

of bonds, the results are the same: The two ways of analyzing the determination of interest rates are equivalent.

An important feature of the analysis here is that supply and demand are always in terms of *stocks* (amounts at a given point in time) of assets, not in terms of *flows*. This approach is somewhat different from certain loanable funds analyses, which are conducted in terms of flows (loans per year). The **asset market approach** for understanding behavior in financial markets—which emphasizes stocks of assets rather than flows in determining asset prices—is now the dominant methodology used by economists, because correctly conducting analyses in terms of flows is very tricky, especially when we encounter inflation.³

Changes in Equilibrium Interest Rates

We will now use the supply and demand framework for bonds to analyze why interest rates change. To avoid confusion, it is important to make the distinction between *movements along* a demand (or supply) curve and *shifts in* a demand (or supply) curve. When quantity demanded (or supplied) changes as a result of a change in the price of the bond (or, equivalently, a change in the interest rate), we have a *movement along* the demand (or supply) curve. The change in the quantity demanded when we move from point A to B to C in Figure 1, for example, is a movement along a demand curve. A *shift in* the demand (or supply) curve, by contrast, occurs when the quantity demanded (or supplied) changes *at each given price (or interest rate)* of the bond in response to a change in some other factor besides the bond's price or interest rate. When one of these factors changes, causing a shift in the demand or supply curve, there will be a new equilibrium value for the interest rate.

In the following pages, we will look at how the supply and demand curves shift in response to changes in variables, such as expected inflation and wealth, and what effects these changes have on the equilibrium value of interest rates.

Shifts in the Demand for Bonds

The theory of asset demand demonstrated at the beginning of the chapter provides a framework for deciding what factors cause the demand curve for bonds to shift. These factors include changes in four parameters:

1. Wealth
2. Expected returns on bonds relative to alternative assets
3. Risk of bonds relative to alternative assets
4. Liquidity of bonds relative to alternative assets

To see how a change in each of these factors (holding all other factors constant) can shift the demand curve, let us look at some examples. (As a study aid, Table 2 summarizes the effects of changes in these factors on the bond demand curve.)

³The asset market approach developed in the text is useful in understanding not only how interest rates behave but also how any asset price is determined. A second appendix to this chapter, which is on this book's web site at www.aw.com/mishkin, shows how the asset market approach can be applied to understanding the behavior of commodity markets; in particular, the gold market.

SUMMARY Table 2 Factors That Shift the Demand Curve for Bonds

Variable	Change in Variable	Change in Quantity Demanded	Shift in Demand Curve
Wealth	↑	↑	
Expected interest rate	↑	↓	
Expected inflation	↑	↓	
Riskiness of bonds relative to other assets	↑	↓	
Liquidity of bonds relative to other assets	↑	↑	

Note: P and i increase in opposite directions: P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis. Only increases in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the remaining columns.

Wealth. When the economy is growing rapidly in a business cycle expansion and wealth is increasing, the quantity of bonds demanded at each bond price (or interest rate) increases as shown in Figure 3. To see how this works, consider point B on the initial demand curve for bonds B_1^d . It tells us that at a bond price of \$900 and an interest rate of 11.1%, the quantity of bonds demanded is \$200 billion. With higher wealth, the quantity of bonds demanded at the same interest rate must rise, say, to \$400 billion (point B'). Similarly, the higher wealth causes the quantity demanded at a bond price of \$800 and an interest rate of 25% to rise from \$400 billion to \$600 billion (point D to D'). Continuing with this reasoning for every point on the initial demand curve B_1^d , we can see that the demand curve shifts to the right from B_1^d to B_2^d as is indicated by the arrows.

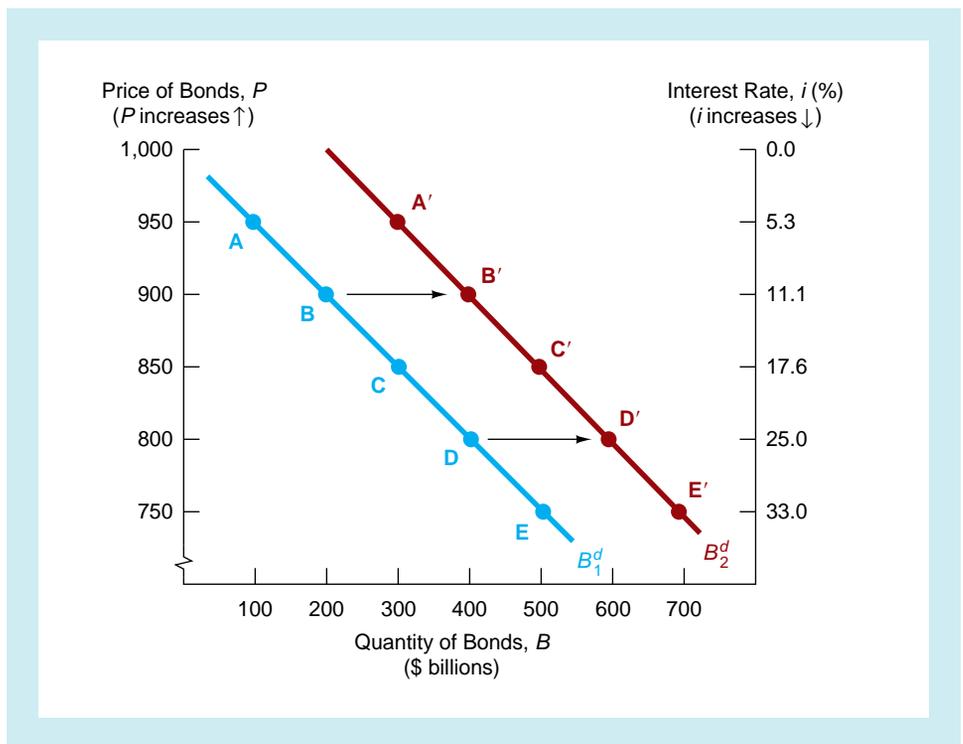
The conclusion we have reached is that *in a business cycle expansion with growing wealth, the demand for bonds rises and the demand curve for bonds shifts to the right*. Using the same reasoning, *in a recession, when income and wealth are falling, the demand for bonds falls, and the demand curve shifts to the left*.

Another factor that affects wealth is the public's propensity to save. If households save more, wealth increases and, as we have seen, the demand for bonds rises and the demand curve for bonds shifts to the right. Conversely, if people save less, wealth and the demand for bonds will fall and the demand curve shifts to the left.

Expected Returns. For a one-year discount bond and a one-year holding period, the expected return and the interest rate are identical, so nothing besides today's interest rate affects the expected return.

FIGURE 3 Shift in the Demand Curve for Bonds

When the demand for bonds increases, the demand curve shifts to the right as shown. (Note: P and i increase in opposite directions. P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis.)



For bonds with maturities of greater than one year, the expected return may differ from the interest rate. For example, we saw in Chapter 4, Table 2, that a rise in the interest rate on a long-term bond from 10 to 20% would lead to a sharp decline in price and a very negative return. Hence if people begin to think that interest rates will be higher next year than they had originally anticipated, the expected return today on long-term bonds would fall, and the quantity demanded would fall at each interest rate. **Higher expected interest rates in the future lower the expected return for long-term bonds, decrease the demand, and shift the demand curve to the left.**

By contrast, a revision downward of expectations of future interest rates would mean that long-term bond prices would be expected to rise more than originally anticipated, and the resulting higher expected return today would raise the quantity demanded at each bond price and interest rate. **Lower expected interest rates in the future increase the demand for long-term bonds and shift the demand curve to the right** (as in Figure 3).

Changes in expected returns on other assets can also shift the demand curve for bonds. If people suddenly became more optimistic about the stock market and began to expect higher stock prices in the future, both expected capital gains and expected returns on stocks would rise. With the expected return on bonds held constant, the expected return on bonds today relative to stocks would fall, lowering the demand for bonds and shifting the demand curve to the left.

A change in expected inflation is likely to alter expected returns on physical assets (also called *real assets*) such as automobiles and houses, which affect the demand for bonds. An increase in expected inflation, say, from 5 to 10%, will lead to higher prices on cars and houses in the future and hence higher nominal capital gains. The resulting rise in the expected returns today on these real assets will lead to a fall in the expected return on bonds relative to the expected return on real assets today and thus cause the demand for bonds to fall. Alternatively, we can think of the rise in expected inflation as lowering the real interest rate on bonds, and the resulting decline in the relative expected return on bonds causes the demand for bonds to fall. **An increase in the expected rate of inflation lowers the expected return for bonds, causing their demand to decline and the demand curve to shift to the left.**

Risk. If prices in the bond market become more volatile, the risk associated with bonds increases, and bonds become a less attractive asset. **An increase in the riskiness of bonds causes the demand for bonds to fall and the demand curve to shift to the left.**

Conversely, an increase in the volatility of prices in another asset market, such as the stock market, would make bonds more attractive. **An increase in the riskiness of alternative assets causes the demand for bonds to rise and the demand curve to shift to the right** (as in Figure 3).

Liquidity. If more people started trading in the bond market, and as a result it became easier to sell bonds quickly, the increase in their liquidity would cause the quantity of bonds demanded at each interest rate to rise. **Increased liquidity of bonds results in an increased demand for bonds, and the demand curve shifts to the right** (see Figure 3). **Similarly, increased liquidity of alternative assets lowers the demand for bonds and shifts the demand curve to the left.** The reduction of brokerage commissions for trading common stocks that occurred when the fixed-rate commission structure was

abolished in 1975, for example, increased the liquidity of stocks relative to bonds, and the resulting lower demand for bonds shifted the demand curve to the left.

Shifts in the Supply of Bonds

Certain factors can cause the supply curve for bonds to shift, among them these:

1. Expected profitability of investment opportunities
2. Expected inflation
3. Government activities

We will look at how the supply curve shifts when each of these factors changes (all others remaining constant). (As a study aid, Table 3 summarizes the effects of changes in these factors on the bond supply curve.)

SUMMARY Table 3 Factors That Shift the Supply of Bonds

Variable	Change in Variable	Change in Quantity Supplied	Shift in Supply Curve
Profitability of investments	↑	↑	
Expected inflation	↑	↑	
Government deficit	↑	↑	

Note: P and i increase in opposite directions: P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis. Only increases in the variables are shown. The effect of decreases in the variables on the change in supply would be the opposite of those indicated in the remaining columns.

Expected Profitability of Investment Opportunities. The more profitable plant and equipment investments that a firm expects it can make, the more willing it will be to borrow in order to finance these investments. When the economy is growing rapidly, as in a business cycle expansion, investment opportunities that are expected to be profitable abound, and the quantity of bonds supplied at any given bond price and interest rate will increase (see Figure 4). *Therefore, in a business cycle expansion, the supply of bonds increases, and the supply curve shifts to the right. Likewise, in a recession, when there are far fewer expected profitable investment opportunities, the supply of bonds falls, and the supply curve shifts to the left.*

Expected Inflation. As we saw in Chapter 4, the real cost of borrowing is more accurately measured by the real interest rate, which equals the (nominal) interest rate minus the expected inflation rate. For a given interest rate, when expected inflation increases, the real cost of borrowing falls; hence the quantity of bonds supplied increases at any given bond price and interest rate. *An increase in expected inflation causes the supply of bonds to increase and the supply curve to shift to the right* (see Figure 4).

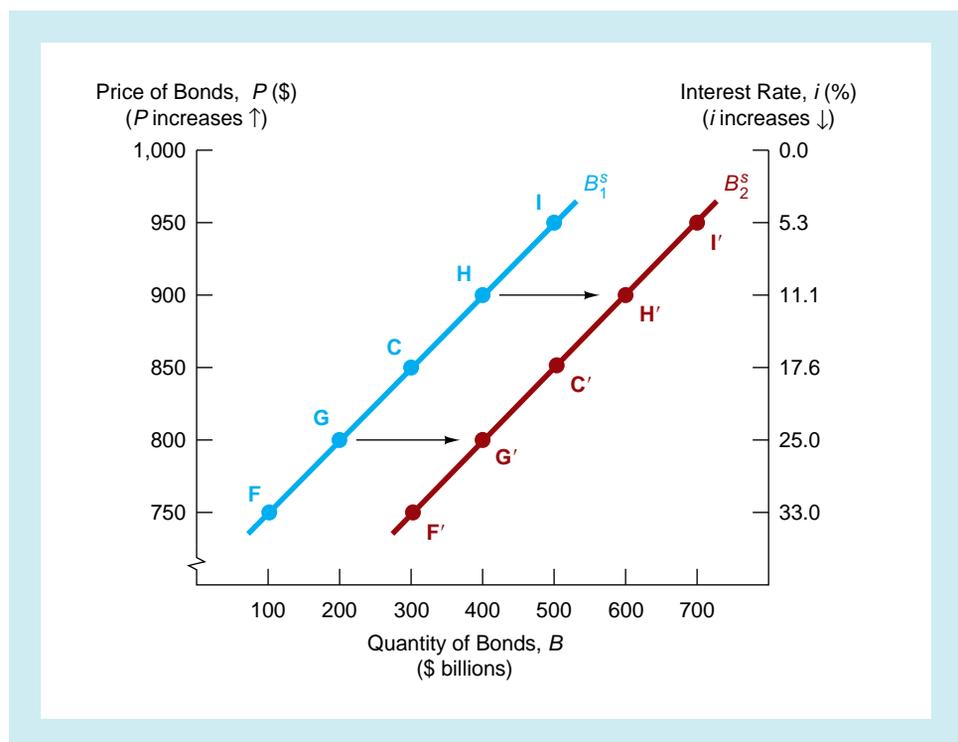
Government Activities. The activities of the government can influence the supply of bonds in several ways. The U.S. Treasury issues bonds to finance government deficits, the gap between the government's expenditures and its revenues. When these deficits are large, the Treasury sells more bonds, and the quantity of bonds supplied at each bond price and interest rate increases. *Higher government deficits increase the supply of bonds and shift the supply curve to the right* (see Figure 4). *On the other hand,*

ftp://ftp.bls.gov/pub/special_requests/cpi/cpia1.txt

Contains historical information about inflation.

FIGURE 4 Shift in the Supply Curve for Bonds

When the supply of bonds increases, the supply curve shifts to the right. (Note: P and i increase in opposite directions. P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis.)



government surpluses, as occurred in the late 1990s, decrease the supply of bonds and shift the supply curve to the left.

State and local governments and other government agencies also issue bonds to finance their expenditures, and this can also affect the supply of bonds. We will see in later chapters that the conduct of monetary policy involves the purchase and sale of bonds, which in turn influences the supply of bonds.

Application

Changes in the Equilibrium Interest Rate Due to Expected Inflation or Business Cycle Expansions



We now can use our knowledge of how supply and demand curves shift to analyze how the equilibrium interest rate can change. The best way to do this is to pursue several applications that are particularly relevant to our understanding of how monetary policy affects interest rates.

Study Guide

Supply and demand analysis for the bond market is best learned by practicing applications. When there is an application in the text and we look at how the interest rate changes because some economic variable increases, see if you can draw the appropriate shifts in the supply and demand curves when this same economic variable decreases. While you are practicing applications, keep two things in mind:

1. When you examine the effect of a variable change, remember that we are assuming that all other variables are unchanged; that is, we are making use of the *ceteris paribus* assumption.
2. Remember that the interest rate is negatively related to the bond price, so when the equilibrium bond price rises, the equilibrium interest rate falls. Conversely, if the equilibrium bond price moves downward, the equilibrium interest rate rises.

Changes in Expected Inflation: The Fisher Effect

We have already done most of the work to evaluate how a change in expected inflation affects the nominal interest rate, in that we have already analyzed how a change in expected inflation shifts the supply and demand curves. Figure 5 shows the effect on the equilibrium interest rate of an increase in expected inflation.

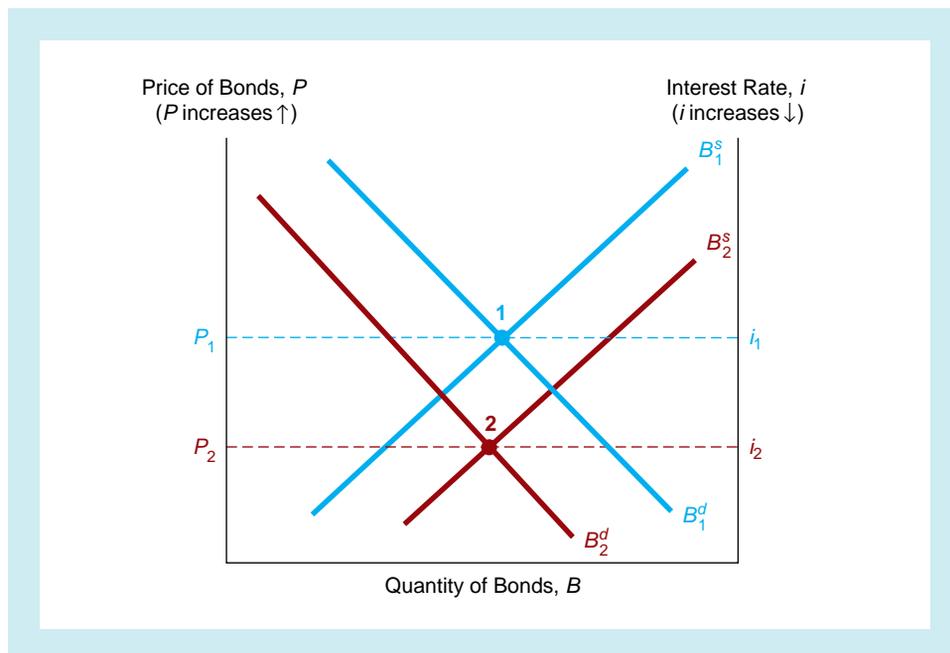
Suppose that expected inflation is initially 5% and the initial supply and demand curves B_1^s and B_1^d intersect at point 1, where the equilibrium bond price is P_1 and the equilibrium interest rate is i_1 . If expected inflation rises to 10%, the expected return on bonds relative to real assets falls for any given bond price and interest rate. As a result, the demand for bonds falls, and the demand curve shifts to the left from B_1^d to B_2^d . The rise in expected inflation also shifts the supply curve. At any given bond price and interest rate, the real cost of borrowing has declined, causing the quantity of bonds supplied to increase, and the supply curve shifts to the right, from B_1^s to B_2^s .

When the demand and supply curves shift in response to the change in expected inflation, the equilibrium moves from point 1 to point 2, the intersection



FIGURE 5 Response to a Change in Expected Inflation

When expected inflation rises, the supply curve shifts from B_1^s to B_2^s , and the demand curve shifts from B_1^d to B_2^d . The equilibrium moves from point 1 to point 2, with the result that the equilibrium bond price (left axis) falls from P_1 to P_2 and the equilibrium interest rate (right axis) rises from i_1 to i_2 . (Note: P and i increase in opposite directions. P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis.)



of B_2^d and B_2^s . The equilibrium bond price has fallen from P_1 to P_2 , and because the bond price is negatively related to the interest rate (as is indicated by the interest rate rising as we go down the right vertical axis), this means that the interest rate has risen from i_1 to i_2 . Note that Figure 5 has been drawn so that the equilibrium quantity of bonds remains the same for both point 1 and point 2. However, depending on the size of the shifts in the supply and demand curves, the equilibrium quantity of bonds could either rise or fall when expected inflation rises.

Our supply and demand analysis has led us to an important observation: **When expected inflation rises, interest rates will rise.** This result has been named the **Fisher effect**, after Irving Fisher, the economist who first pointed out the relationship of expected inflation to interest rates. The accuracy of this prediction is shown in Figure 6. The interest rate on three-month Treasury bills has usually moved along with the expected inflation rate. Consequently, it is understandable that many economists recommend that inflation must be kept low if we want to keep interest rates low.

Business Cycle Expansion

Figure 7 analyzes the effects of a business cycle expansion on interest rates. In a business cycle expansion, the amounts of goods and services being produced in the economy rise, so national income increases. When this occurs, businesses will be more willing to borrow, because they are likely to have many profitable investment opportunities for which they need financing. Hence at a given bond price and interest rate, the quantity of bonds that firms want to sell (that is, the supply of bonds) will increase. This means that in a business cycle expansion, the supply curve for bonds shifts to the right (see Figure 7) from B_1^s to B_2^s .

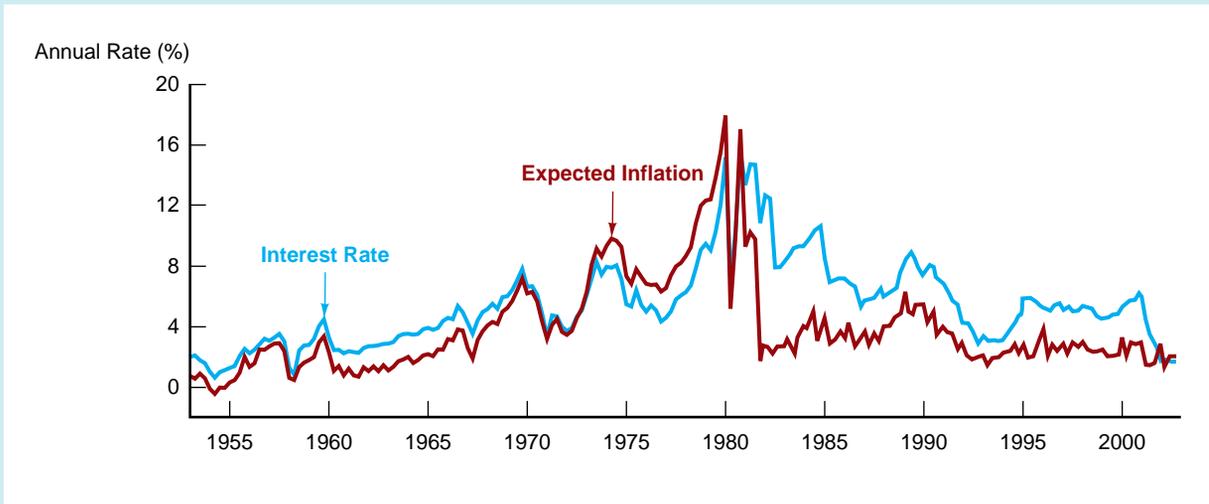
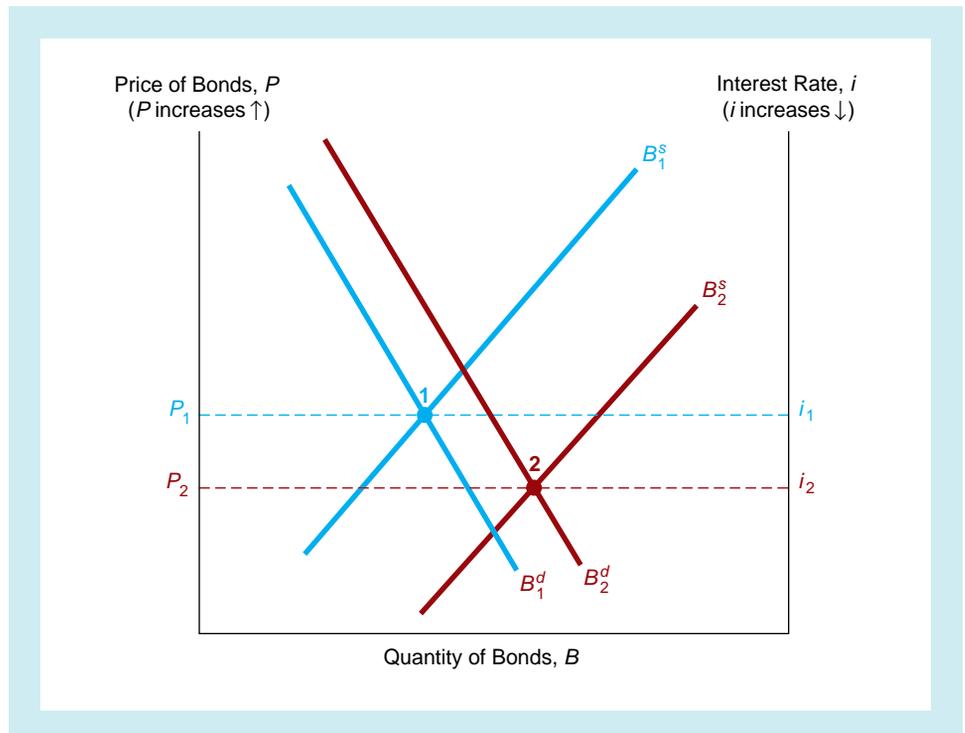


FIGURE 6 Expected Inflation and Interest Rates (Three-Month Treasury Bills), 1953–2002

Source: Expected inflation calculated using procedures outlined in Frederic S. Mishkin, “The Real Interest Rate: An Empirical Investigation,” *Carnegie-Rochester Conference Series on Public Policy* 15 (1981): 151–200. These procedures involve estimating expected inflation as a function of past interest rates, inflation, and time trends.

FIGURE 7 Response to a Business Cycle Expansion

In a business cycle expansion, when income and wealth are rising, the demand curve shifts rightward from B_1^d to B_2^d , and the supply curve shifts rightward from B_1^s to B_2^s . If the supply curve shifts to the right more than the demand curve, as in this figure, the equilibrium bond price (left axis) moves down from P_1 to P_2 , and the equilibrium interest rate (right axis) rises from i_1 to i_2 . (Note: P and i increase in opposite directions. P on the left vertical axis increases as we go up the axis, while i on the right vertical axis increases as we go down the axis.)



Expansion in the economy will also affect the demand for bonds. As the business cycle expands, wealth is likely to increase, and then the theory of asset demand tells us that the demand for bonds will rise as well. We see this in Figure 7, where the demand curve has shifted to the right, from B_1^d to B_2^d .

Given that both the supply and demand curves have shifted to the right, we know that the new equilibrium reached at the intersection of B_2^d and B_2^s must also move to the right. However, depending on whether the supply curve shifts more than the demand curve or vice versa, the new equilibrium interest rate can either rise or fall.

The supply and demand analysis used here gives us an ambiguous answer to the question of what will happen to interest rates in a business cycle expansion. The figure has been drawn so that the shift in the supply curve is greater than the shift in the demand curve, causing the equilibrium bond price to fall to P_2 , leading to a rise in the equilibrium interest rate to i_2 . The reason the figure has been drawn so that a business cycle expansion and a rise in income lead to a higher interest rate is that this is the outcome we actually see in the data. Figure 8 plots the movement of the interest rate on three-month U.S. Treasury bills from 1951 to 2002 and indicates when the business cycle is undergoing recessions (shaded areas). As you can see, the interest rate rises during business cycle expansions and falls during recessions, which is what the supply and demand diagram indicates.

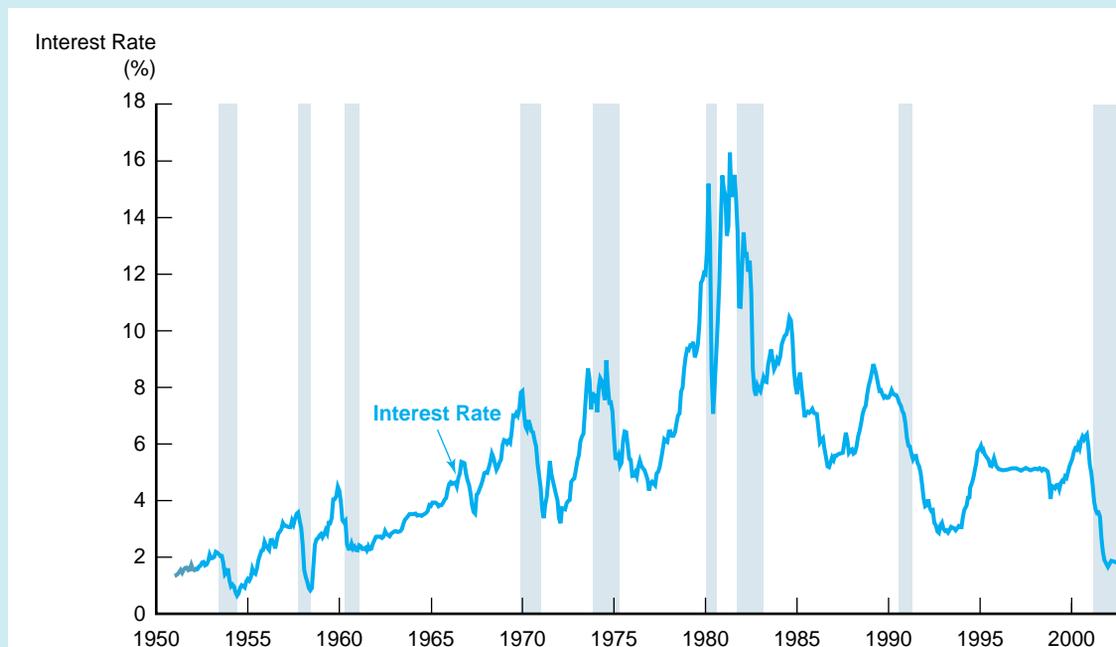


FIGURE 8 Business Cycle and Interest Rates (Three-Month Treasury Bills), 1951–2002

Shaded areas indicate periods of recession. The figure shows that interest rates rise during business cycle expansions and fall during contractions, which is what Figure 7 suggests would happen.

Source: Federal Reserve: www.federalreserve.gov/releases/H15/data.htm.



Application

Explaining Low Japanese Interest Rates

In the 1990s and early 2000s, Japanese interest rates became the lowest in the world. Indeed, in November 1998, an extraordinary event occurred: Interest rates on Japanese six-month Treasury bills turned slightly negative (see Chapter 4). Why did Japanese rates drop to such low levels?

In the late 1990s and early 2000s, Japan experienced a prolonged recession, which was accompanied by deflation, a negative inflation rate. Using these facts, analysis similar to that used in the preceding application explains the low Japanese interest rates.

Negative inflation caused the demand for bonds to rise because the expected return on real assets fell, thereby raising the relative expected return on bonds and in turn causing the demand curve to shift to the right. The negative inflation also raised the real interest rate and therefore the real cost of borrowing for any given nominal rate, thereby causing the supply of bonds to contract and the supply curve to shift to the left. The outcome was then exactly the opposite of that graphed in Figure 5: The rightward shift of the demand curve and leftward shift of the supply curve led to a rise in the bond price and a fall in interest rates.

The business cycle contraction and the resulting lack of investment opportunities in Japan also led to lower interest rates, by decreasing the supply of bonds and shifting the supply curve to the left. Although the demand curve also would shift to the left because wealth decreased during the business cycle contraction, we have seen in the preceding application that the demand curve would shift less than the supply curve. Thus, the bond price rose and interest rates fell (the opposite outcome to that in Figure 7).

Usually, we think that low interest rates are a good thing, because they make it cheap to borrow. But the Japanese example shows that just as there is a fallacy in the adage, “You can never be too rich or too thin”: (maybe you can’t be too rich, but you can certainly be too thin and do damage to your health), there is a fallacy in always thinking that lower interest rates are better. In Japan, the low and even negative interest rates were a sign that the Japanese economy was in real trouble, with falling prices and a contracting economy. Only when the Japanese economy returns to health will interest rates rise back to more normal levels.



Application

Reading the *Wall Street Journal* “Credit Markets” Column

Now that we have an understanding of how supply and demand determine prices and interest rates in the bond market, we can use our analysis to understand discussions about bond prices and interest rates appearing in the financial press. Every day, the *Wall Street Journal* reports on developments in the bond market on the previous business day in its “Credit Markets” column, an example of which is found in the “Following the Financial News” box. Let’s see how statements in the “Credit Markets” column can be explained using our supply and demand framework.



The column describes how the coming announcement of the Bush stimulus package, which was larger than expected, has led to a decline in the prices of Treasury bonds. This is exactly what our supply and demand analysis predicts would happen.

The larger than expected stimulus package has raised concerns about rising future issuance of government bonds, as is mentioned in the second paragraph. The increased supply of bonds in the future will thus shift the supply curve to the right, thereby lowering the price of these bonds in the future by more than expected. The resulting decline in the expected return on these bonds because of their higher future price will lead to an immediate rightward shift in the demand for these bonds today. The outcome is thus a fall in their equilibrium price and a rise in their interest rates.

Our analysis thus demonstrates why, even though the Bush plan has not increased the supply of bonds today, the price of these bonds falls immediately.

Following the Financial News



The “Credit Markets” Column

The “Credit Markets” column appears daily in the *Wall Street Journal*; an example is presented here. It is found in the third section, “Money and Investing.”

CREDIT MARKETS

Treasurys Drop Ahead of Bush Stimulus Package Selloff Is Fueled by Reports Of More Extensive Plan Than Investors Expected

BY MICHAEL MACKENZIE
Dow Jones Newswires

NEW YORK—Already buckling amid signs of improvement in the economy and a departure of investors seeking better returns in corporate bonds and equities, Treasurys face another bearish element when President Bush outlines his fiscal-stimulus package today.

Reports that the package could total about \$600 billion over 10 years, much larger than expected by bond investors, contributed to a further selloff yesterday amid concerns about rising future issuance of government bonds.

After closing 2002 around 2.73% and 3.81%, respectively, five-year and 10-year Treasury yields have risen sharply in the new year. Yesterday, five-year and 10-year yields ended at 3.04% and 4.06%, respectively, up from 2.98% and 4.03% Friday.

The benchmark 10-year note's price, which moves inversely to its yield, at 4 p.m. was down 11/32 point, or \$3.44 per \$1,000 face value, at 99 15/32.

The 30-year bond's price was down 14/32 point at 105 27/32 to yield 4.984%, up from 4.949% Friday.

The selloff was concentrated in shorter-maturity Treasurys, as investors sold those issues while buying long-dated Treasurys in so-called curve-flattening trades. Later, hedging related to nongovernment bond issues helped lift prices from lows but failed to spark any real rally.

Although uncertainty about geopolitical issues continued to lend some support to Treasurys, the proposed Bush stimulus package “is front and center for the Treasurys market at the moment,” said Michael Kastner, head of taxable fixed income for Deutsche Private Banking, New York. “Details are leaking out, and Treasurys are selling off.”

The prospect of rising government spending means more Treasury issuance, concentrated in the five- and 10-year areas, analysts said. Lehman Brothers forecast “net supply” of Treasurys would increase about \$300 billion this year.

“The Treasury market already reflects the assumption that a large stimulus package will be unveiled,” said Joseph Shatz, government-securities strategist at Merrill Lynch. However, he noted that key questions for the market are “what elements of stimulus will

be passed, and the time frame of stimulus objectives.”

Indeed, there are some factors that mitigate the package's short-term impact on the economy and the market, some added. Analysts at Wrightson ICAP in Jersey City, N.J., said roughly half of a \$500 billion to \$600 billion stimulus package “will be longer-term supply-side tax reform measures spread evenly over the period, while the other half would be more quick-focused fixes for the business cycle.”

The proposal to eliminate taxes individuals pay on dividends would boost stocks, likely at the expense of bonds, analysts said.

They also noted that the Bush proposals have to muster congressional support, which could take some time.

Yet, most added, there is no escaping the sense that the stars are aligned against the Treasury market this year, with a hefty stimulus package another bleak factor clouding the outlook for government bonds.

“Treasury yields are currently too low,” said Deutsche's Mr. Kastner. “Uncertainty over Iraq is maintaining some support for Treasurys, but we are starting to sense that the mood of the market is one of selling the rallies.”