By explicitly including the MP and IS curves in the aggregate demand and supply analysis, we can analyze the response of asset prices, in particular real interest rates and stock prices, to the macroeconomic shocks we discussed in the chapter. We start by using aggregate supply and demand analysis with the MP and IS curves to explain the impact of demand and supply shocks on real interest rates, inflation, and aggregate output. Then, using a standard formula for valuation of stocks, we use these results to see the impact of these shocks on stock prices.

Impact of Demand Shocks on Real Interest Rates, Inflation, and Output

Demand shocks are of two types, those that occur from shocks to monetary policy and those that occur from shocks to spending.

Monetary Policy Shocks

Suppose the economy is initially at point 1 in all three panels of Figure 12A2.1, where inflation is at $\pi_1$, aggregate output is at $Y_1 = Y'$, and the real interest rate is at $r_1$. Suppose also that the Federal Reserve decides to autonomously ease monetary policy by lowering real interest rates at any given inflation rate. As we can see in panel (a) of Figure 12A2.1, this monetary policy action results in a downward shift of the monetary policy curve from $MP_1$ to $MP_2$. This monetary policy shock does not cause the IS curve to change in panel (b), although it does lead to a movement along this IS curve. As we saw in Chapter 10, the aggregate demand curve in panel (c) shifts out to the right from $AD_1$ to $AD_2$, because the lower real interest rate at any given inflation rate leads to
Response to an Autonomous Monetary Easing

The Fed’s decision to lower interest rates at any given inflation rate shifts the monetary policy curve from $MP_1$ to $MP_2$ in panel (a) and shifts the aggregate demand curve in panel (c) out to the right to $AD_2$, because the lower real interest rate at any given inflation rate leads to higher consumption, investment spending, and net exports. The economy moves to point 2 in all the panels, with both a higher rate of inflation at $\pi_2$ and higher output at $Y_2$, and as can be seen from the IS curve, the real interest rate falls to $r_2$. The short-run aggregate supply curve will now shift up until it reaches $AS_3$, and the economy moves to point 3, where aggregate output is now back at potential and inflation has risen to $\pi_3$. The real interest rate is back at $r_1$ because output is back at $Y_1 = Y^p$. 

Step 1. Autonomous monetary easing temporarily reduces real interest rates...

Step 2. which temporarily raises aggregate output in the IS diagram...

Step 3. and temporarily raises output in the AD/AS diagram...

Step 4. but permanently raises inflation.
higher investment spending and net exports, thereby increasing equilibrium output at each inflation rate. The rightward shift in the aggregate demand curve then moves the economy to point 2 in all the panels, with both a higher rate of inflation at $\pi_2$ and higher output at $Y_2$, and as we can see from the $IS$ curve in panel (b), the real interest rate falls to $r_2$.

As we saw in the chapter, because output is now above potential, the short-run aggregate supply curve in panel (c) will shift up until it reaches $AS_3$. The economy moves to point 3, where aggregate output is now back at potential and inflation has risen to $\pi_3$. From the $IS$ curve in panel (b), we can see that the real interest rate is back at $r_1$ because output is back at $Y_1 = Y^p$.

The conclusion from this exercise is that an autonomous monetary policy easing reduces real interest rates and raises aggregate output temporarily, but not permanently. On the other hand, the inflation rate does rise permanently.

This result formally illustrates a point we will discuss in Chapter 13, that monetary policy authorities can affect real interest rates in the short run, but they do not control real interest rates in the long run. Indeed, as we see in panel (b), the long-run real interest rate is determined by the $IS$ curve, at which savings equals investment in goods market equilibrium, which is consistent with the analysis in Chapter 4.

**Spending Shocks**

Spending shocks can occur either because of changes in fiscal policy (changes in taxes or government purchases) or because of autonomous changes in consumption expenditure, investment spending, or net exports. Let’s see what happens when there is a positive spending shock, either because government purchases increase or because business optimism leads to an increase in investment. Because monetary policy is unchanged, the $MP$ curve in panel (a) of Figure 12A2.2 does not shift. The $IS$ and $AD$ curves in panels (b) and (c), however, shift out to the right, as we learned in Chapters 9 and 10, because increased spending causes equilibrium output to increase at any given inflation and real interest rate. The economy moves to point 2 in panel (c), with both output and inflation higher at $Y_2$ and $\pi_2$. Because inflation is higher, we see from panels (a) and (b) that the real interest rate has risen to $r_2$. Then, as we saw in the previous example, the aggregate supply curve shifts up to $AS_3$, and the economy moves to point 3. Output returns to potential, but notice that because inflation rises to $\pi_3$, the real interest rate rises even further to $r_3$ in panels (a) and (b).

The conclusion from this analysis is that positive spending shocks lead to higher real interest rates in both the short and long run. Positive spending shocks lead to higher output in the short run, but not in the long run, and do lead to higher inflation in both the short run and long run.
Figure 12A2.2
Response to a Positive Spending Shock

A positive spending shock shifts the $IS$ and $AD$ curves to the right to $IS_2$ in panel (b) and to $AD_2$ in panel (c). The economy moves to point 2, with both output and inflation higher at $Y_2$ and $\pi_2$. Because inflation is higher, we see from panels (a) and (b) that the short-run real interest rate rises to $r_2$. The short-run aggregate supply curve then shifts up to $AS_2$, and the economy moves to point 3. Output returns to potential, but because inflation rises to $\pi_3$, the real interest rate rises even further to $r_3$. 

Step 1. Positive spending shock shifts $IS$ to right.

Step 2. Short-run output increases, but long-run output remains unchanged.

Step 2. Short-run and long-run real interest rates increase.

Step 4. Short-run and long-run inflation increase.
Impact of Supply Shocks on Real Interest Rates, Inflation, and Output

Now we look at the effects of temporary and permanent supply shocks.

**Temporary Supply Shocks**
As in the chapter, we examine a temporary negative supply shock resulting from a rise in oil prices in Figure 12A2.3. The supply shock leads to an upward shift in the aggregate supply curve from $AS_1$ to $AS_2$ in panel (c), but does not lead to a shift in the $MP$ or $IS$ curves in either panel (a) or (b). When the economy moves to point 2, where output has fallen to $Y_2$ and inflation has risen to $\pi_2$, we see that the real interest rate rises to $r_2$ at point 2 on both the $MP$ and $IS$ curves in panels (a) and (b). Then, as we saw in the text, in the long run the aggregate supply curve will shift back down to $AS_1$ and the economy will return to point 1 in all the panels, so inflation, output, and the real interest rate return to their initial levels.

The conclusion is the following: *a temporary supply shock that raises prices will cause the real interest rate to rise in the short run, but not in the long run. Although the temporary supply shock causes inflation to rise and output to fall in the short run, it has no long-run impact on either of these variables.*

**Permanent Supply Shocks**
In Figure 12A2.4, we look at a permanent negative supply shock. In this case, in panel (c), the long-run supply curve shifts leftward from $LRAS_1$ to $LRAS_2$, while the short-run aggregate supply curve shifts up from $AS_1$ to $AS_2$. However, again neither the $MP$ or $IS$ curves shift in panels (a) or (b). When the economy moves to point 2 in all three panels, inflation rises to $\pi_2$, output falls to $Y_2$, and the real interest rate rises to $r_2$.

*A permanent negative supply shock leads to higher real interest rates in both the short and the long run. It also results in lower output in both the long and the short run, and higher inflation in both the short and the long run.*
Response to a Temporary Negative Supply Shock

The temporary negative supply shock leads to an upward shift in the aggregate supply curve to $AS_2$ in panel (c). When the economy moves to point 2, where output has fallen to $Y_2$ and inflation has risen to $\pi_2$, the interest rate rises to $r_2$ at point 2 on both the $MP$ and $IS$ curves in panels (a) and (b). In the long run, the aggregate supply curve will shift back down to $AS_1$ and the economy will return to point 1, where inflation, output, and the real interest rate return to their initial levels.
FIGURE 12A2.4
Response to a Permanent Negative Supply Shock

In panel (c), the permanent negative supply shock shifts the long-run supply curve to the left to LRAS₂, while the short-run aggregate supply curve shifts up to AS₂. When the economy moves to point 2, inflation rises to π₂, while output falls to Y₂. The higher inflation rate is then associated with a higher real interest rate r₂, as shown in panels (a) and (b).

Step 1. A permanent negative supply shock shifts LRAS leftward and AS upward...

Step 2. Increasing inflation in the long run...

Step 3. Increasing real interest rates in the long run...

Step 4. And decreasing output in the long run.
Impact of Shocks on the Stock Market

To assess the impact of these shocks on the stock market, we use a valuation formula for stock prices known as the generalized dividend model. It says that the value of a share of stock should equal the present discounted value of future dividends. We write this model as follows:

\[ P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + r^s)^t} \]  

where

\( P_0 \) = the current price of the stock, where the zero subscript refers to time period zero, that is, the present

\( D_t \) = the dividend paid at time \( t \)

\( r^s \) = the investor’s required return for the stock

Future dividends should be positively related to overall economic activity and thus to aggregate output, while the required rate of return on stocks that we use to discount the future dividends would move positively with the real interest rate. Armed with these facts, we can now use the results to see what happens to stock prices as a result of demand and supply shocks.

**Monetary Policy Shocks**

We saw in Figure 12A2.1 that an autonomous monetary policy easing lowers real interest rates and raises output in the short run. The lower real interest rates reduce the denominator and higher output raises the numerator in Equation 1, thereby raising stock prices. We get the following result: *an autonomous monetary policy easing should raise stock prices.*

**Spending Shocks**

In Figure 12A2.2, we saw that a positive spending shock leads to both higher output and real interest rates in the short run and higher real interest rates in the long run. Here the effects on stock prices are unclear. The higher output raises the numerator in Equation 1 and would raise stock prices, while higher real interest rates would increase the denominator and cause stock prices to fall. *The effect of a positive spending shock on stock prices is ambiguous.*

**Temporary Supply Shocks**

In Figure 12A2.3, we saw that a temporary negative supply shock causes output to fall in the short run and real interest rates to rise. The denominator in Equation 1 rises, while the numerator falls, both lowering stock prices. *A temporary negative supply shock should cause stock prices to fall.*

**Permanent Supply Shocks**

A permanent negative supply shock causes output to fall in the short run, as we saw in Figure 12A2.4, and also causes output to decline in the long run. Furthermore, it results in a higher real interest rate both in the short and long run. The fall in the numerator
and rise in the denominator of Equation 1 are thus likely to be much larger than was
the case for the temporary supply shock, because the effects are long-lasting. A permanent negative supply shock therefore causes stock prices to fall even more than they would if the supply shock were temporary.

We see from the analysis in this appendix that macroeconomic shocks have an important impact on financial markets. But it works the other way, too: we will see in Chapter 15 that financial shocks can have major effects on the macroeconomy.
rates, inflation, and aggregate output (distinguish between temporary and permanent effects on these variables when appropriate).

4. Suppose that as a result of many years of investment in research and development of new technologies, an economy discovers a new way of producing energy using renewable sources, like wind or solar power. Explain the effects of this technological breakthrough on real interest rates, inflation, and aggregate output (distinguish between temporary and permanent effects on these variables when appropriate).

5. For each of the following events, describe the effect on stock prices:
   a) An autonomous monetary policy easing
   b) A decrease in government spending
   c) A temporary positive supply shock
   d) A permanent positive supply shock