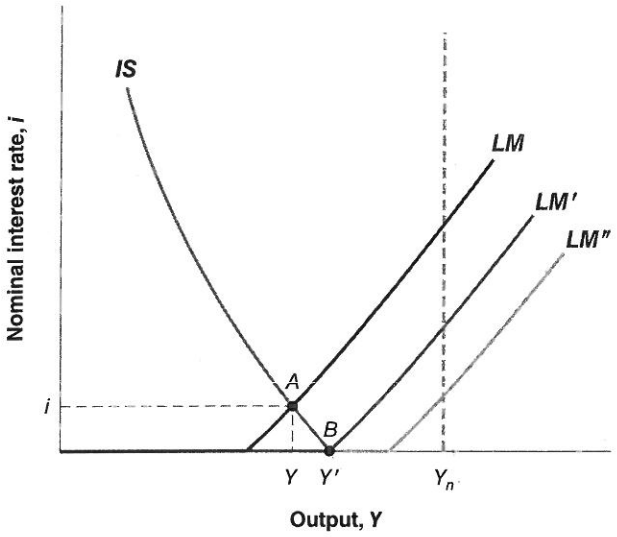


Figure 9-9

The IS–LM Model and the Liquidity Trap

In the presence of a liquidity trap, there is a limit to how much monetary policy can increase output.

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. Suppose the economy is initially at point *A* in Figure 9-9. Equilibrium is at point *A*, at the intersection of the *IS* curve and the *LM* curve, with output Y and interest rate i. And suppose that this level of output is very low. The question is: Can monetary policy help the economy return to a higher level of output, say to Y_n?

Suppose the central bank increases the money supply, shifting the *LM* curve from *LM* to *LM'*. The equilibrium moves from point *A* down to point *B*. The interest rate decreases from i to zero, and output increases from Y to Y'. Thus, to this extent, expansionary monetary policy can indeed increase output.

What happens, however, if starting from point *B*, the central bank increases the money supply further, shifting the *LM* curve from *LM'* to, say, *LM"*? The intersection of *IS* and *LM"* remains at point *B*, and output remains equal to Y'. Expansionary monetary policy no longer has an effect on output; it cannot therefore help output increase to Y_n.

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. If, at this zero interest rate, the demand for goods is still too low, then there is nothing further conventional monetary policy can do to increase output.

You will note that, in the previous paragraph, we referred to the limits of *conventional* monetary policy; that is, monetary policy using open market operations aimed at decreasing the interest rate typically controlled by the Fed—in the United States, policy aimed at decreasing the interest rate on T-bills. The question is whether some *unconventional* measures may still be used. This is what the Fed (and other central banks around the world) have explored since 2008.

In the simple *IS–LM* model presented in Chapter 5, there was only one type of bond and one interest rate, and thus, once this rate was down to zero, there was nothing more monetary policy could do. But, in reality, there are many types of bonds and many interest rates. Some of these interest rates are higher than the interest rate on T-bills. This suggests the following unconventional monetary policy: Rather than

◀ See for example the different interest rates facing AAA and BBB firms in Figure 9.4.

buying Treasury bills through open market operations, the Fed could buy other bonds; for example, mortgages—loans made by banks to households, or Treasury bonds—government bonds which promise payment over, say, 10 or 20 years. By doing so, it may be able to decrease the interest rate on those bonds or on those mortgages. These lower interest rates can help increase demand.

Such a policy goes under the name of **credit easing** or **quantitative easing**, and this is indeed what the Fed has done at various times during this crisis. How helpful is quantitative easing? We shall look at the evidence in Chapter 17 and again in Chapter 24. But the conclusion can be stated simply. These unconventional measures have some effect, but the effect is often small. When the economy is in the liquidity trap, the scope for monetary policy to affect demand and output is sharply limited.

The Limits of Fiscal Policy: High Debt

A recurrent theme of this book is that both monetary policy and fiscal policy can be used to affect demand and, in turn, output. So, even if monetary policy has reached sharp limits, isn't fiscal policy the solution? The answer is that fiscal policy also has limits. The problem is that, if the demand for goods does not recover over time by itself, if people or firms do not eventually become more optimistic and increase spending, 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; in the United States, the ratio has increased from 42% in 2006 to 72% 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 limits the contribution of fiscal policy to demand and to the recovery.

We shall look at the precise relation between debt and deficits in Chapter 23. But the notion that deficits lead to higher debt is straightforward.

More on this in Chapter 23.

9-3 The Slow Recovery

While output growth is now positive in the United States, the recovery is very slow. Under current forecasts, unemployment is predicted to remain high for many years. There are increasing worries of a "lost decade." Looking at what has happened in Japan since the 1990s, these worries are justified: For nearly two decades, Japan has been in an economic slump. As the Focus box "Japan, the Liquidity Trap, and Fiscal Policy" shows, zero interest rates and large budget deficits have not succeeded in getting the Japanese economy back to normal.

Why has the recovery from the crisis so slow in the United States? Some economists point to the aggregate supply side. They argue that the banking crisis has decreased the natural level of output, so that it would be wrong to think that we can go back to the pre-crisis level of output. More accurately, taking into account that output typically grows over time, it would be wrong to think that output can return to its old pre-crisis trend line. The weak recovery that we observe may be the best the economy can deliver. Indeed, the evidence from a large number of past banking crises, summarized in the Focus box "Do Banking Crises Affect Output in the

We saw in Chapter 7 how some shocks, such as a permanent increase in the price of oil, can lead to a lower natural level of output. The financial crisis provides another potential example.

Japan, the Liquidity Trap, and Fiscal Policy

FOCUS

In the early 1990s, the Japanese stock market, which had boomed earlier, suddenly crashed. The Nikkei index, a broad index of Japanese stock prices, had gone up from 7,000 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 7,000 in 2003 (as we write, the Nikkei index is around 9,000). 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 from the early 1990s on. 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. What has happened in Japan since 1990 is a tough warning to other advanced countries that it may take a long time to recover.

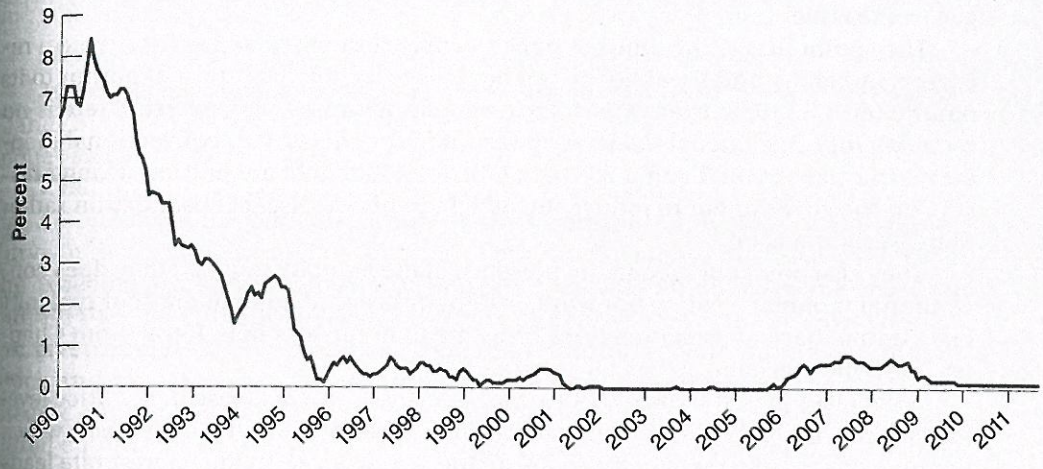


Figure 1 ***The Interest Rate in Japan since 1990. Japan has been in a liquidity trap since the mid-1990s.***

Source: One-year government bond rate, DLX, International Monetary Fund database

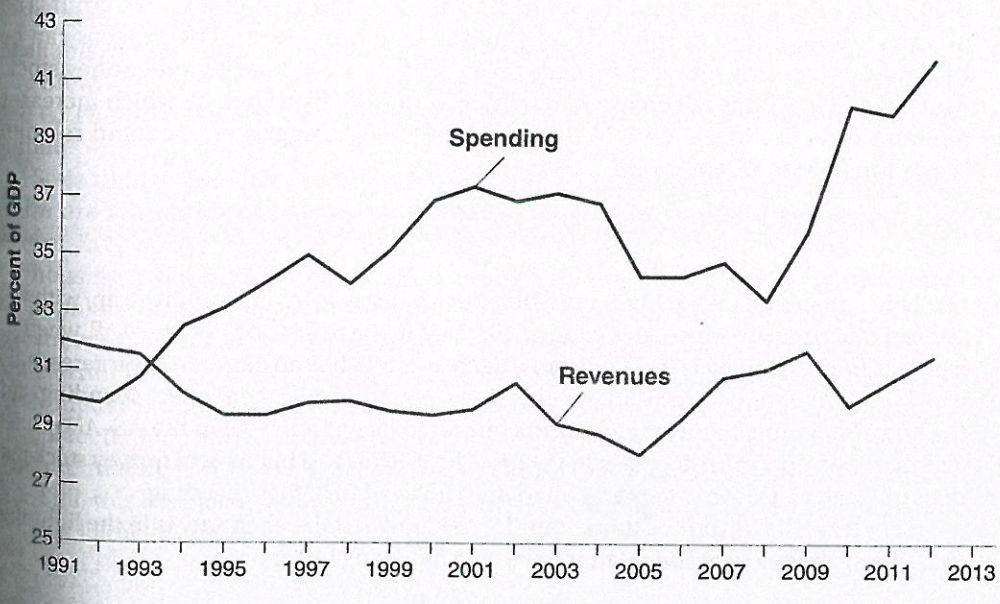


Figure 2 ***Government Spending and Revenues (as a percentage of GDP), Japan, since 1990. Increasing government spending and decreasing revenues have led to steadily larger deficits.***

Source: IMF World Economic Outlook database

Medium Run?" suggests that indeed output remains below its old pre-crisis trend line for many years. One can think of a number of reasons why this may be the case. The banking crisis may affect the efficiency of the banking system for a long time, leading to lower productivity (again relative to trend): Some of the new regulations introduced to decrease the risk of another financial crisis, such as increases in the capital ratio that banks must maintain, may indeed decrease risk; but they may also make intermediation between borrowers and lenders more costly, thus decreasing the natural level of output.

It may indeed be that the economy cannot return to its pre-crisis trend line. But in the context of the United States, this does not appear sufficient to explain the slow recovery from the crisis. In 2011, unemployment was around 9%. Pre-crisis, most estimates of the natural rate of unemployment were about 6%. It is unlikely that such a large increase in unemployment is entirely due to an increase in the natural rate of unemployment. In other words, what we are observing seems to be a rate of unemployment far above the underlying natural rate and, by implication, a level of output far below its natural level. So, most economists point also to the aggregate demand side. For the time being, insufficient aggregate demand, they argue, is the issue.

They point first to the limits of policy we have examined earlier. In a typical recovery, monetary and fiscal policy can be used to hasten the return of output to its natural level. In the current crisis, they can play a limited role at best. There is no room left for conventional monetary policy, and the effects of unconventional monetary policy are limited and uncertain. Worries about debt are putting strong pressure on the government to reduce the deficit, to pursue fiscal consolidation rather than fiscal expansion.

They also point out that, in the presence of the liquidity trap, not only does conventional monetary policy not work, but the process of adjustment that typically takes output back to its natural level in the medium run also fails. Recall from Chapter 7 how the mechanism typically works:

A decrease in output below its natural level leads to a decrease in the price level (at least relative to its trend). 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 (8.3) in Chapter 8):

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

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, 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:

$$Y = Y(G, T)$$

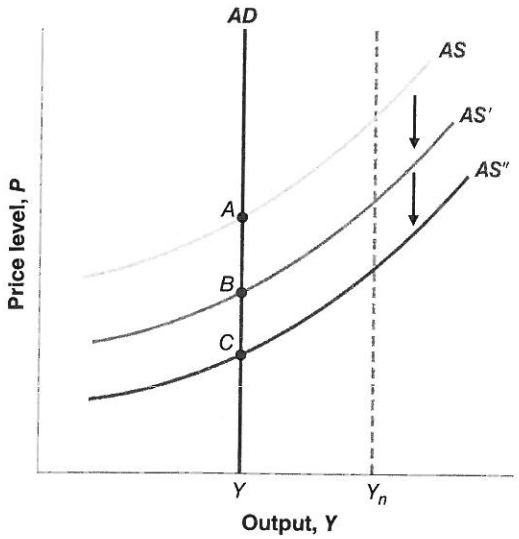


Figure 9-10

The Liquidity Trap and Adjustment Failure

If the economy is in the liquidity trap and output is below its natural level, the price level may decrease over time, but output does not increase.

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 9-10, 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 relevant for our case, the lower the output, the lower the price level. The aggregate demand relation is now vertical. 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.

So is there hope that the U.S. economy will eventually return to normal? Yes. There are a number of reasons to think that aggregate demand will eventually recover. Eventually, the damage done to the banking system should be repaired. Very low housing investment and thus a decreasing housing stock, together with a growing population, should eventually lead to an increase in prices and higher housing investment in the future. Also, some types of consumption and investment cannot be deferred forever. Low purchases of consumer durables and of equipment now imply higher purchases later: Eventually, cars and machines break down and must be replaced. Economists sometimes refer to this mechanism as **pent-up demand**: Demand that does not take place today is *pent up* and increases demand in the future. Still, this may all take time, and, at the time of writing, a strong recovery appears to be far in the future.

FOCUS

Do Banking Crises Affect the Natural Level of Output?

Leaving aside the current crisis, there is a lot of evidence that banking crises lead to large decreases in output in the short run. But do they have an effect on output in the medium run? Or, put in terms of our model, do they affect the natural level of output?

To answer this question, researchers at the IMF looked at a number of banking crises across many countries from 1970 to 2002. They defined banking crises as episodes where there were either bank runs or a large number of bank failures. They identified 88 such crises. In each case, they looked at the behavior of GDP in the years following each crisis.

Using econometrics, they reached two conclusions: First, financial crises typically lead to a decrease in output relative to trend, even in the medium run. Second, while this conclusion holds on average, there is a lot of variation across countries. Some countries go back to trend, while others suffer large decreases.

The flavor of their results is given in Figure 1, which shows what happened in four countries following a banking crisis: Mexico after 1994, Korea after 1997, Sweden after 1991, and Thailand after 1997. In all four cases, there were major bank failures. For each country, the figure shows the evolution of GDP (the blue line) relative to the pre-crisis trend (dashed red line). You can see that, in three of the cases—Korea, Sweden, and Thailand—there was a large decrease in output relative to the pre-crisis trend, and this decrease was still largely present five years after the crisis. In other words, five years after the crisis, the rate of growth of GDP was roughly the same as before the crisis, but the level of GDP was lower than it would have been absent the crisis.

Can we tell why banking crises affect output, even in the medium run? The same researchers also looked at what happened to employment and what happened to productivity as a result of the crisis. They concluded that, on average, the decline in output could be broken down as follows: one-third related to a decrease in employment; two-thirds related to a decrease in productivity (both relative to trend). This suggests that the banking system plays an important role in the economy. Banking crises weaken the ability of the banking system to allocate funds to the right borrowers. This, in turn, makes the economy less productive.

Source: International Monetary Fund World Economic Outlook, October 2009, Chapter 4.

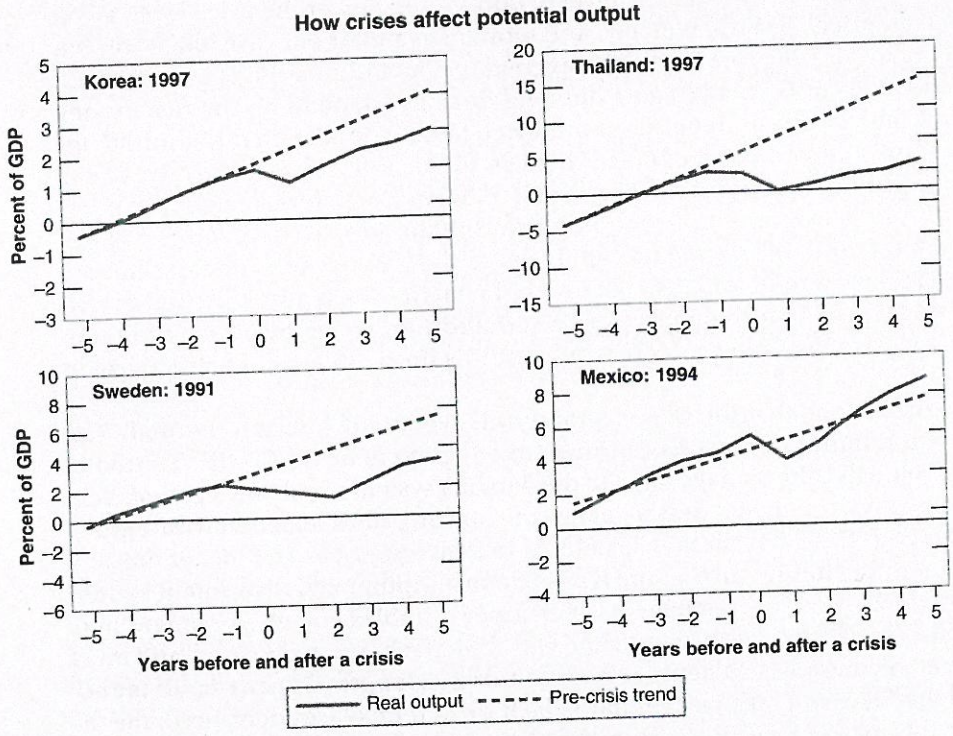


Figure 1 *The Evolution of Output after Four Banking Crises*

Summary

- The trigger of the crisis was a decrease in housing prices.
- The effect of lower housing prices was considerably amplified by the effects on the banking system. Because they had very low capital ratios, some banks became insolvent. Because the assets they held were highly complex, their value in the face of a decrease in housing prices and defaults on mortgages was highly uncertain, investors became reluctant to lend to banks, and many banks became illiquid. Banks became unwilling to lend to each other or to anyone else.
- Much higher interest rates for borrowers and, in some cases, the inability to borrow at all, led to a large decrease in spending. Worries about another Great Depression led to sharp declines in confidence and a further decrease in spending. The financial crisis led to a macroeconomic crisis and a large decline in output.
- Policies—fiscal, monetary, and financial—were used. They probably prevented an even larger decline in output but did not prevent the recession. Both fiscal and monetary policies now face sharp limits. Conventional monetary policy no longer works. The interest rate on T-bills has been decreased to zero, and the U.S. economy is in a liquidity trap. Large budget deficits have led to a large increase in debt, and there is strong pressure on the U.S. government to start reducing deficits now.
- The recovery is slow, and unemployment is expected to remain high for some time. It may be that the financial crisis has done lasting damage to the banking system, and the natural level of output may have decreased relative to trend. At this stage, however, the problem is on the demand side. The limits of policy, and the failure of the standard adjustment mechanism to return the economy to its natural level, imply that demand is likely to remain weak, and the recovery is likely to remain slow for some time to come.

Key Terms

mortgage lenders, 184
subprime mortgages (subprimes), 184
underwater mortgage, 185
financial intermediaries, 185
solvency, 186
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Questions and Problems

QUICK CHECK

All Quick Check questions and problems are available on MyEconLab.

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

a. The loss in output that resulted from the financial crisis is many times larger than the losses on mortgages held by U.S. financial institutions.

b. An increase in a bank's leverage ratio tends to increase both the expected profit of the bank and the risk of the bank going bankrupt.

c. The high degree of securitization in the U.S. financial system helped to diversify risk and probably lessened the economic effect of the fall in housing prices.

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 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.

2. *Traditional monetary and fiscal policy—the IS–LM view*

Consider an economy described by Figure 9-9, with output lower than the natural level of output and the nominal interest rate at zero.

a. Draw Figure 9-9 using the *LM* curve passing through Point A.

b. If the Federal Reserve 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 policy options are available to the government to try to increase output? Consider traditional policy options only, and not financial policies. How does your answer relate to the policy decisions of the Obama administration and the U.S. Congress in February 2009?

3. *Traditional monetary and fiscal policy—the AS–AD view*

Consider an economy described by Figure 9-10, with output lower than the natural level of output and the nominal interest rate at zero.

a. Draw Figure 9-10 and explain why the *AD* curve has a vertical portion.

b. If the Federal Reserve 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 policy options are available to the government to try to increase output? Consider traditional policy options only, and not financial policies. How does your answer relate to the policy decisions of the Obama administration and the U.S. Congress in February 2009?

DIG DEEPER

All Dig Deeper questions and problems are available on MyEconLab.

4. *Nontraditional macroeconomic policy: financial policy and quantitative easing*

Consider again the economy described in Figure 9-9, and suppose that the IS and LM relations are

$$IS: \quad Y = C(Y - T, confidence) + I(Y, confidence, i + premium) + G$$

$$LM: \quad M/P = YL(i)$$

Interpret the interest rate as the federal funds rate, the policy interest rate of the Federal Reserve. Assume that the rate at which firms can borrow is much higher than the federal funds rate, equivalently that the premium in the IS equation is high.

a. Suppose that the government takes action to improve the solvency of the financial system. If the government's action is successful and banks become more willing to lend—both to one another and to nonfinancial firms—what is likely to happen to the premium? What will happen to the *IS–LM* diagram? Can we consider financial policy as a kind of macroeconomic policy?

b. Faced with a zero nominal interest rate, suppose the Fed decides to purchase securities directly to facilitate the flow of credit in the financial markets. This policy is called quantitative easing. If quantitative easing is successful, so that it becomes easier for financial and nonfinancial firms to obtain credit, what is likely to happen to the premium? What effect will this have on the *IS–LM* diagram? If quantitative easing has some effect, is it true that the Fed has no policy options to stimulate the economy when the federal funds rate is zero?

5. *Modern bank runs*

Consider a simple bank that has assets of 100, capital of 20, and checking deposits of 80. Recall from Chapter 4 that checking 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.

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

d. Set up this bank's balance sheet.

e. Again suppose the perceived value of the bank's assets falls. If lenders are nervous about the solvency of the bank, will they be willing to continue to provide short-term credit to the bank at low interest rates?

f. 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?

6. *The Troubled Asset Relief Program (TARP)*

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

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 the 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 the TARP ultimately became.) The government exchanges treasury bonds (which become assets for the bank) for ownership shares.

d. Suppose the government exchanges 25 of Treasury 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 Treasury 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?

EXPLORE FURTHER

7. 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 9-3 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? as compared to the fall of 2008? Explain.

Further Readings

- There are already 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.