

# Chapter 7.1: Aggregate Demand and Aggregate Supply

In the previous chapter, we introduced the market for money and then added it to our aggregate expenditure model from chapter 4. Combining the two models may have felt somewhat complicated, but if you look at the economy one piece at a time, the process remains tractable and we can gain important insights about the way that monetary policy can influence production.

In this chapter, our analysis will get a bit more complicated, but it is not without purpose. By bringing in one more element of the economy, we will eventually be able to simplify our analysis. At the end of the chapter, we will analyze the entire economy using a model that is comparable to the supply and demand model from chapter 2.

## Aggregate Demand

Because last chapter added many new elements to our analysis, it is worth doing a few review questions to make sure that we are comfortable with all we have learned.

### Question 7.1: Effects of Inflation

The economy begins at an equilibrium level of output, where  $Y_1 = 10,000$ . At this level of output, the price level is  $P_1 = 100$ , the money supply is  $M_1 = 1$  million and the equilibrium interest rate is  $r_1 = 5\%$ .

What happens to the equilibrium interest rate when the price level rises to  $P_2 = 120$ ?

**A**

The interest rate increases

**B**

The interest rate decreases

**C**

The interest rate does not change

**D**

The Federal Reserve decreases the money supply

To answer this question, you only need to utilize the money market. The figure below shows that the money demand curve is directly impacted by the change in price from  $P_1 = 100$  to  $P_2 = 120$ . The money demand curve increases as prices rise, shifting the money demand curve to the right.

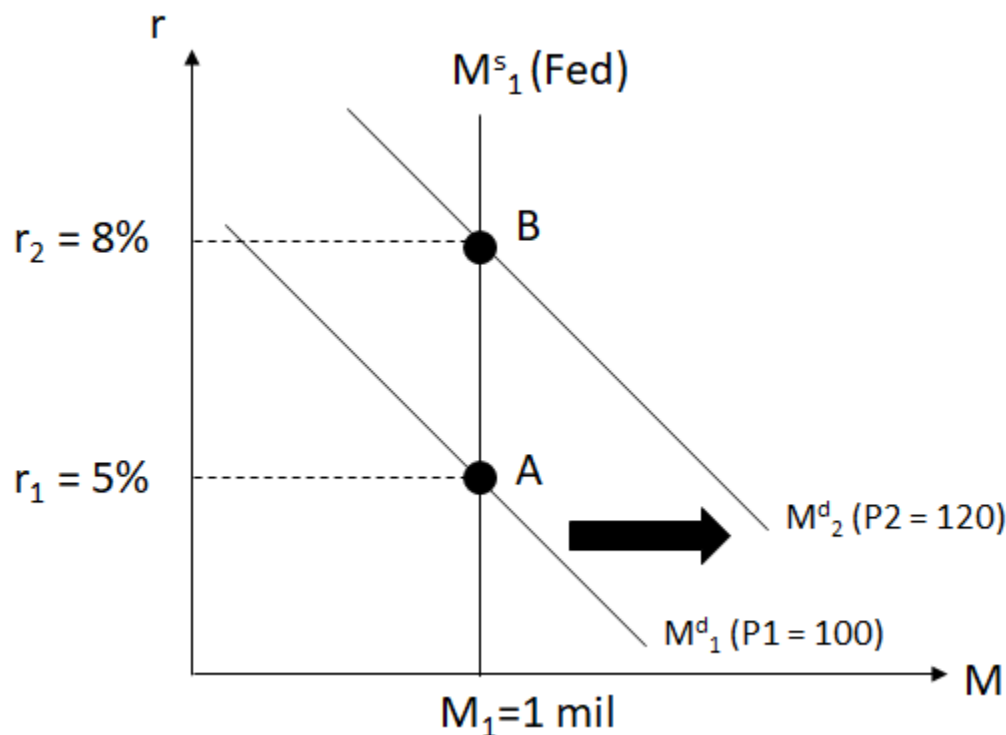


Figure 7.1.01

In the figure above, the money market equilibrium starts at point A and the equilibrium interest rate is 5%. The price level is noted in parenthesis after the money demand curves, since the price level directly shifts the money demand curve. The Fed is noted after the money supply curve since they are the institution that determines the level of money supply in the economy.

After the price level rises from 100 to 120, the money market equilibrium increases from point A to point B and the interest rate increases from  $r_1 = 5\%$  to  $r_2 = 8\%$ . The choice of 8% is random. Any number above 5% could have been chosen.

### Question 7.2: The Effects of Inflation

The economy begins at an equilibrium level of output, where  $Y_1 = 10,000$ . At this level of output, the price level is  $P_1 = 100$ , the money supply is  $M_1 = 1$  million and the equilibrium interest rate is  $r_1 = 5\%$ . The price level rises to  $P_2 = 120$ , increasing the equilibrium interest rate to  $r_2 = 8\%$ .

What happens to aggregate expenditures in this economy after the price level rises to  $P_2 = 120$  and the interest rate increases to  $r_2 = 8\%$ ?

**A**

Aggregate expenditures decrease because autonomous consumption and government spending decrease

**B**

Aggregate expenditures increase because autonomous consumption and planned investment spending increase.

**C**

Aggregate expenditures decrease because autonomous consumption and planned investment spending decrease.

**D**

Aggregate expenditures increase because planned investment spending and government spending increase.

Last chapter we learned that changes in the interest rate have a direct impact on the behavior of consumers and firms. Specifically, when the interest rate increases, borrowing becomes more expensive and the return to savings is greater. This leads to a reduction in autonomous consumption and planned investment spending, which decreases the entire aggregate expenditure curve.

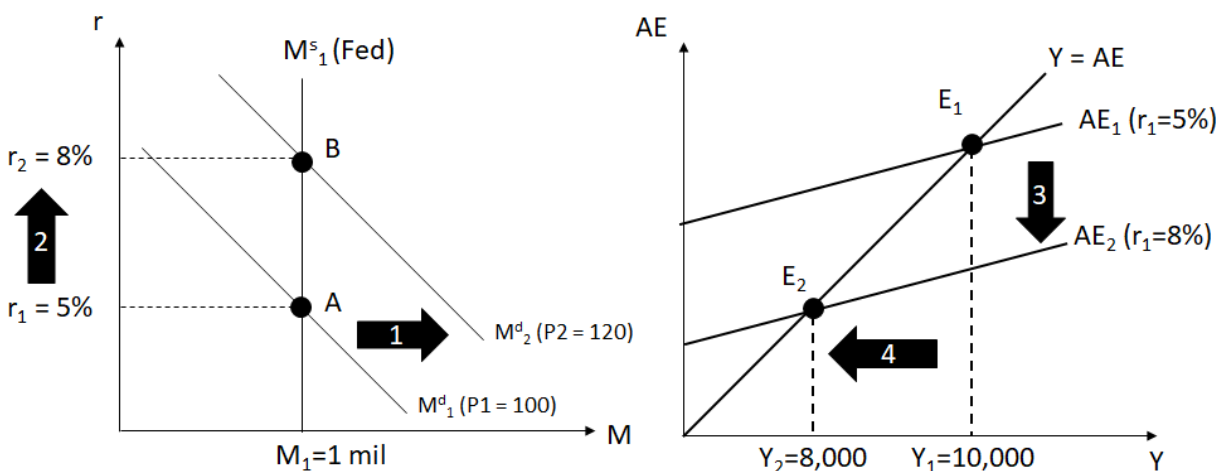


Figure 7.1.02

The figure above shows the aggregate impact of the increase in prices. Arrow 1 is the initial shift we saw in the previous question, which moves the money

demand curve from  $M^d_1$  to  $M^d_2$ . The increase in the interest rate from  $r_1 = 5\%$  to  $r_2 = 8\%$  is captured by arrow 2.

After the increase in the interest rate, the reduction in autonomous consumption and planned investment spending is seen at arrow 3. The aggregate expenditure curve falls from  $AE_1$  ( $r_1=5\%$ ) to  $AE_2$  ( $r_2=8\%$ ). The final arrow, arrow 4, shows that the equilibrium level of output decreases from  $Y_1=10,000$  to  $Y_2=8,000$ .

Although there is a lot going on in our analysis, hopefully seeing the relationship between the money market and aggregate expenditures for a second time (after introducing it last chapter) is a bit easier to digest. Notice that overall, the economy had a price increase from 100 to 120 and the equilibrium output decreased from 10,000 to 8,000.

This relationship between output and price may feel familiar. If it is familiar feeling, it is probably because it is very similar to the relationship we saw in the demand curve back in chapter 2 when we compared the quantity demanded of gasoline to the price of gas. The difference here is that the equilibrium level of output in the aggregate expenditures model decreases as prices increase.

The entire process above can be simplified by plotting out all the combinations of prices and equilibrium output levels from the money market and aggregate expenditures model. From our analysis, we have two combinations:  $(P_1=100, Y_1=10,000)$  and  $(P_2=120, Y_2=8,000)$ . The question could have asked what happens to the equilibrium level of output when the price level changes to 80, 110, 140, etc. and we would have even more combinations.

The relationship we see with two combinations of  $P$  and  $Y$  will hold for all combinations. Specifically, as the general level of prices rise, the equilibrium

in our aggregate expenditures model will decrease. The figure below shows how we can condense our analysis of the price change into a single graph.

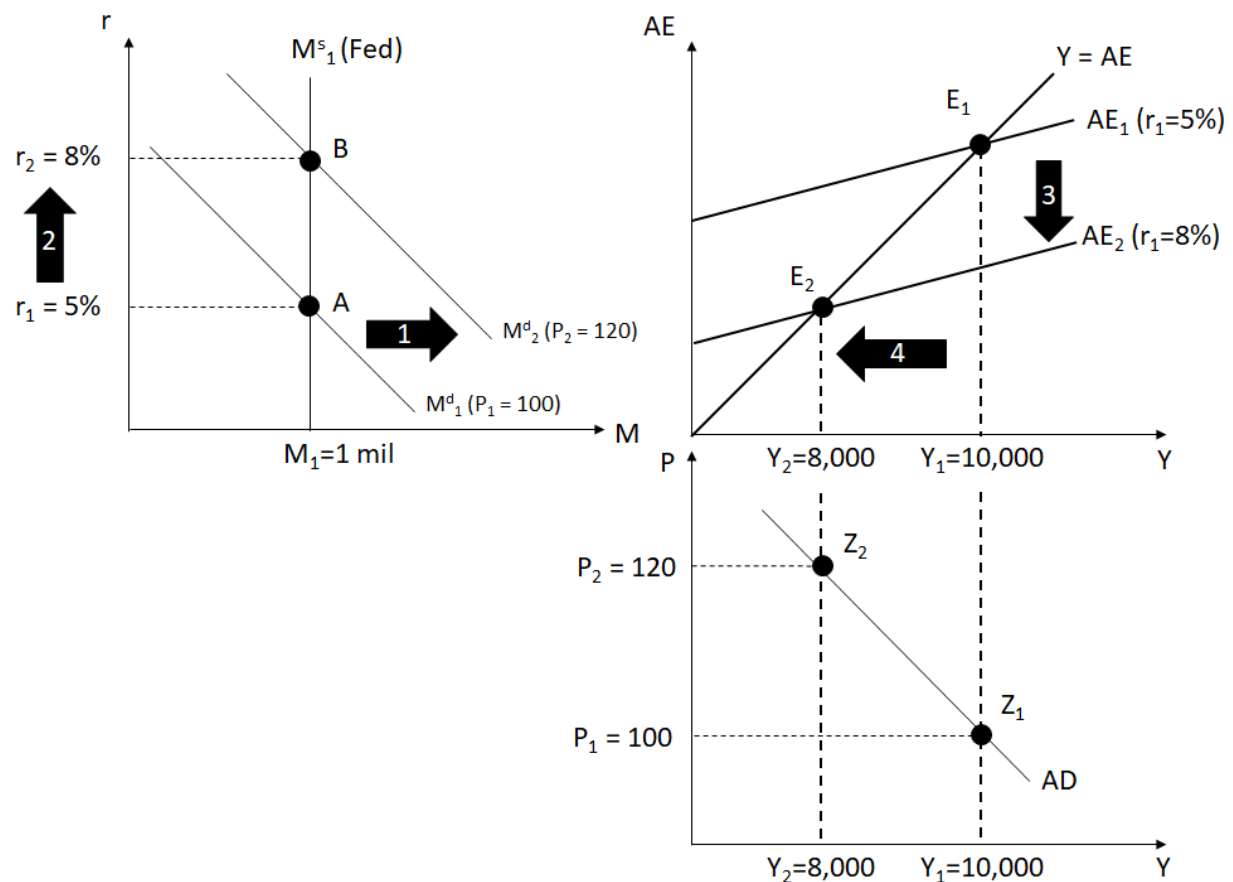


Figure 7.1.03

The third graph, below the aggregate expenditures graph, compares the general level of prices to the equilibrium level of output. At point  $Z_1$ , the price level is 100, which determines the location of the money demand curve in the money market graph. The 5% interest rate when the price level is 100 generates the initial aggregate expenditure curve ( $AE_1$ ), which has an equilibrium level of output at 10,000.

Moving from point  $Z_1$  to  $Z_2$  is caused by an increase in the price level. The price level rise shifts the money demand curve right (arrow 1) and starts us on the trajectory of arrows we went through above. By the time that we reach  $Z_2$ , the

price level is 120, the interest rate is 8% and the equilibrium level of output is 8,000.

The curve relating prices (P) and equilibrium output (Y) can literally be thought of as the "equilibrium level of spending in the economy at every price level" curve. That description does not roll off the tongue (neither would an acronym of the ELBSITEAEPL curve). Because the relationship is comparing prices and output, it is similar in nature to a demand curve, but because it captures equilibrium from the aggregate expenditure model, it is defined as the **aggregate demand curve**. In the graph above, the aggregate demand curve is denoted as AD.

Take a moment to think about what the AD curve is telling us. At every single point on the AD curve, we are in equilibrium in the money market and aggregate expenditures model. This means that on the AD curve,  $Y=AE$  and AD curve is essentially a curve of multiple equilibria. While the derivation of the AD curve is somewhat complicated, it allows us to pack a lot of information into a single, familiar curve.

Unlike a standard demand curve, the AD curve captures equilibrium from another model. This means that any element that is used to create equilibrium in our aggregate expenditure model is wrapped into the AD curve. Eventually, we will drop the two models that generate the AD curve, but we have to make sure we feel comfortable with what the AD curve is capturing.

To that end, let's start by figuring out what moves us along the AD curve?

**Question 7.3: Moving Along the AD Curve**

Which of the following would cause a movement along the AD curve?

**A**

A change in the money supply

**B**

A change in government spending

**C**

A change in net exports

## D

A change in the general level of prices

Hopefully your first reaction to this question is, "wasn't this just covered?" The only thing that moves us along any demand curve is a change in the price level. In the case of the aggregate demand curve, we move along the AD curve when the general level of prices change. That change causes the money demand curve to shift (arrow 1 above), leading to a change in the interest rate (arrow 2), which shifts the aggregate expenditure curve (arrow 3) and eventually the equilibrium level of output (arrow 4).

The first three potential answers in question 7.3 are definitely related to our analysis, but none of them move us along the AD curve. In the next section, we will see what can shift the entire AD curve.

## Shifts in the Aggregate Demand Curve

When thinking about shifts in the AD curve, we can start in the same place we started thinking about shifts in demand in previous chapters. The AD curve is showing us what the equilibrium level of output will be (according to the aggregate expenditures model) at various price levels. In order for the AD curve to shift, we need to think about what would change the equilibrium level of output other than the price level.

### Shifts in the AD Curve

What events change the equilibrium level of  $Y^* = AE^*$  other than price?

The discussion question is posed a bit differently than you may have expected in order to illustrate a point. Because the AD curve is dependent on the level of equilibrium output at a particular price level, we need to take a step back and think about what can change where our aggregate expenditure curve (AE) intersects our  $Y = AE$  equilibrium line.

There are many possible answers to the discussion question and one common, incorrect answer. If you mentioned that prices could change AD, take another look at the question at the end of the previous section. A price

change moves us along the AD curve and we used a change in prices to derive the AD curve in the first place.

Of the many possible answers, let's start with something that we have examined a number of times before. Remember the housing market crash in 2007-2008 from back in chapter 2 (and chapter 3...and chapter 4...and chapter 5...and chapter 6)? Does the housing market crash alter the AD curve?

**Question 7.4: Housing Market Crash and Aggregate Demand**

When there is a housing market crash, what will happen to the aggregate demand curve?

**A**

The AD curve will increase (shift right)

**B**

The AD curve will decrease (shift left)

**C**

The AD curve will not change

**D**

The AD curve will pivot and slope upwards

In order to answer this question, start by drawing out the three graphs from above: the money market, the aggregate expenditure curve and the aggregate demand curve relating the general level of prices and the equilibrium level of output from the aggregate demand model ( $Y = AE$ ). As you draw out the markets, it will be helpful to put determinants of the curves in parentheses. For example, the money supply is determined by the Federal Reserve, the price level determines the money demand curve and the aggregate expenditure curve is partially driven by the interest rate.

In the figure below, the starting points of the economy are at Point A in the money market, Point  $E_1$  on the aggregate demand curve and Point  $Z_1$  on the AD curve. When the housing market crashes, we need to think back to who is impacted initially. It is not necessarily the money market or even prices. The first thing that happens when there is a housing market crash is that household wealth falls. Additionally, housing developers will likely put new projects on hold.



The housing market crash will then have a direct impact on aggregate expenditures. Autonomous consumption (AC) will decrease with the reduction in household wealth and planned investment spending ( $I^p$ ) will also decrease because fewer new homes will be built. The first (and primary) movement that depicts the housing market crash is a decrease in the AE curve.

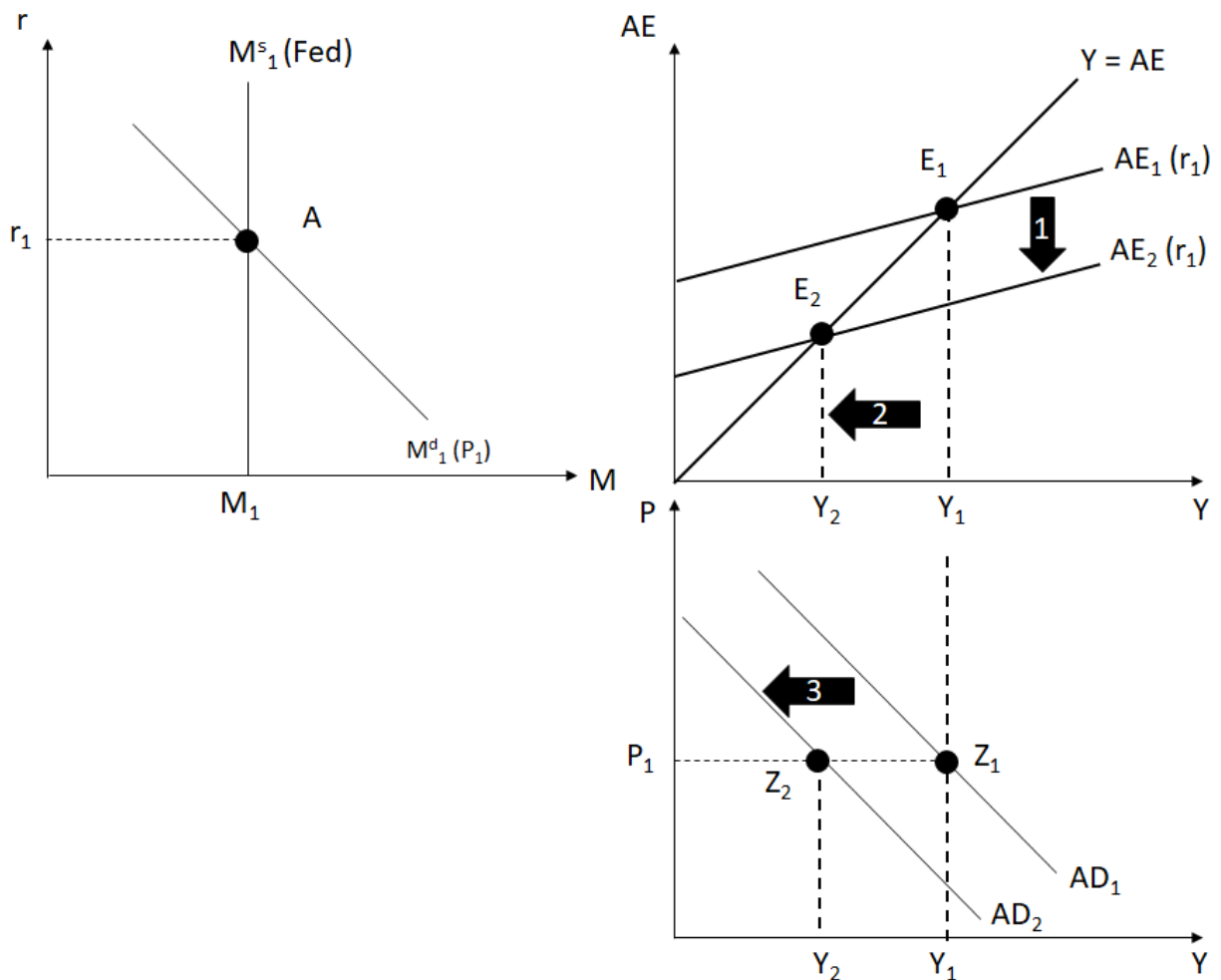


Figure 7.1.04

In the figure above, the housing market crash is shown in step 1. The reduction in the equilibrium output decreases  $AE_1$  to  $AE_2$ . The exact moment that the housing market crashes, neither the interest rate nor the general level of prices change. This may seem somewhat awkward initially, but imagine that the house someone is living in suddenly becomes less valuable. That

does not mean that when they go to the grocery store, the price of an avocado is different or the interest rate on their savings account changes. Instead, the household may start saving a bit more knowing that their home is not as valuable as it used to be and their wealth has decreased.

When the aggregate expenditure curve decreases, the new equilibrium level of output (where  $Y = AE$ ), decreases from  $Y_1$  to  $Y_2$ . This is captured by arrow 2. The reduction in the equilibrium output combined with the fact that prices have not changed means that a new aggregate demand curve must go through the original price level ( $P_1$ ) at a lower level of output ( $Y_2$  instead of  $Y_1$ ). The point  $Z_2$  lies at  $P_1$  and  $Y_2$  and arrow 3 shows the movement of the aggregate demand curve from  $AD_1$  to  $AD_2$ .

Anytime that there is a change in the AE curve caused by something other than a price change, the AD curve will shift with it. Take another look at the discussion question above and see if you can confirm if any of the answers would shift the AD curve.

As we discussed above, a change in the price level will not shift the AD curve. Instead, a change in the price level will shift money demand, then the interest rate, followed by the AE curve and the equilibrium level of output,  $Y$ . Because the change in  $Y$  was caused by a change in price, there is a movement along the AD curve.

## Fiscal Policy and the AD Curve

### Question 7.5: Shifts in AD

Can policy makers shift the AD curve?

**A**

Yes, but only the government (Congress and the President) can shift AD

**B**

Yes, but only the Federal Reserve can shift AD

**C**

Yes, both the government and the Federal Reserve can shift AD

**D**

No, neither the government nor the Federal Reserve can shift AD.

To answer the question above, think back to what happens when the government changes  $G$  or  $T$  and when the Federal Reserve changes the money supply. Neither of these actions directly influence the price level, so any action by policy makers that change the aggregate expenditure curve ( $AE$ ) will ultimately shift the aggregate demand curve ( $AD$ ). In other words, both fiscal and monetary policy cause shifts in the  $AD$  curve.

In order to see the relationship between fiscal policy and the  $AD$  curve, start again with an economy that is in equilibrium in the money market, show the aggregate expenditure model and the aggregate demand curve. The figure below uses generic values for money, the interest rate, spending, output and prices, but you can put actual values on the graph if you are more comfortable with that.

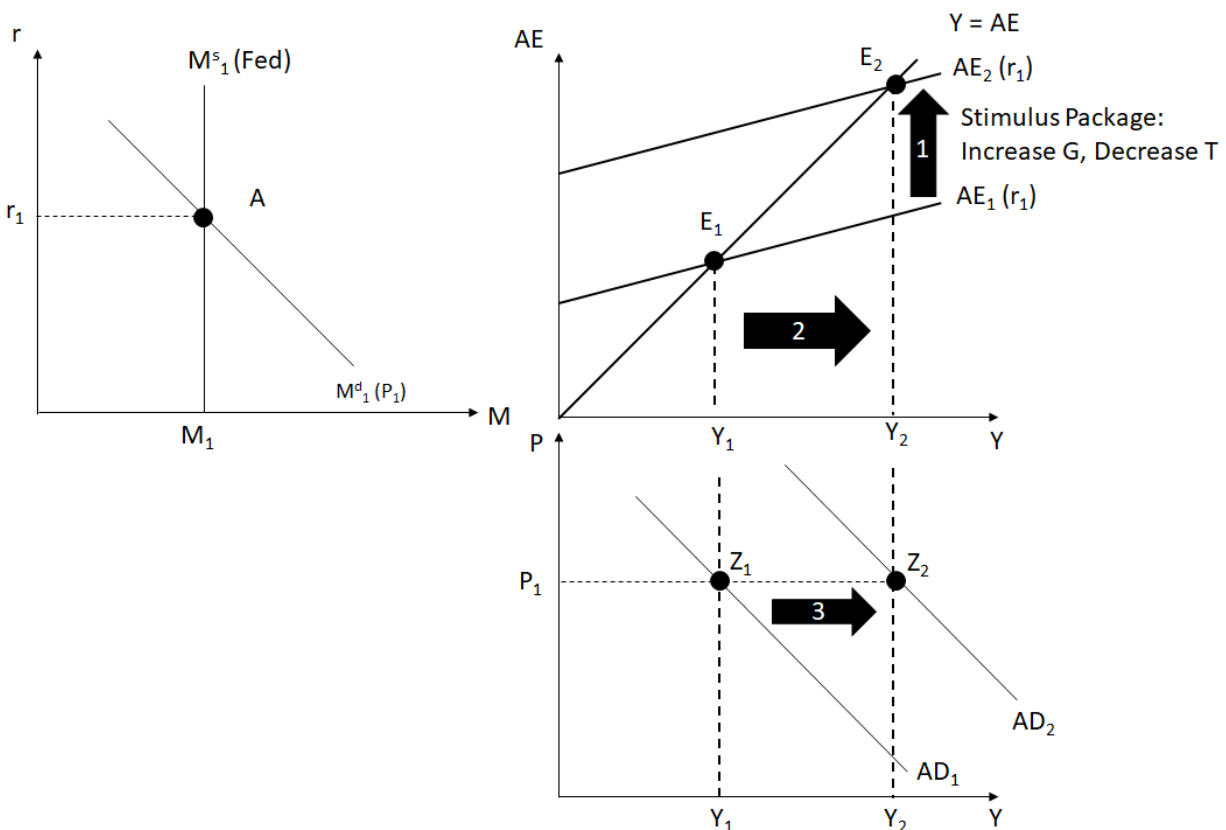


Figure 7.1.05

After the housing market crash, the government passed a stimulus package that increased government spending ( $G$ ) and decreased taxes ( $T$ ). We can show the effect of the stimulus package in our model. Specifically, the stimulus package will have a direct impact on the aggregate expenditure curve. With more government spending,  $G$  is greater, and lower taxes mean that  $T$  is lower. As we have seen in previous chapters, these changes increase the AE curve from  $AE_1$  to  $AE_2$ .

Increasing the AE curve increases the level of equilibrium output from  $Y_1$  to  $Y_2$ . Similar to the housing market, the moment that the government enacts the stimulus package does not cause an instantaneous change in prices. There is a new level of equilibrium output at  $Y_2$ , but prices are still at their original level,  $P_1$ . A new AD curve must then pass through this point. The original aggregate demand curve,  $AD_1$ , shifts to the right and  $AD_2$  passes through  $Y_2$  and  $P_1$  at point  $Z_2$ .

If you drew out the money market graph, you will notice that nothing in the money market changed as the AD curve shifted from the stimulus package. That is because the Federal Reserve did not do anything in our thought experiment. Because the Fed did not change the money supply and we have not looked far enough ahead to address any potential price changes, there is nothing that happened that would alter either the money demand or money supply curve.

In the example above, you should recognize that the government can shift the AD curve by altering the level of  $G$  or  $T$ . As we saw from the stimulus package example, an increase in  $G$  or decrease  $T$  will shift the AD curve to the right because the equilibrium level of output from the aggregate expenditures model increases, but prices do not immediately change.

Conversely, a reduction in  $G$  or increase in  $T$  will directly lower the AE curve. The lower equilibrium level of output combined with the fact that prices do not immediately respond to fiscal policy will shift the AD curve to the left. It is

important to continuing thinking of fiscal policy as changes driven by the government that directly influence the AE curve. However, fiscal policy also is associated with a shift in the AD curve.

## **Monetary Policy and the AD Curve**

The answer to question 7.5 above was (C)-both the government and the Federal Reserve can shift the AD curve. We just saw how government can use fiscal policy to shift AD, but how can monetary policy be used to shift AD? Again, start with a generic economy in equilibrium in the money market, equilibrium output from the aggregate expenditures model is at  $Y_1$  and an AD curve that goes through point  $Z_1$  where prices are  $P_1$  and equilibrium output is  $Y_1$ .

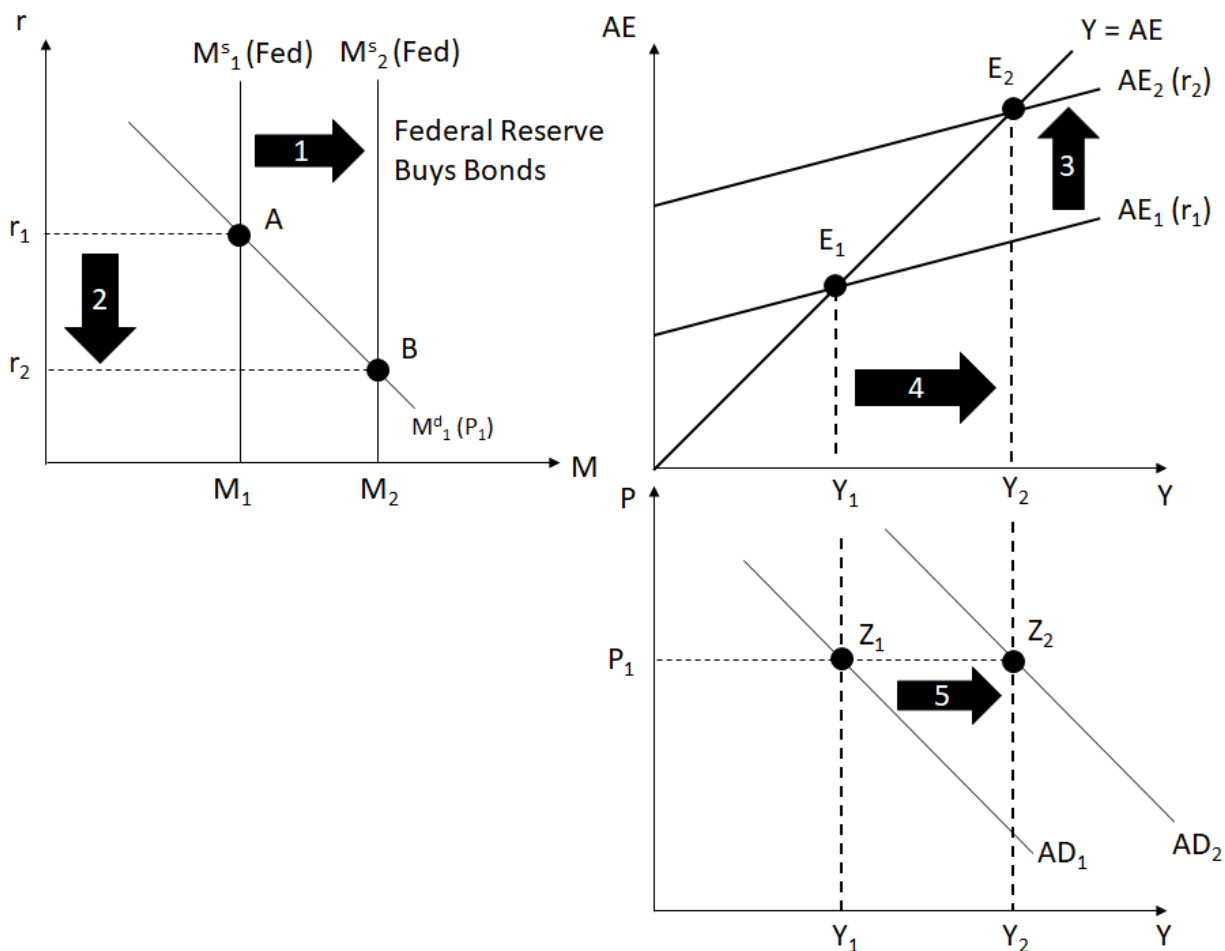


Figure 7.1.06

Because we are interested in exploring how behavior of the Federal Reserve influences the AD curve, we need to think about how the Fed directly impacts our model. The power of the Federal Reserve is that they have complete control of the money supply curve. Last chapter, we learned that the Fed can buy and sell bonds through open market operations.

During the Great Recession, the Fed took a number of actions to increase the money supply. We can show this in the model above as a shift right in the money supply (arrow 1). This reduces the interest rate from  $r_1$  to  $r_2$  (arrow 2). As the interest rate falls, there is an increase in the AE curve as autonomous consumption and planned investment spending increase (arrow 3). The new equilibrium output increases from  $Y_1$  to  $Y_2$  (arrow 4) when  $AE_1$  increases to  $AE_2$ .

Consistent with our previous shifts in AD, the increase in the money supply in the first step does not have a direct impact on the price level. After the increase in the money supply, the new equilibrium level of output is at  $Y_2$  and the price level is at the original level of  $P_1$ . In other words, the AD curve moves from  $AD_1$  to  $AD_2$  (arrow 5) and the new AD curve intersects  $P_1$  and  $Y_2$  at point  $Z_2$ .

The outcome from our monetary policy example and fiscal policy example are the same. When the Fed increases the money supply, the AD curve will shift to the right. When the government increase  $G$ , the AD curve will also shift right. The AD curve will shift left when the Fed decreases the money supply or the government decreases  $G$  (or increases  $T$ ).

The most important takeaway from these examples is that fiscal and monetary policy can shift the AD curve. When the housing market crashed, the AD curve shifted left, but the government and the Federal Reserve responded by shifting the AD curve to the right.

Shifts in the AD curve can be caused by a number possible events which originate from either the money market or the aggregate expenditures model. However, as we move forward shocks to the economy and policy responses can be captured with the aggregate demand (and aggregate supply) curves.

In the figure below, the consequences of our examples above are condensed into the aggregate demand curve only. The housing market crash decreases the AD curve from  $AD_{\sim 2007}$  to  $AD_{\sim 2008}$ . The response of the government and Federal Reserve increases the AD curve up to  $AD_{\sim 2009}$ .

Analyzing the AD curve on its own is a lot simpler than the process we used to shift the curve above. But it is important to remember what is driving the shifts in AD as it is easy to mistake a movement along AD with a shift in AD since both events start from other models.

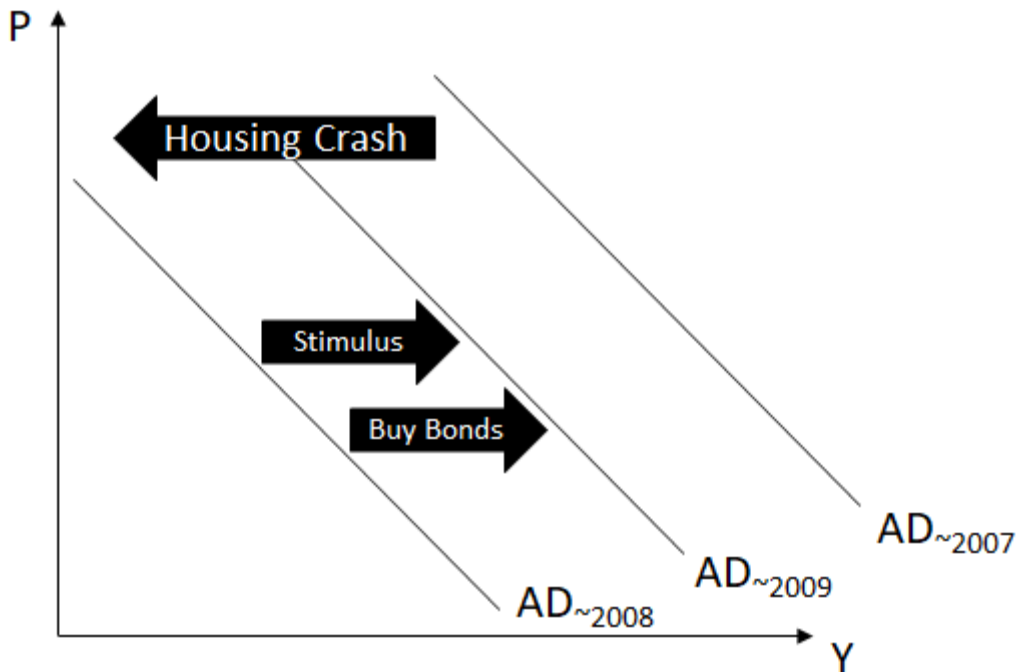


Figure 7.1.07

A new and interesting characteristic of the aggregate demand curve is that every point along the AD curve is an equilibrium point in the aggregate expenditures model. In describing AD shifts, we have assumed that prices did not change. However, it would not be surprising if you said to yourself, "I thought prices rise when demand increases," or something similar. In order to paint a complete picture of the economy, we need to introduce aggregate supply to our analysis.

## Aggregate Supply

Deriving the aggregate demand curve was complex. For better or worse, the aggregate supply will not need to be derived in the same manner.

The aggregate demand curve shows us the combinations of price levels and equilibrium in the aggregate expenditures model. At every point on the AD curve, spending is equal to output. At the core of our discussion about AD is that there is enough output in the economy being produced by suppliers. This may or may not be the case.



When prices are very low, there is a lot of spending in the economy, but with prices at a low level, firms may not be willing to produce as much as people want to buy. On the opposite end of the spectrum, firms may want to produce a lot at high prices but the high prices will reduce spending and firms will not sell all of their production.

To find complete macroeconomic equilibrium, aggregate supply needs to be added to our model. The [aggregate supply curve](#) (AS) will be on the same graph as the aggregate demand curve, which compares the general level of prices to output. Similar to supply from our original supply and demand analysis, aggregate supply will show the amount that firms are willing and able to produce at various price levels.

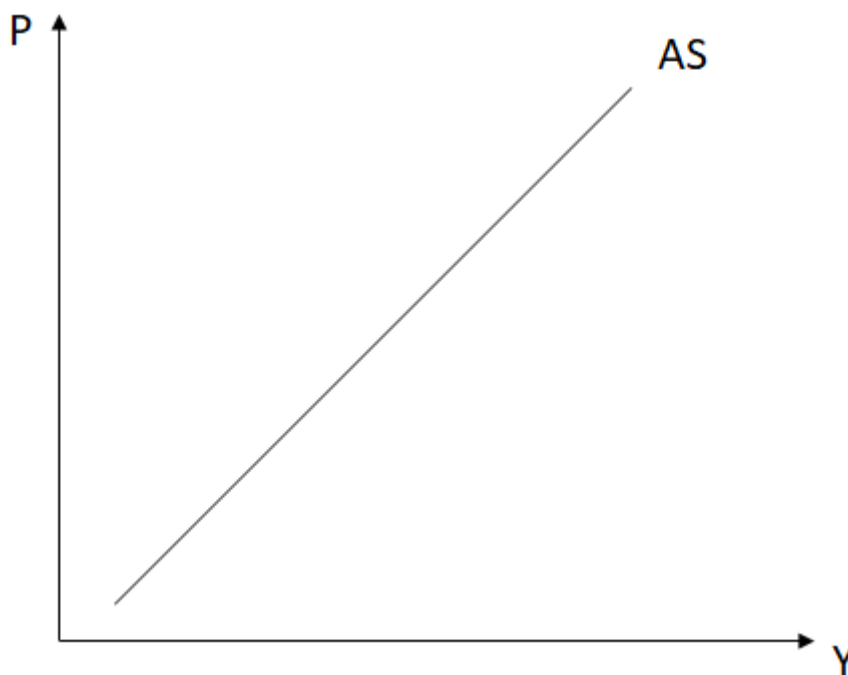


Figure 7.1.08

The figure above should feel quite comfortable compared to the previous section. The AS curve is an upward sloping curve that relates the amount that all firms in the economy are willing to produce (Y) to the general level of prices (P). As the general level of prices rise, firms are willing to produce more. When prices decrease, firms will be willing to produce less.

It is easy to take the shape of the AS curve for granted, but it is important to recognize what the AS curve is capturing. In the short-run, firms will try to decide how much they want to produce based on a many pieces of information. This includes their available labor and capital, future prices and the season.

The most important factor in determining the level of production is the price of the good being sold. This is because the cost of production increases as the amount of output rises.

An argument can be made that additional units of production cost the same to make as previous units at some points along a supply curve. However, these levels of output where there is a constant cost of production differ for all firms.

Eventually, the cost of production will rise for all firms as their output levels increase. Firms produce output using labor and capital. In the short run, capital is likely fixed, so in order to produce more output, firms will need to hire more workers. Each worker hired will be less productive than the existing workforce. This is because firms are efficient. If the next worker was more productive than the existing workforce, that worker should have already been hired.

Another reason that costs rise with production is that capital is fixed in the short run. When a new worker happens to be just as productive as the existing workforce, the fact that capital is not increasing means that each additional worker will have less capital to use than the previous worker and be less productive.

This is all just a long-winded way of saying that prices need to increase in order for firms to be willing to produce more output. Otherwise, they will not be able to cover the costs associated with the additional output. Because of the increasing costs of production, the supply curve from chapter 2 and the

aggregate supply curve above is upward sloping. The main difference between the supply curve for one good and the aggregate supply curve is that the AS curve represents all firms in the economy, producing all goods and services.

**Question 7.6: Movements Along Aggregate Supply**

Which of the following will move you along the aggregate supply curve?

**A**

An improvement in the quality of the labor force.

**B**

A natural disaster that reduces the stock of capital.

**C**

A change in the general level of prices.

**D**

New technology.

By this point the course, you may be saying to yourself, "this question has been asked a bunch of times". And you would be correct. The only difference is that we are changing the setting.

Question 7.6 is reiterating how the AS curve is derived. The figure below shows how the price level moves us along the AS curve. Imagine starting at point  $Z_1$ . At this point, the price level is  $P_1$  and firms are willing to produce  $Y_1$ .

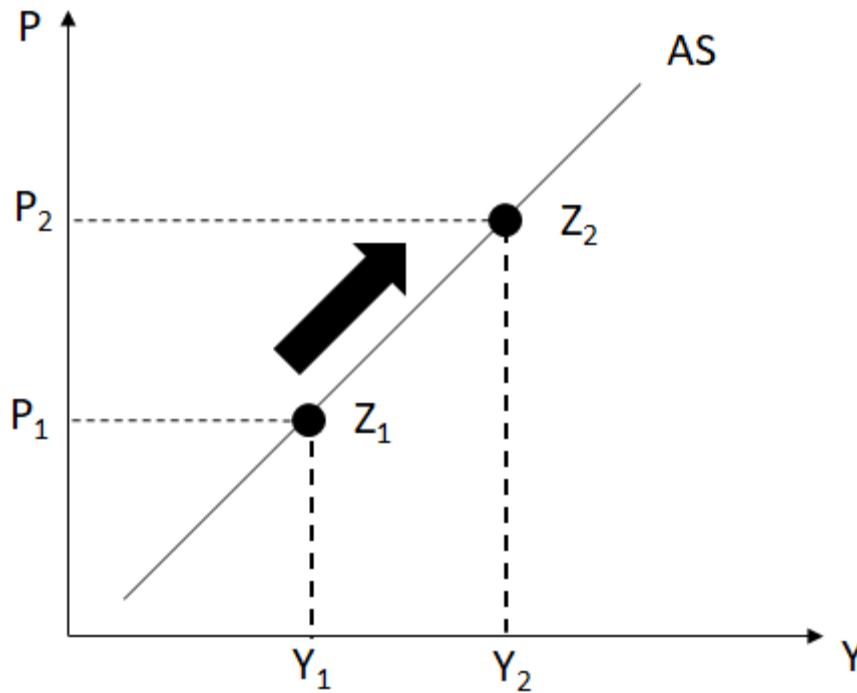


Figure 7.1.09

When the price level rises, firms are willing to hire more workers and produce more output. Even though the additional labor may not be as productive as the existing workforce (making each additional unit of output more costly), the higher price of the goods makes it possible for firms to increase production. The increasing price is captured by the movement from  $Z_1$  to  $Z_2$ . Along the AS curve, price is rising from  $P_1$  to  $P_2$  and output is increasing from  $Y_1$  to  $Y_2$ .

## Shifts in the Aggregate Supply Curve

### Shifts in Aggregate Supply

What changes the amount firms are willing and able to produce other than the price level?

We have had a discussion like this before when we talked about shifts in the supply curve. When talking about shifts in the aggregate supply curve, one needs to think about possible events that would have a large-scale impact on the amount that a firm produces other than the price of goods and services. There are a number of events that will fall into this category.

## Cost of Inputs

Arguably the biggest shifter of the aggregate supply curve is the cost of inputs, capital and labor. Imagine that all of a sudden, workers cost more to employ. This can be because minimum wage increases or because certain benefits, such as health insurance, become required. After either of these events, each worker costs the firm more to employ. This means that firms will have to charge more for goods and services than before.

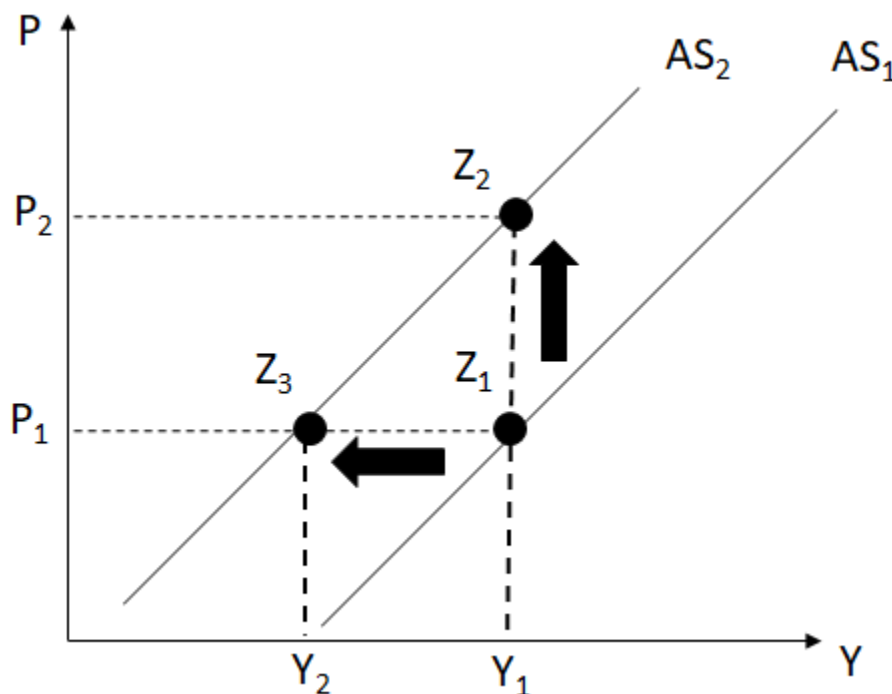


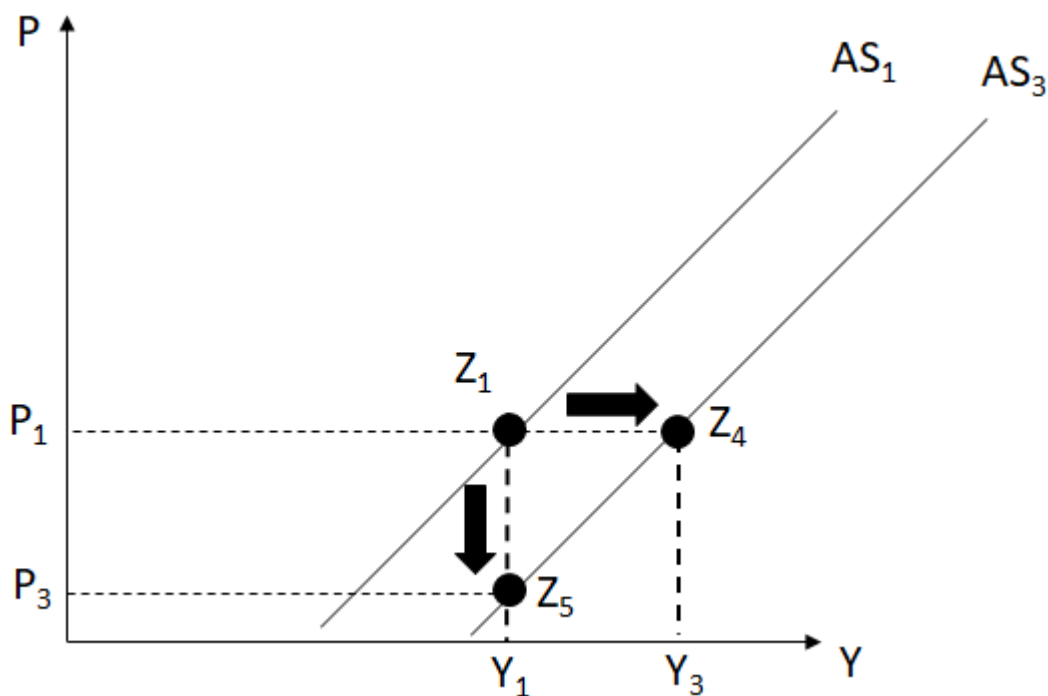
Figure 7.1.10

The figure above shows the reduction in the AS curve that results from an increase in the cost of labor. In the figure, the firm is originally at point  $Z_1$  where production was  $Y_1$  at a price level of  $P_1$ . The response of firms to the increase in costs can be thought of two ways. First, the firm may continue producing  $Y_1$ , but in order to compensate the firm for the higher production costs, the price will have to rise to  $P_2$  and the firm will be at point  $Z_2$ .

Alternatively, the firm will reduce the amount they produce from  $Y_1$  to  $Y_2$ , but the price level will remain the same. In this case, the firm moves from point

$Z_1$  to  $Z_3$ , where the price level is at  $P_1$ , but the output level is  $Y_2$ . Regardless of how the firm alters price or output, they will be on a new aggregate supply curve as  $AS_1$  shifts left to  $AS_2$ .

In the case of labor, it is reasonable to assume that the cost of labor is often rising. That is not necessarily the case with capital. The cost of capital can rise or fall depending on a variety of factors. A machine can become cheaper or become refurbished to use less energy. When the cost of inputs decrease, the firms will be more willing and able to increase production without an increase in price.



Figure

7.1.11

In the figure above, an increase in the aggregate supply curve is depicted. Again, firms begin at point  $Z_1$ , where they are producing  $Y_1$  units when the price level is  $P_1$ . When the cost of capital decreases, firms have at least two options. First, they can increase production from  $Y_1$  to  $Y_3$ , but keep the price the same at  $P_1$ . This moves the firms from point  $Z_1$  to  $Z_4$ . It is also possible that

the firm will continue to produce at  $Y_1$ , but they will be willing to produce that much at a price level of  $P_3$ . In other words, firms move from point  $Z_1$  to  $Z_5$ .

It does not matter whether firms move to point  $Z_4$  or  $Z_5$ . In either case the aggregate supply curve shifts from  $AS_1$  to  $AS_3$ . Firms are producing more output at every price level on the curve  $AS_3$  compared to the curve  $AS_1$ .

## **Technology**

Changes in the cost of capital are slightly different from improvements in technology. When technology improves, more can be produced with the same amount of capital. In the world of economic research, large data sets are often utilized. The faster a computer is, the quicker data analysis can be done and more projects can be completed in the same amount of time as the past when slower computers were the norm. Similarly, a new tractor will be able to plow a field faster than older tractors since the technology of new tractors has improved over time.

Unlike the cost of inputs, technology will only increase the aggregate supply curve. When technology improves, the AS curve will shift to the right as more output can be produced at the same price level.

## **Competition**

In chapter 2, the supply curve for a good increased when the number of firms in the market increased. The same idea applies to the AS curve. When there is more competition in the economy, the total amount of production will increase at every price level causing an increase in AS. Conversely, less competition will result in less production at every price level, decreasing AS and shifting it to the left.

## **Weather Events**

You may recall a time in the past when the weather was particularly bad over a large area of the country. This may happen when a hurricane moves up the

east coast of the United States and causes transportation delays from Florida to Maine. In this scenario, production and transportation of products is often halted. This causes a reduction in the amount of production, even though prices may not change immediately. A lower level of production at all price levels will result in a decrease in the AS curve.

But not all weather events are bad. In years of ideal weather, agricultural crops may thrive more than expected. The output in this case will be greater than anticipated, but the additional output was not associated with an increase in the cost of production. This means that the AS curve will increase and production will increase at all price levels.

## **Other Factors**

We have highlighted a few of the events that shift the AS curve. However, any event that changes the amount that a firm produces other than the cost will shift the AS curve. Take another look at the discussion at the start of this section and revisit whether the answers on the board would actually lead to a shift in the AS curve.

With the AD and AS curves understood on their own, it is time to combine the two curves and show how we end up at a complete macroeconomic equilibrium.

# **Chapter 7.2: Complete Macroeconomic Equilibrium**

We have spent a lot of time building up to this moment, but we are finally here! It is time to see what the economy looks like when all of our markets are



in equilibrium. The short answer of what it means to be in complete macroeconomic equilibrium is fairly straightforward. When our aggregate demand and aggregate supply curves intersect, the economy is in equilibrium.

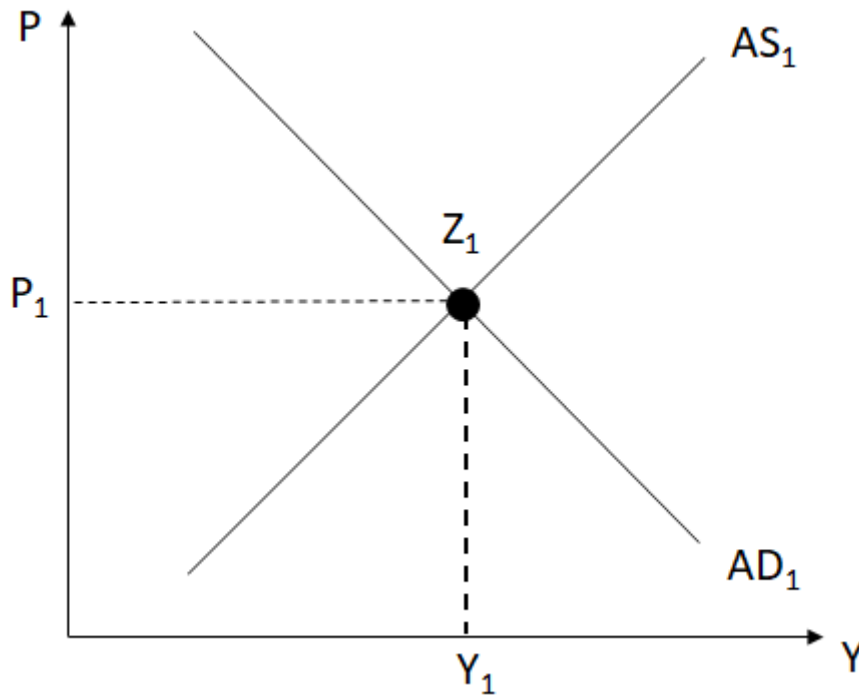


Figure 7.2.01

In looking at the figure above, it seems we have come full circle. You may be thinking, "we have done a lot of work to get back to where we started the entire course". This sentiment certainly has merit.

Equilibrium above occurs at  $Z_1$ . At this point, the equilibrium price level is  $P_1$  and the equilibrium level of output is  $Y_1$ . The movement towards our equilibrium point is similar to our original supply and demand model back in chapter 2.

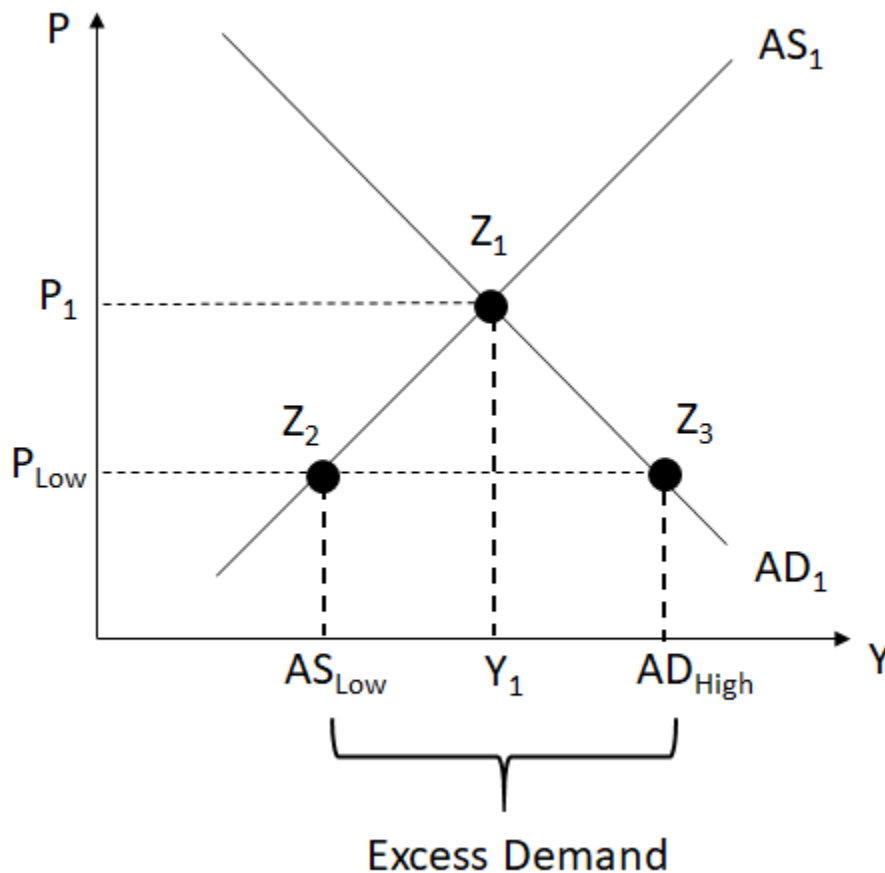


Figure 7.2.02

When the general level of prices are lower than  $P_1$ , for example at  $P_{Low}$ , the economy will not be in equilibrium. At this lower price, firms will not produce  $Y_1$ . Instead, they will produce  $AS_{Low}$  and be at point  $Z_2$ . This low price is associated with a lower demand for money, a lower interest rate and more spending. This means that at point  $Z_3$ , spending will be at  $AD_{High}$ , which is greater than both  $Y_1$  and  $AS_{Low}$ . The excess demand will generate upward pressure on prices. As prices rise, spenders will move from  $Z_3$  to  $Z_1$  and firms will move from  $Z_2$  to  $Z_1$ . At  $Z_1$ , there is no pressure on prices or output to change.

The opposite behavior will occur when the price is too high. At a price of  $P_{High}$ , firms are willing to produce at point  $Z_5$ , where output is at  $AS_{High}$ . Even though there is a lot of production, the prices are too high to warrant that much spending. At point  $Z_4$ , there is  $AD_{Low}$  spending when the price is at  $P_{High}$ .

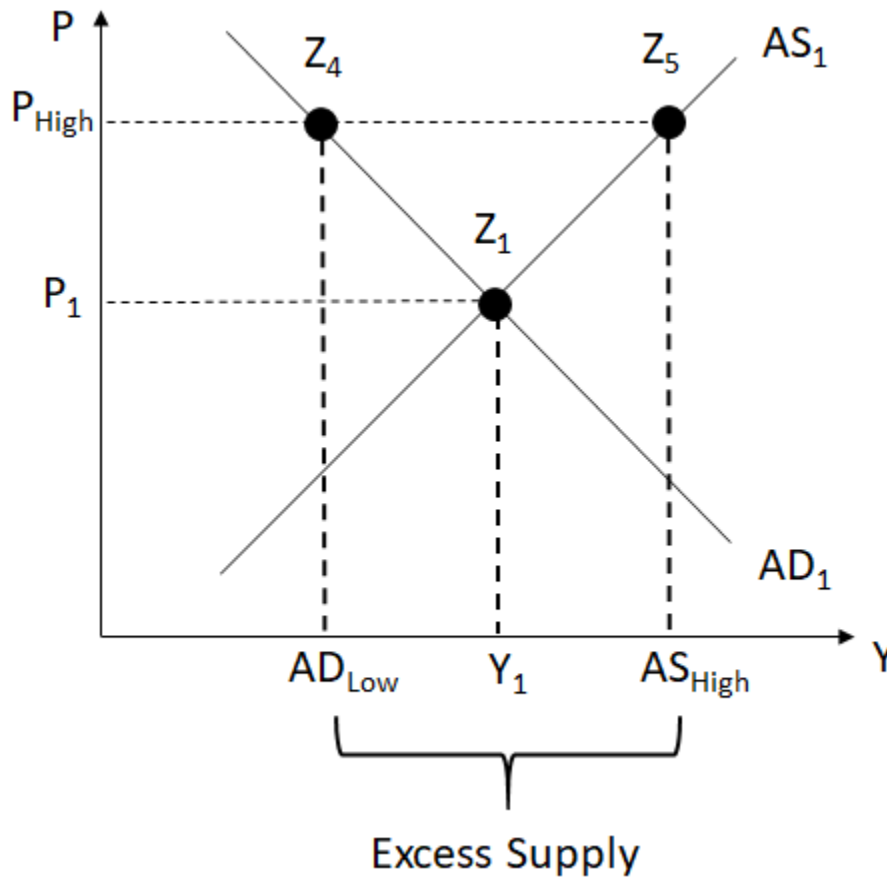


Figure 7.2.03

At prices above  $P_1$ , there will be excess supply. Just as we saw back in chapter 2, when prices are too high, the downward pressure on prices will move us towards our equilibrium. The falling prices will cause firms to reduce their output, moving from  $Z_5$  to  $Z_1$  and spenders will move from  $Z_4$  to  $Z_1$ . The equilibrium point of  $Z_1$  occurs at a price level of  $P_1$ . At this point,  $Y = AE$  at an output of  $Y_1$  and firms are willing and able to produce  $Y_1$  at this price.

So far, our examination of complete macroeconomic equilibrium is nearly identical to the market for a single good. What makes our analysis more complete is that there are other markets at play as we derive equilibrium. We are about to reach the apex of complexity here, so make sure you feel good about the money market, aggregate expenditures and the aggregate demand and aggregate supply curves.

The figure below shows what is meant by complete macroeconomic equilibrium in detail. In the money market, the Federal Reserve has set the money supply to be  $M_1$ . The money supply intersects the money demand curve at point A. The money demand curve is largely determined by the price level  $P_1$  and the equilibrium interest rate is  $r_1$ .

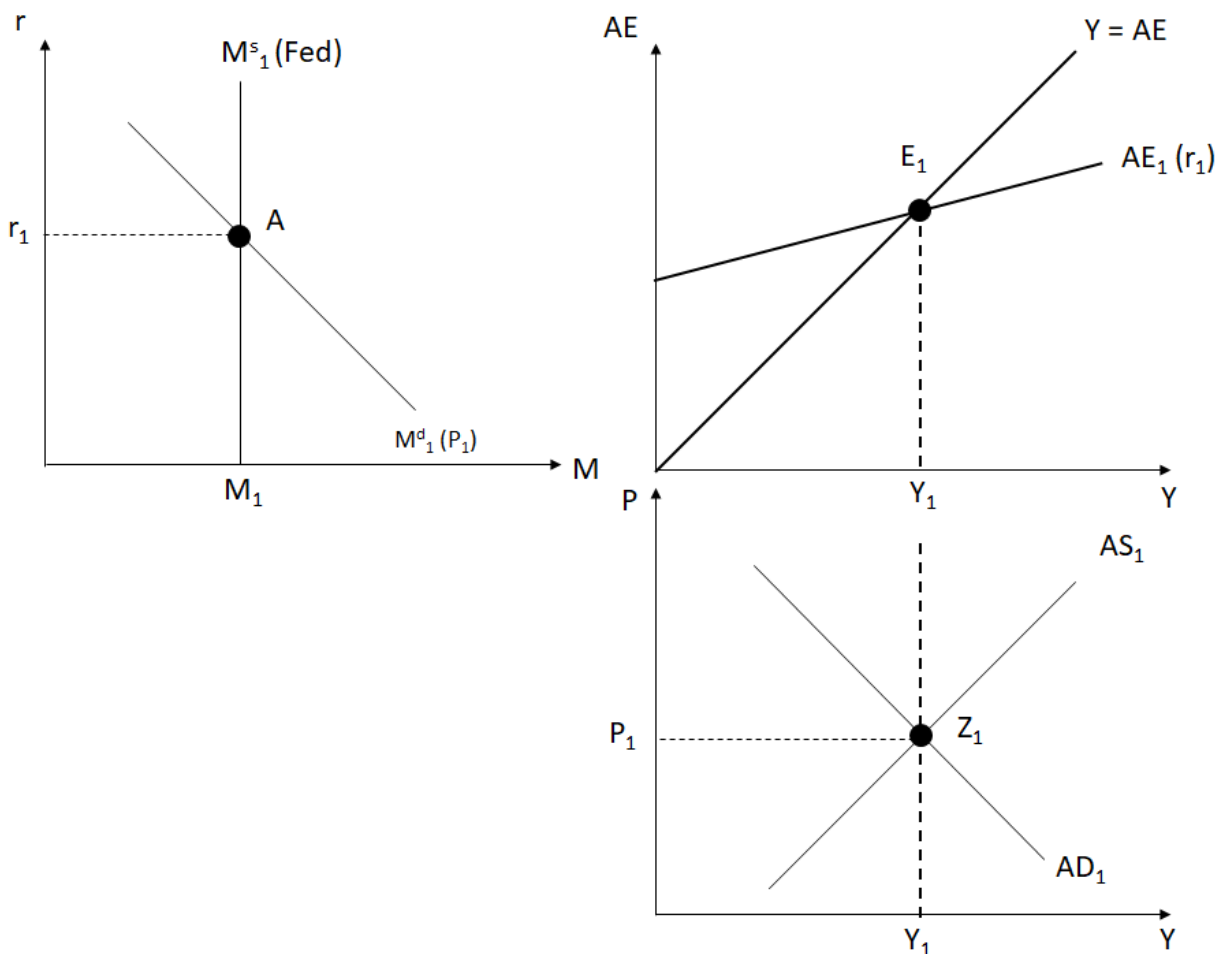


Figure 7.2.04

The equilibrium interest rate of  $r_1$  partially determines the level of aggregate expenditures, which is denoted by the curve  $AE_1(r_1)$ . The  $AE_1$  curve intersects the  $Y = AE$  equilibrium curve at point  $E_1$  and at  $Y_1$ , spending is equal to output. Because the price level of  $P_1$  is associated with equilibrium in the aggregate expenditures model of  $Y_1$ , the aggregate demand curve,  $AD_1$ , contains the combination  $P_1$  and  $Y_1$ . At a price level of  $P_1$ , firms are willing and able to

produce  $Y_1$  units of output. The aggregate supply curve,  $AS_1$ , contains the combination  $P_1$  and  $Y_1$  as well. At point  $Z_1$ , aggregate demand is equal to aggregate supply.

Equilibrium is achieved in every market in our model in the figure above. The price has no pressure to move. If the price is too low, there will be excess demand, which will lead to upward pressure on prices. Increasing prices will shift the money demand curve to right, increasing the equilibrium interest rate. The higher interest rate reduces the AE curve, moving us along the AD curve. At the same time, the price rise moves us along the AS curve until we reach a point where there is no pressure on any of the markets to change.

There is a lot going on in the figure above, but as we have done this entire book, take each movement and each market one-at-a-time. An individual market is hopefully straightforward by this point in the course. Now it is just a matter of seeing how all of the markets interact with one another.

## Shocks to the Economy

One way to get comfortable with the complexity of our complete macroeconomic equilibrium is to see what happens when the economy is shocked. How does equilibrium change in each of our markets when there is housing market crash?

### Question 7.7: Shocks to the Macroeconomy

The economy is initially in an equilibrium at  $M_1$ ,  $r_1$ ,  $Y_1$  and  $P_1$ . What happens when there is a housing market crash?

**A**

Output, prices and the interest rate will decrease

**B**

Output, prices and the interest rate will increase

**C**

Output and prices will decrease, but the interest rate will not change

**D**

Output and prices will decrease and the Federal Reserve will carry out open market operations

This is an all encompassing question, but fortunately, you have analyzed each part of the shock separately. The first thing we need to do is identify what moves first.

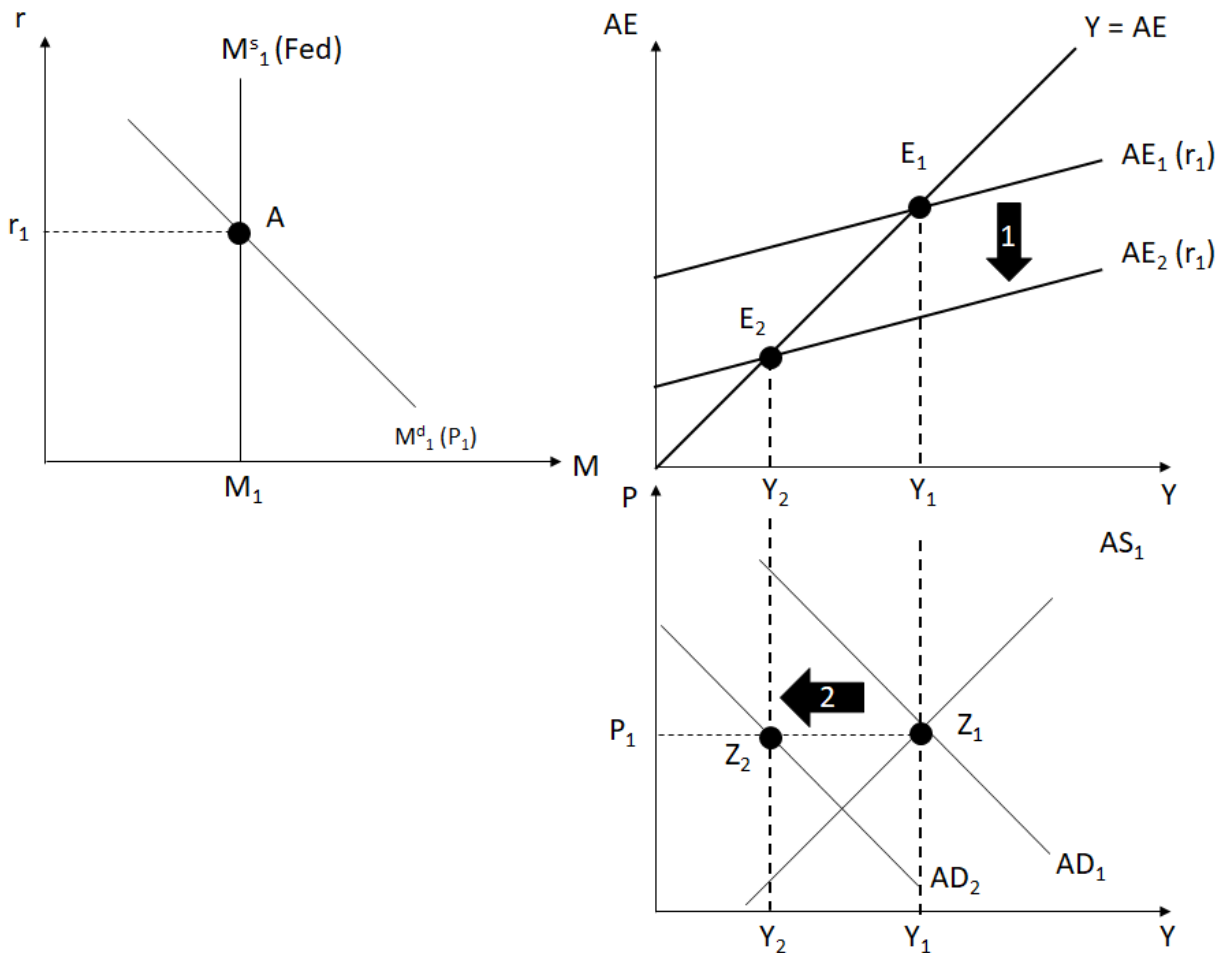


Figure 7.2.05

The figure shows us in our initial equilibrium in the money market, the aggregate expenditures model and the aggregate demand/aggregate supply model. From our analysis earlier in this chapter, we saw that the housing market crash reduced autonomous consumption ( $AC$ ) and planned investment spending ( $I^P$ ). This reduces the  $AE$  curve from  $AE_1$  to  $AE_2$  (arrow 1). There is a lower level of equilibrium output in our aggregate expenditures model,  $Y_2$ , but prices have not yet changed. This causes our aggregated demand curve to shift from  $AD_1$  to  $AD_2$  (arrow 2).

If there are not any additional adjustments, the price level remains at  $P_1$ , but the level of output firms are willing to produce ( $Y_1$ ) is greater than what is being bought ( $Y_2$ ). This excess supply is captured by the distance between  $Z_1$  and  $Z_2$ .

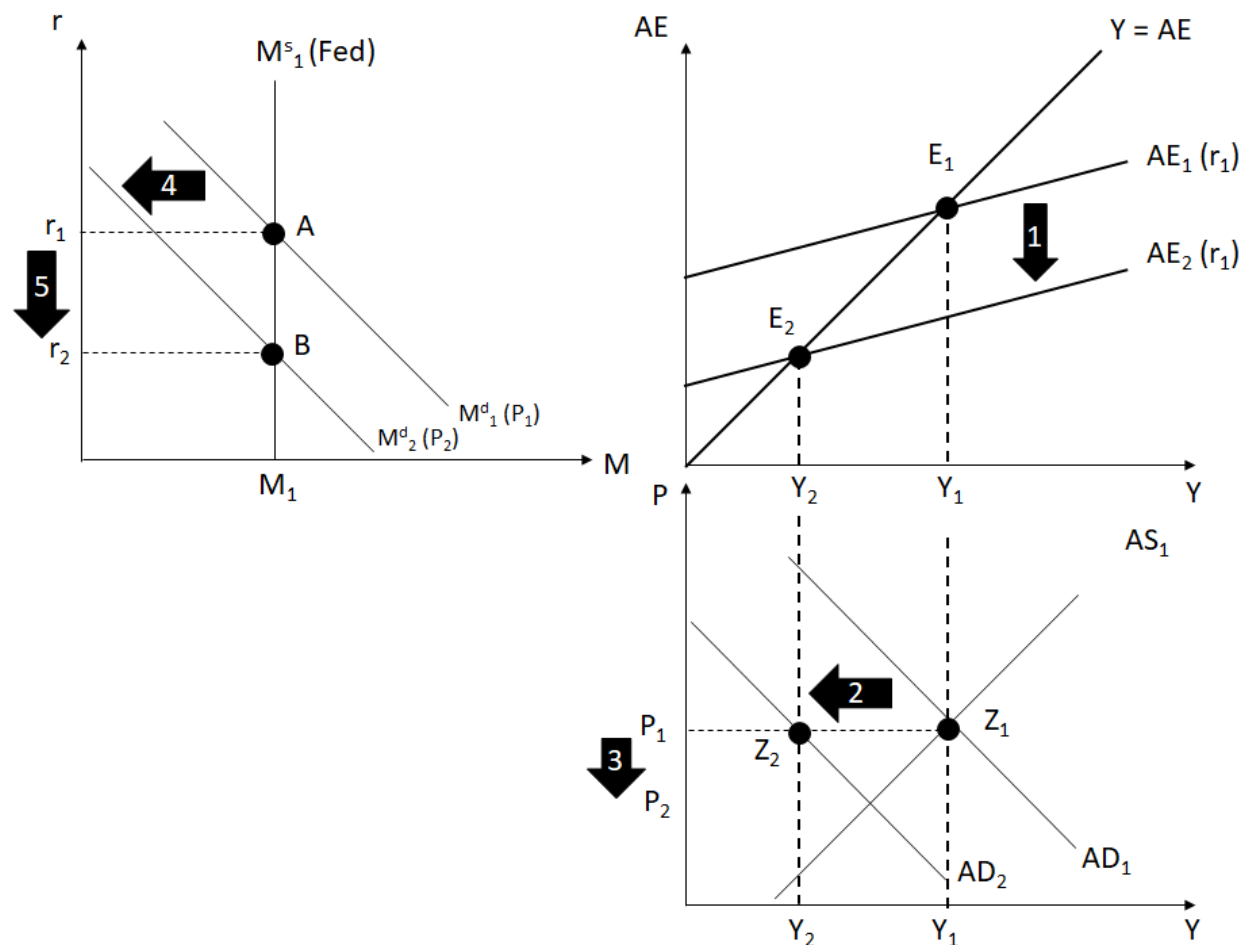


Figure 7.2.06

Because there is excess supply, there is downward pressure on prices. As prices move from  $P_1$  to  $P_2$  (arrow 3), there are changes that occur in other markets. Specifically, lower prices will have a direct impact on the money demand curve. Lower prices will decrease the money demand curve, shifting it left from  $M^d_1$  to  $M^d_2$  (arrow 4). The shift in the money demand curve causes a reduction in the interest rate from  $r_1$  to  $r_2$  (arrow 5).

Although the money market has adjusted in the figure above, the change in the interest rate means that there is a change in the aggregate expenditures curve.

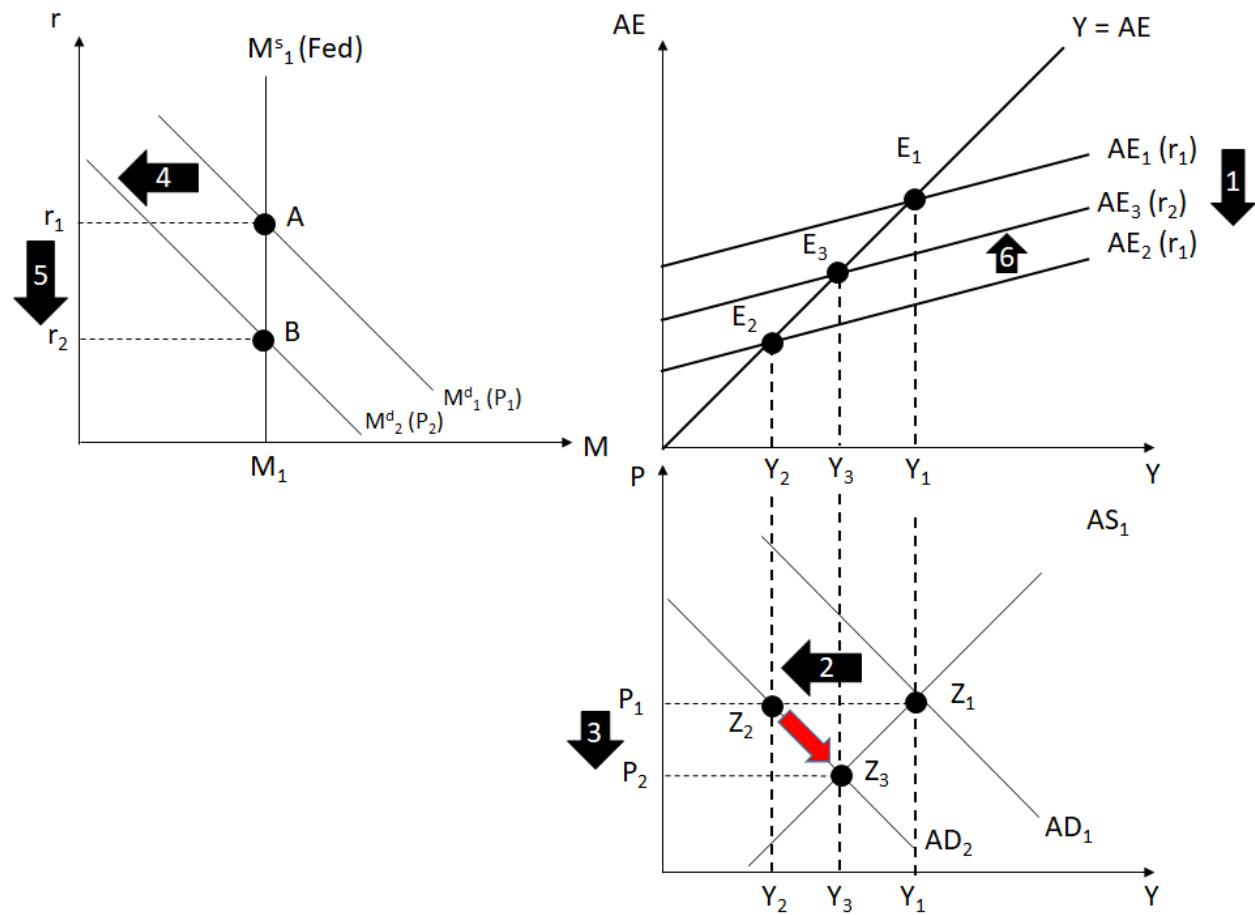


Figure 7.2.07

We have showed a number of times that a lower interest rate causes the aggregate expenditure curve to increase as a result of more autonomous consumption and planned investment spending. This increase in the AE curve is shown in arrow 6.  $AE_2(r_1)$  increases to  $AE_3(r_2)$ . The new equilibrium level of output in the aggregate expenditures model is now  $Y_3$ .

Firms are willing to produce  $Y_3$  when the price level is  $P_2$ . Additionally, the reduction in prices from  $P_1$  to  $P_2$ , which led to a decrease in the money demand curve and increase in the AE curve, moves us along the AD curve from  $Z_2$  to  $Z_3$ . At  $Z_3$ , the price level of  $P_2$  puts us in equilibrium in the money market



at point B with an interest rate of  $r_2$ . The lower interest rate combined with the housing market crash is captured by the aggregate expenditure curve  $AE_3$  ( $r_3$ ) and an equilibrium of  $Y_3$ . Because firms are willing to produce  $Y_3$  at a price of  $P_2$ , we are in a complete macroeconomic equilibrium.

Overall, the economy experiences a reduction in output,  $Y$ , a reduction in prices,  $P$  and a reduction in the interest rates,  $r$ . Now that we are in a position where output has decreased, policy makers may decide they want to do something to bring the economy back to the original level of output ( $Y_1$ ) and price level ( $P_1$ ).

We know from our previous chapters that the Federal Reserve enacted monetary policy after the housing market crash. In particular, they carried out open market purchases and increased the money supply. How does increasing the money supply change alter macroeconomic equilibrium?

**Question 7.7: Monetary Policy and Complete Macroeconomic Equilibrium**

The economy is initially in equilibrium at  $M_1$ ,  $r_1$ ,  $Y_1$  and  $P_1$ . What happens to output, prices and the interest rate after the Federal Reserve buys bonds?

**A**

Output, prices and the interest rate will decrease

**B**

Output, prices and the interest rate will increase

**C**

Output and prices will decrease, but the interest rate will not change

**D**

Output and prices will increase, but the interest rate will decrease

In order to answer this question, let's use our three graphs one more time. The figure below shows the first four steps of carrying out open market purchases. In step 1, the Fed buys bonds, increasing the money supply. This causes a decrease in the interest rate in step 2. Overall, the money market equilibrium moves from A to B and the equilibrium interest rate falls from  $r_1$  to  $r_2$ .

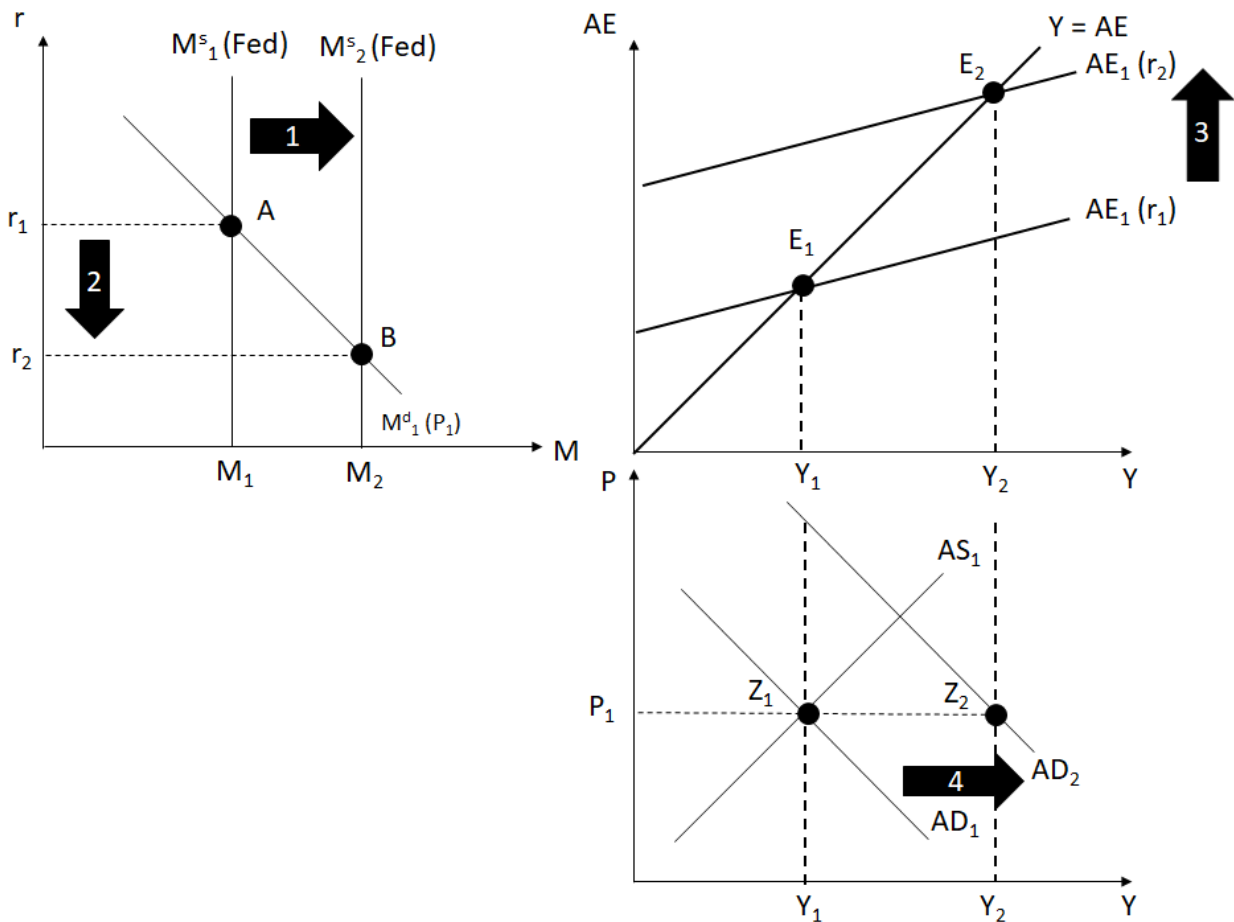


Figure 7.2.08

After the interest rate decrease, the aggregate expenditure curve increases from  $AE_1(r_1)$  to  $AE_1(r_2)$  as a result of the increase in autonomous consumption and planned investment spending. This movement is captured by arrow 3 and equilibrium in the aggregate expenditures model moves from  $E_1$  to  $E_2$ . The equilibrium level of spending increases from  $Y_1$  to  $Y_2$ .

Since  $Y$  increased but the price level has not changed yet, aggregate demand increases from  $AD_1$  to  $AD_2$  (arrow 4). After the increase in AD there is more spending in the economy (point  $Z_2$ ) than firms are willing to produce at a price of  $P_1$  (point  $Z_1$ ).

After step 4, there is excess demand. This means that there will be pressure for prices to rise (arrow 5). As prices rise, there is an increase in money demand

from  $M^d_1$  to  $M^d_2$  (arrow 6). After the money demand increases, the equilibrium in the money market moves from point B to point C and the interest rate rises from  $r_2$  to  $r_3$ . The higher interest rate is associated with a reduction in aggregate expenditures, as seen in step 8. Spending is now equal to output at  $Y_3$ .

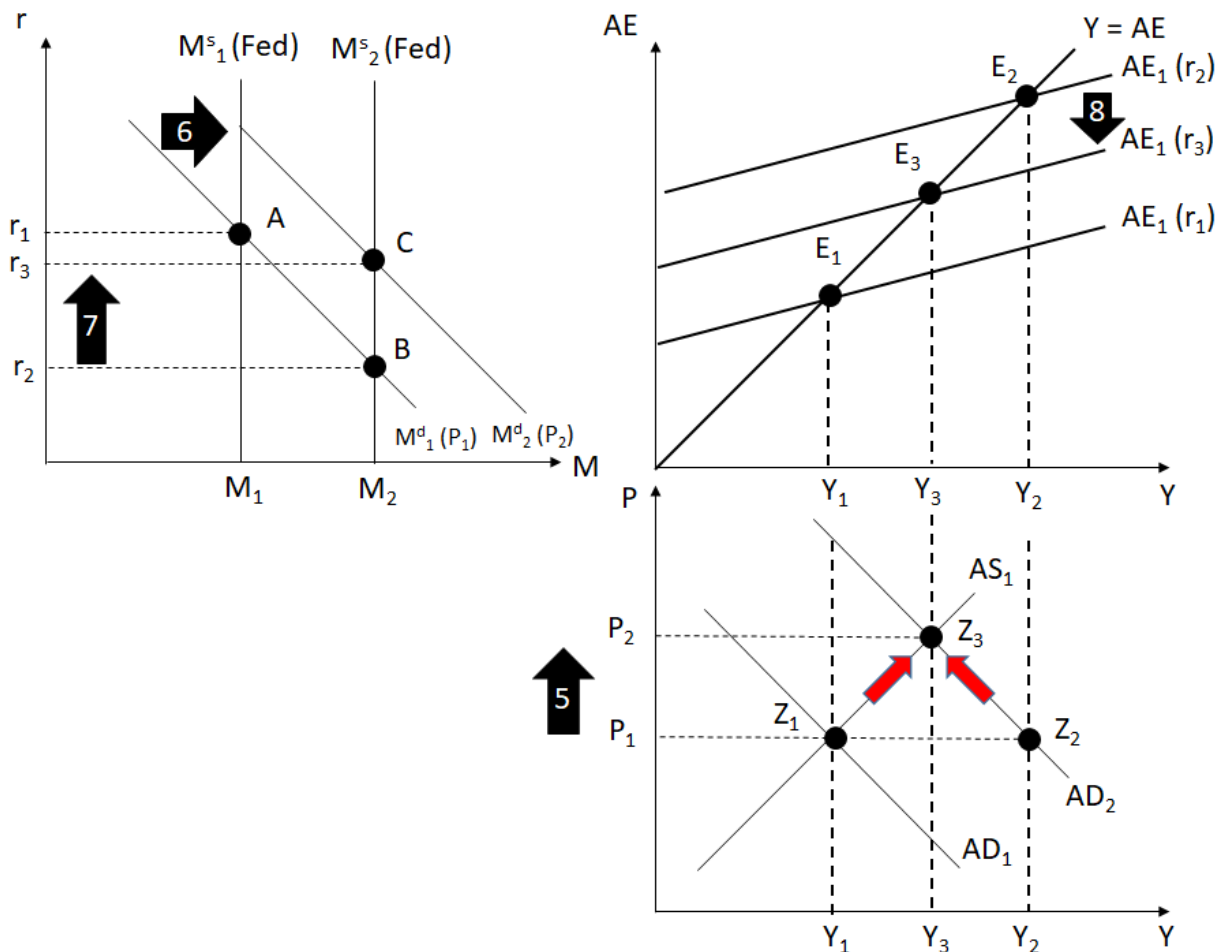


Figure 7.2.09

Because the decrease in output from  $Y_2$  to  $Y_3$  was driven by a price change, we move along the  $AD_2$  curve from  $Z_2$  to  $Z_3$ . As the price rises from  $P_1$  to  $P_2$ , firms are also willing to produce more. At a price of  $P_2$ , firms are willing to produce at  $Y_3$ , the same value where  $Y = AE$ . Overall, output and prices increased, but the interest rate decreased from  $r_1$  to  $r_3$ .

## Simplifying AD Shocks

The expositions above are complex. Showing the effects of monetary policy are particularly cumbersome. But it is the complexity that makes the analyses valuable. We are trying to model out the entire macroeconomy, so it is bound to get difficult at points. As promised, moving forward, shocks will not be as complex, but it is important that you recognize all that is going on in the background that gets the economy to equilibrium.

The housing market can be succinctly shown by just looking at the the aggregate demand and aggregate supply model. We know from our analysis that the housing market crash causes a decrease in the aggregate demand curve.

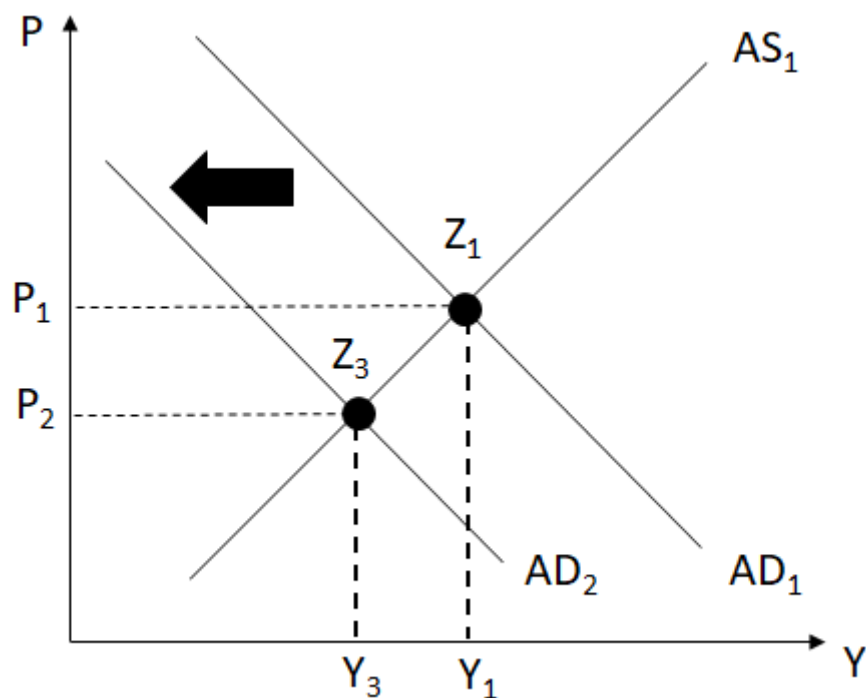


Figure 7.2.10

The shift to the left in aggregate demand leads to a reduction in the general level of prices and a reduction in output. In the figure, the equilibrium moves from  $Z_1$  to  $Z_3$ , in order to remain consistent with the previous example. This is how we are going to analyze shocks to economy moving forward, but it is

important to remember that the shock is caused by an initial reduction in aggregate expenditures.

**Question 7.9: Shocks to the Economy**

The economy is initially in equilibrium at  $M1$ ,  $r1$ ,  $Y1$  and  $P1$ . There is an increase in net exports. What happens to output, prices and the interest rate after the rise in net exports?

**A**

Output, prices and the interest rate will decrease

**B**

Output, prices and the interest rate will increase

**C**

Output and prices will decrease, but the interest rate will not change

**D**

Output and prices will decrease, but the interest rate will decrease

Let's approach this question using just the aggregate demand and aggregate supply model. When there is an increase in net exports, the first step in our analysis is to figure out how the change in net exports initially impacts our equilibrium. From chapter 4, we learned that an increase in net exports increases the aggregate expenditure curve. Any increase in the AE curve that is caused by something other than a price change will shift the AD curve to the right.

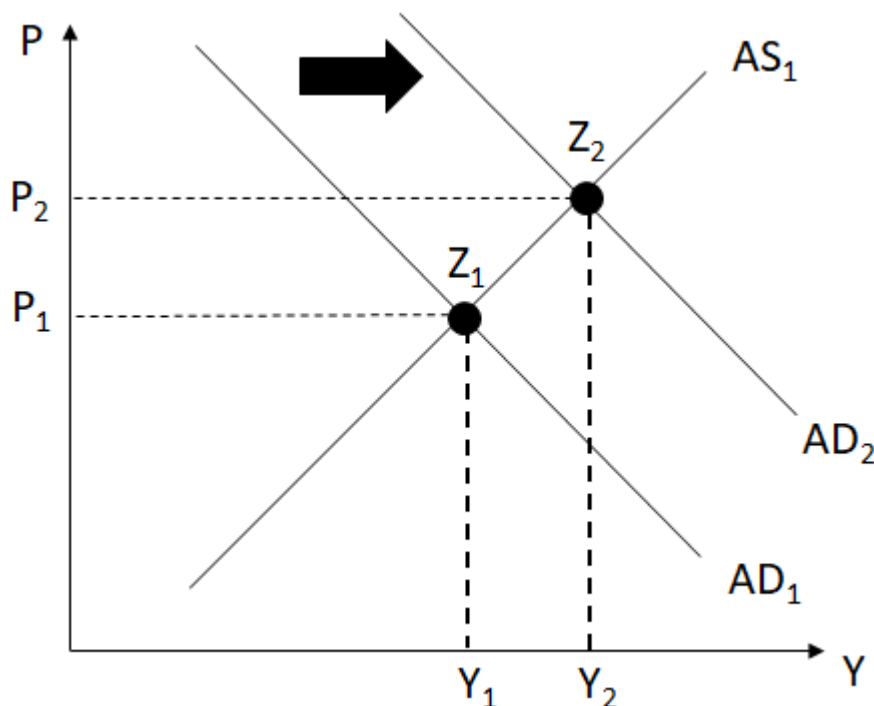


Figure 7.2.11

In the figure above, the AD curve increases as a result of the increase in net exports. The equilibrium moves from  $Z_1$  to  $Z_2$ , which is associated with an increase in both output and prices. Simplifying our analysis to only examine the aggregate demand and supply curves makes the net export shock relatively straightforward to analyze.

The cost of simplifying the analysis is that we do not have the money market graphed out and we would like to know what happens to the equilibrium interest rate. But if we remember that the price rise from  $P_1$  to  $P_2$  will increase the demand for money and cause the interest rate to increase.

If you are uncomfortable making this connection without the money market, retry the question with the money market and aggregate expenditure model. Even if you are comfortable, it will help to go through the dynamics of a shock one more time.

# **Chapter 7.3:**

## **Macroeconomic Shocks and Policy Responses**

### **Demand Shocks**

The shocks we covered in the previous section involved shifts in aggregate demand. The shift in AD can be caused by a number of factors, but anything that changes the AE curve other than price is considered a demand shock. The housing market crash, monetary policy and change in net exports all provided examples of demand shocks.

We can generalize the demand shocks above into two simple categories: positive and negative demand shocks. Positive demand shocks occur when something happens that increases the AD curve. Negative demand shocks work in the opposite direction and decrease the AD curve, shifting it left.

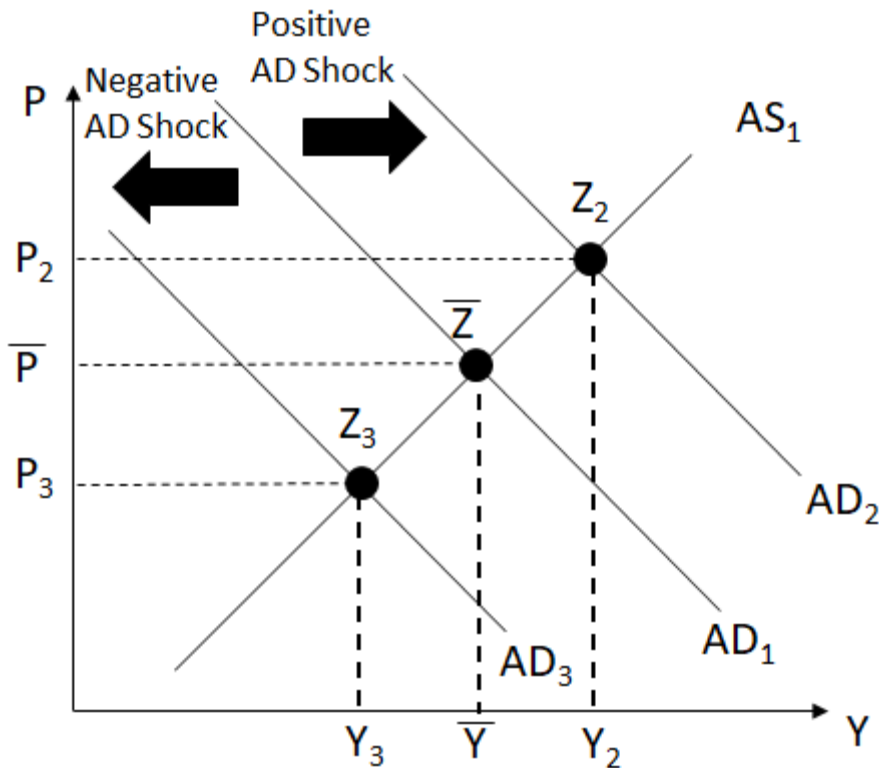


Figure 7.3.01

The figure above only uses the aggregate demand and aggregate supply curves to show positive and negative demand shocks. The starting point,  $Z\text{-bar}$ , is at the full-employment level of output,  $Y\text{-bar}$ , and a stable level of prices that policy makers would like the price level to be at,  $P\text{-bar}$ .

When there is a positive demand shock, the aggregate demand curve shifts from  $AD_1$  to  $AD_2$  and equilibrium moves from  $Z\text{-bar}$  to  $Z_2$ . As we saw in the previous section, output and prices rise. Because we have defined our full-employment level of output and what constitutes a stable level of prices, the positive demand shock increases output above full-employment output and there is inflation.

In the case of a negative demand shock, the opposite outcomes occur. Output and prices decrease as  $AD_1$  moves to  $AD_3$ , and the equilibrium moves from  $Z\text{-bar}$  to  $Z_3$ . With  $Y_3$  below  $Y\text{-bar}$ , the economy has cyclical unemployment and is in a recession. Additionally, the price level of  $P_3$  is under  $P\text{-bar}$ , which means there is deflation, something that policy makers want to avoid as well.



**Question 7.10: Positive Demand Shock**

Which of the following is an example of a positive demand shock?

**A**

The stock market rallies, increasing the value of investments

**B**

There is a natural disaster that causes havoc on the transportation system

**C**

A new technology is invented that improves the efficiency of manufacturing

**D**

Households are nervous about future job prospects

**Question 7.11: Negative Demand Shock**

Which of the following events is an example of a negative demand shock?

**A**

The stock market rallies, increasing the value of investments

**B**

There is a natural disaster that causes havoc on the transportation system

**C**

A new technology is invented that improves the efficiency of manufacturing

**D**

Households are nervous about future job prospects

Questions 7.10 and 7.11 test your understanding of demand shocks. Hopefully these questions remind you of aggregate expenditure questions we covered over in chapter 4.

In question 7.10, a stock market rally will increase the wealth of investors. Even though income does not rise, households that benefit from this rally will feel more comfortable spending money than before. This leads to an increase in autonomous consumption, increasing the AE curve and shifting the AD curve to the right. In other words, a positive demand shock occurs because of the stock market rally.

To answer question 7.11, you should be looking for an event that would cause a decrease in AE. The stock market rally increases the AE curve, while the natural disaster and technology options are related to production and shift the AS curve. Consumer sentiment was discussed in chapter 4 and the last

answer is describing a decrease in consumer sentiment is the correct answer to 7.11. Households that are nervous about job prospects will reduce their spending, even if their income remains the same. This causes autonomous consumption to fall, decreasing the AE curve and shifting the AD curve left. A decrease in consumer confidence leads to a negative demand shock.

Think of some more examples of positive and negative demand shocks now that you have learned more about them.

### **Positive and Negative Demand Shocks**

What are some more examples of positive demand shocks? What about negative demand shocks?

The purpose of going through demand shocks in detail is ultimately so we can inform policy makers about how to respond to the shocks. Recall that there are three goals that we are trying to achieve. First, we want citizens in a country to have a high standard-of-living. Let's assume that this occurs at  $Y\text{-bar}$ . Second, we want to have stable prices, which in our setting, means that we would like prices to remain at  $P\text{-bar}$ . Lastly, we want the economy to be producing at the full-employment level of output, also at  $Y\text{-bar}$ .

In short, policy makers want to do everything they can to keep the economy at  $Z\text{-bar}$ , our starting point. The policy actions that can be used in our analysis are fiscal or monetary policy. Let's provide some policy recommendations in response to demand shocks, keeping in mind our goal of full-employment and stable prices.

### **Question 7.12: Policy Recommendations to Demand Shocks**

Assume that the economy begins at full-employment ( $Y\text{-bar}$ ) and the ideal price level ( $P\text{-bar}$ ). If there is a negative demand shock, what fiscal policy actions should be carried out to achieve our goal of full-employment and stable prices?

**A**

Increase the money supply

**B**

Decrease the money supply

**C**

Increase government expenditures

**D**

Increase taxes

When there is a negative demand shock, the AD curve decreases. Arrow 1 in the figure below depicts the negative demand shock. The negative shock can come from any event that decreases AE other than price. Throughout the book, we have thought of this as a housing market crash.

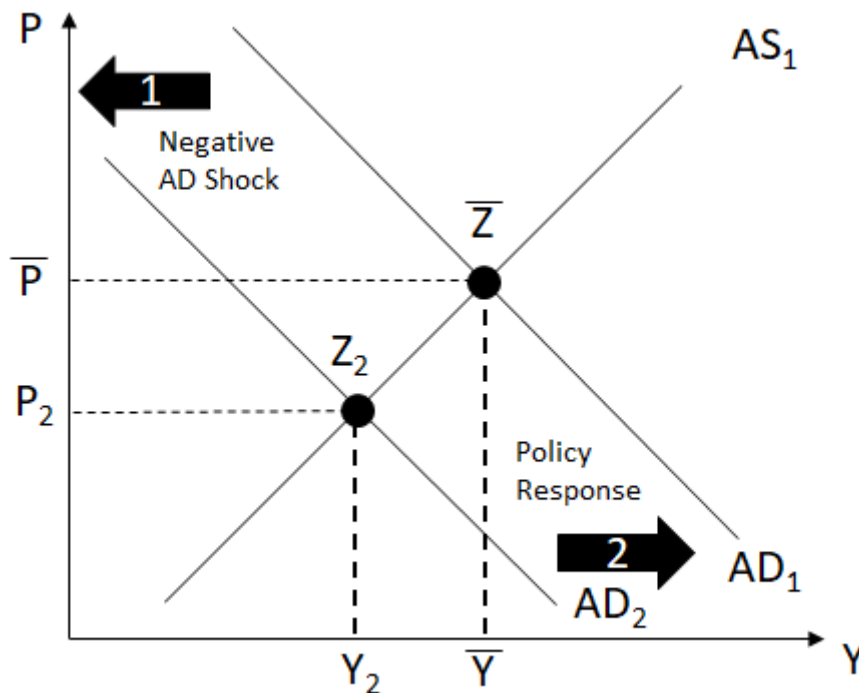


Figure 7.3.02

After the negative demand shock, the equilibrium moves from  $\bar{Z}$  to  $Z_2$ . If we are interested in the response of fiscal policy makers, we first must remember that fiscal policy involves changing  $G$  or  $T$ . Second, we need to recognize that any fiscal policy that is implemented will initially change the AE curve, and then shift the AD curve.

After the negative demand shock, policy makers want to move the equilibrium back to  $\bar{Z}$ . In order to do this, all they need to do is carry out an action that increases the AE curve. This could be done by increasing  $G$  or decreasing  $T$ . Either action will shift the AD curve. Arrow 2 in the figure above shows the fiscal policy response as  $AD_2$  moves back to  $AD_1$ . This is an example of counter-cyclical fiscal policy, as policy makers counter the decrease in  $Y$  below  $\bar{Y}$  by increasing the  $Y$  back to the full-employment level of output.

In assessing whether the response of policy makers is appropriate, we need to ask ourselves, did the action of the policy makers lead to full-employment and stable prices? Given that the policy response brings us back to  $Y\text{-bar}$  and  $P\text{-bar}$ , we would argue that the response of policy makers is appropriate. As we have learned earlier, the primary cost of using fiscal policy in this manner is that it potentially increases the deficit and adds to the debt. However, if monetary policy is enacted and open market purchases take place, it is possible for the Fed to increase  $AD_2$  to  $AD_1$  as well.

**Question 7.13: Policy Recommendations to Demand Shocks**

Assume that the economy begins at full-employment ( $Y\text{-bar}$ ) and the ideal price level ( $P\text{-bar}$ ). If there is a positive demand shock, what monetary policy actions should be carried out to achieve our goal of full-employment and stable prices?

**A**

Increase the money supply

**B**

Decrease the money supply

**C**

Increase government expenditures

**D**

Increase taxes

Question 7.13 is similar to 7.12, but has a few changes. First, there is a positive demand shock. This can occur for a number of reasons, as discussed above, such as a rise in the value of stocks. Second, the question is interested in the appropriate monetary policy response, as opposed to fiscal policy. Therefore, we are interested in whether the Federal Reserve should buy or sell bonds, not whether the government should change  $G$  or  $T$ .

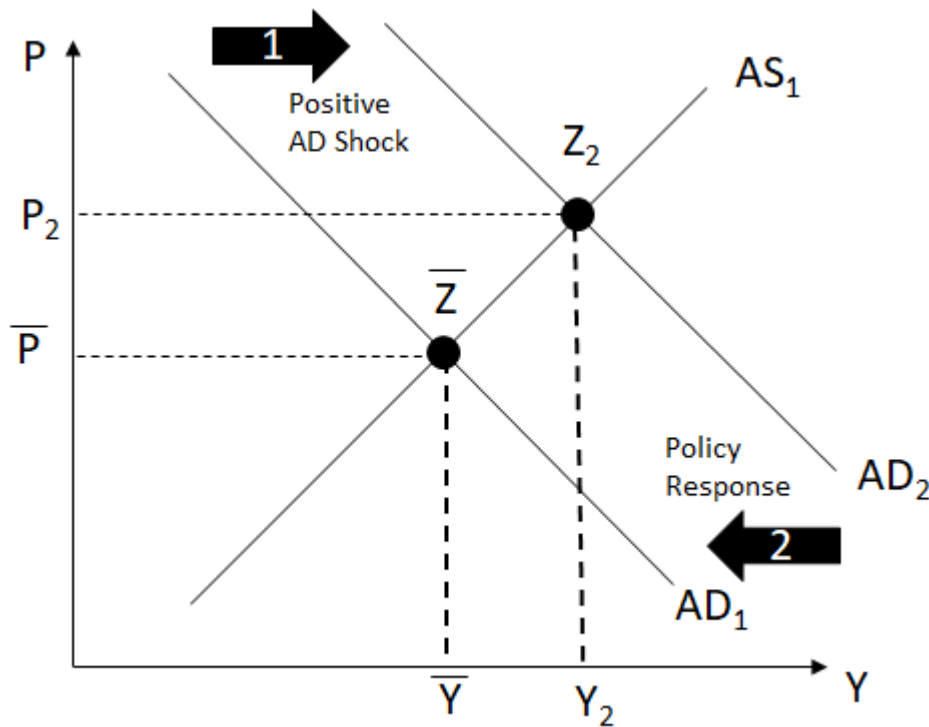


Figure 7.3.03

The positive demand shock shifts the AD curve shifts to the right, which is shown with arrow 1 below. The equilibrium moves from  $Z\text{-bar}$  to  $Z_2$ , and both prices and output are above what policy makers are aiming for. We know from earlier in the chapter that the Federal Reserve can shift the AD curve themselves through open market operations.

Purchasing bonds will increase the money supply, decrease the equilibrium interest rate, increase the AE curve and shift AD to the right. This action would be compounding the problem created by the demand shock. Instead, the Federal Reserve could decrease the money supply, which will eventually lead to a decrease in the AD curve. This action is seen in arrow 2 as the Federal reserve shifts  $AD_2$  back to  $AD_1$ .

After the Fed carries out open market purchases, the equilibrium returns back to  $Z\text{-bar}$ . The equilibrium level of output is  $Y\text{-bar}$  and the price level is  $P\text{-bar}$ . The policy makers have countered the demand shock with a demand shock of their own and there is full-employment and prices are stable. The same outcome could have been achieved by decreasing  $G$  or increasing  $T$ . As we

have discussed in previous chapters, enacting fiscal policy is often more difficult than asking the Federal Reserve to respond with monetary policy.

We have just examined the appropriate policy response to two demand shocks, one positive and one negative. The main idea behind the policy recommendations are that policy makers have the ability to shift the AD curve. When there is a change in the AD curve that moves the economy away from full-employment output and makes prices unstable, policy makers can counter the shock. When AD shifts the equilibrium away from  $Z\text{-bar}$ , policy makers just need to shift AD back to the original curve.

## **Supply Shocks**

The policy response to a demand shock is relatively straightforward. Policy makers just need to move the AD to the position they desire. This is easier in theory than in practice, but the appropriate policy recommendation is clear.

The clarity with regards to policy recommendations is not apparent when there is a supply shock. To see the trade-off that policy makers face after a supply shock, begin again at  $Z\text{-bar}$  where equilibrium is at the full-employment level of output,  $Y\text{-bar}$ , and prices are at an ideal level,  $P\text{-bar}$ .

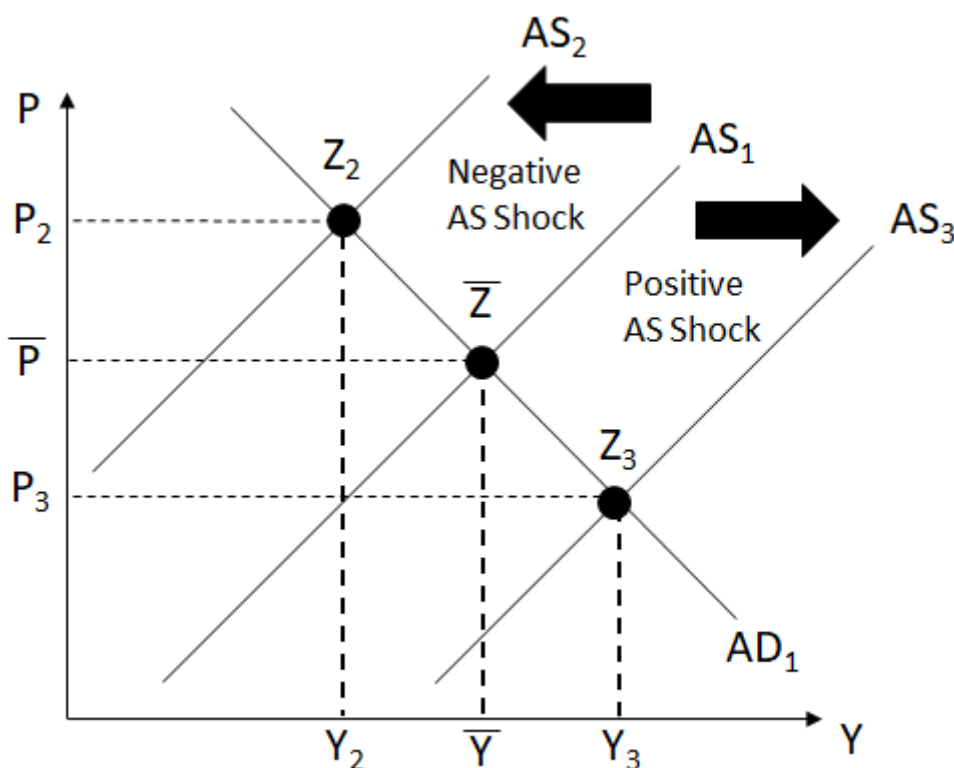


Figure 7.3.04

When there is a negative supply shock, for example, because of an increase in the cost of inputs, the AS curve will shift from  $AS_1$  to  $AS_2$ . Equilibrium will move from  $Z\text{-bar}$  to  $Z_2$ . At  $Z_2$ , prices are higher ( $P_2 > P\text{-bar}$ ) and there is unemployment ( $Y_2 < Y\text{-bar}$ ). At point  $Z_2$ , the economy is stagnant and experiencing inflation. If stagnation and inflation were a Hollywood couple they would be called [Stagflation](#).

Point  $Z_3$  shows the outcome of a positive supply shock. This could be the result of an improvement in technology and will lead to an increase in output to  $Y_3$  and a decrease in price to  $P_3$ . Although more output and lower prices may sound good to consumers, policy makers do not want to overwork the labor force by producing above  $Y\text{-bar}$ . As we saw early in the book, deflation is also something policy makers want to avoid.

After a supply shock, policy makers can try to maintain stable prices and bring the economy back to full-employment. However, since they can only change

the AD curve and achieving both goals in the short run is not possible. That begs the question, what should policy makers do when there is a supply shock?

**7.14: Policy Response to Supply Shocks**

Assume the economy begins at the full-employment level of output ( $Y\text{-bar}$ ) and the ideal price level ( $P\text{-bar}$ ). There is a negative supply shock. The Federal Reserve would like to make sure that the economy remains at the full employment level of output. What monetary policy action should be carried out?

**A**

Buy bonds

**B**

Sell bonds

**C**

Do Nothing

**D**

Ask Congress for a loan

To answer question 7.14, we need to think beyond our aggregate demand and aggregate supply curves. The curves can help guide us, but we need to remember what is going on in the other markets in the economy.



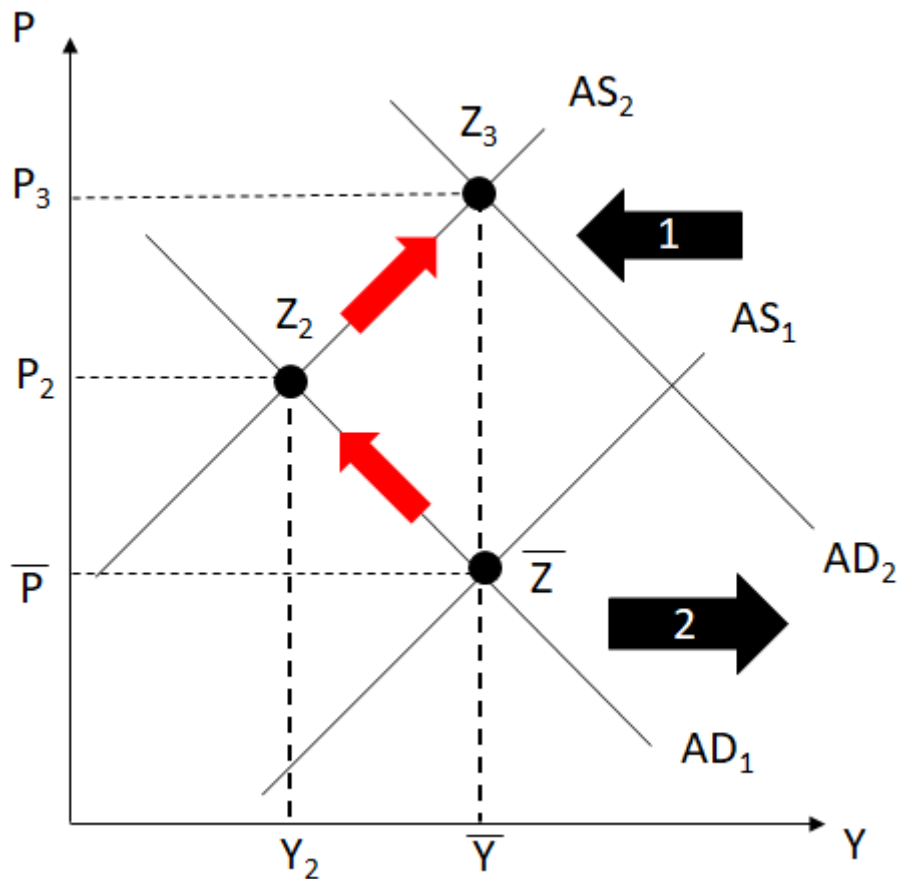


Figure 7.3.05

The negative supply shock that moves  $AS_1$  to  $AS_2$  is captured by arrow 1 in the figure above. The equilibrium moves from  $Z\text{-bar}$  to  $Z_2$ . At  $Z_2$ , there is stagflation. In the question, the Federal Reserve assesses the situation and decides that they want to fight the unemployment increase from the negative supply shock. In order to bring the economy back to full-employment, the Federal Reserve starts by recognizing that their actions can alter the AD curve.

Knowing they can shift the AD curve and that they want the economy to produce at  $Y\text{-bar}$ , the Federal Reserve aims to move the AD curve from  $AD_1$  to  $AD_2$  (arrow 2). This causes the equilibrium to move from  $Z_2$  to  $Z_3$ , leading to a higher price level,  $P_3$ , and bringing the output back to the full-employment level,  $Y\text{-bar}$ . We learned earlier in this chapter that the Federal Reserve can increase the AD curve by purchasing bonds. Purchasing bonds will increase

the money supply, reduce interest rates, increase AE and shift the AD curve to the right.

Overall, the Federal Reserve saves jobs, but it comes at the expense of higher prices. Literally, this means that some people will have jobs at  $Z_3$  that did not have jobs at  $Z_2$ . These individuals are quite happy. However, everyone in the economy has to now pay higher prices in order to make sure these jobs are saved.

This type of policy is "nice" in the sense that everyone in the economy sacrifices in the form of higher prices to make sure jobs are not lost. Because of the "nice" feeling associated with the policy, economists describe the behavior of saving jobs at the cost of higher prices a [Dove Policy](#).

**Question 7.15: Policy Response to Supply Shocks**

Assume the economy begins at the full-employment level of output ( $Y\text{-bar}$ ) and the ideal price level ( $P\text{-bar}$ ). There is a negative supply shock. The Federal Reserve would like to make sure that price in economy remain stable (at  $P\text{-bar}$ ). What monetary policy action should be carried out?

**A**

Buy Bonds

**B**

Sell Bonds

**C**

Do Nothing

**D**

Ask Congress for a loan

Now assume that the Federal Reserve decides to fight the high prices caused by a negative supply shock instead of increasing output and reducing unemployment. Similar to question 7.14, we will have to remember that there is a lot going on behind the scenes of the aggregate demand and aggregate supply curve.

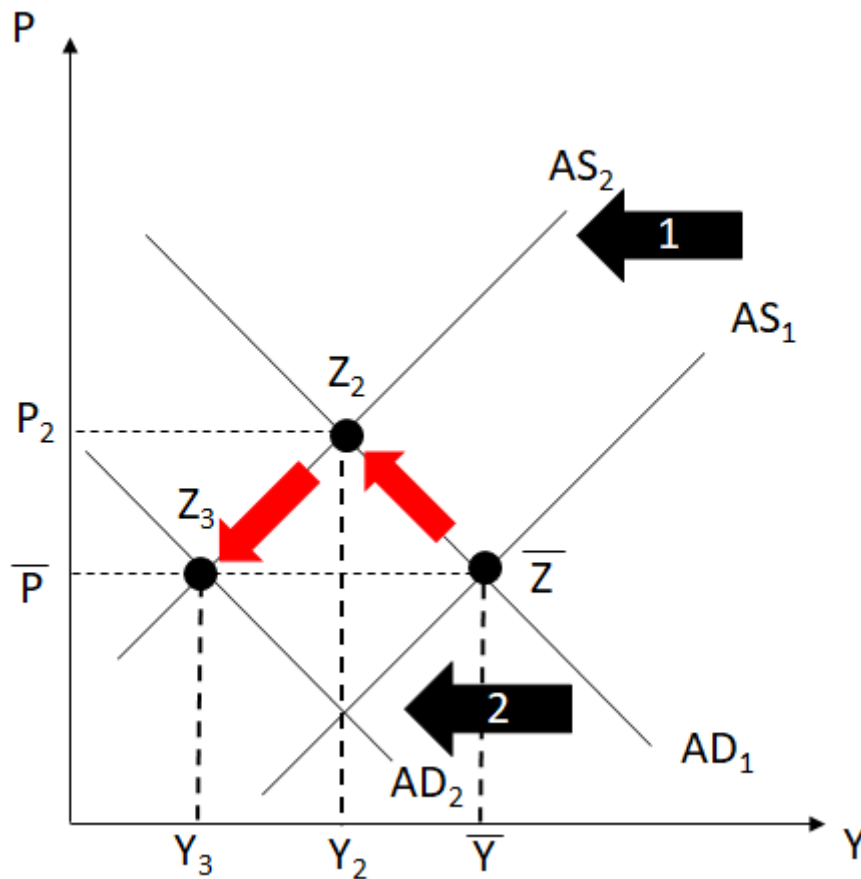


Figure 7.3.06

Arrow 1 of the figure above is the same negative supply shock that occurred in question 7.14 as  $AS_1$  shifts left to  $AS_2$ . The economy is experiencing stagflation at point  $Z_2$  and the Federal Reserve wants to make sure prices remain stable at  $P\text{-bar}$ . The Fed has to move along the  $AS_2$  curve since they can only control the AD curve. This means that their goal is to get the economy to  $Z_3$ . At this point, prices are stable.

In order to move the economy to  $Z_3$ , the Fed has to decrease the AD curve from  $AD_1$  to  $AD_2$  (arrow 2). This involves selling bonds, increasing the interest rate, decreasing AE and shifting the AD curve left. When the economy reaches point  $Z_3$ , the general level of prices are stable at  $P\text{-bar}$ , but unemployment has increased even more since production has decreased from  $Y_2$  to  $Y_3$ .

Unlike the previous question, the Federal Reserve made the choice to increase unemployment further in order to avoid higher prices. What is happening in this scenario is that all members of the economy benefit from lower prices, but some workers have to sacrifice their jobs in order for prices to remain stable.

This policy response is not as "nice" as the dove policy in the previous question. Because some jobs are sacrificed so that everyone in the economy is better off, this policy action is nicknamed a [Hawk Policy](#).

Whether the Federal Reserve chooses a dove policy or hawk policy is often a function of the relative difference between the unemployment rate and inflation following a supply shock. When there is a large increase in unemployment, but a relatively small increase in inflation, the Fed will often carry out a dove policy. In the case where stagflation occurs causing prices to rise noticeably but only a small increase in the unemployment rate, the Fed is likely to carry out a hawk policy.

There is not a hard and fast rule that the Fed follows when there is a negative supply shock. It is possible that the best response to a negative supply shock is to do nothing. As you learn more about long-run macroeconomics, you will see that if there is not policy response to a negative supply shock, the economy will naturally return to the original AS curve. This is a function of unemployment driving wages down and shifting the AS curve to the right. A future class or lecture will address long-run adjustments.

Before we move on to analyzing policy responses from real world examples, try a few questions that bring together everything we have learned in the course.

#### **7.16: Shocks to the Macroeconomy**

Assume the economy is in a full-employment equilibrium. The full-employment level of output is \$1 million, the equilibrium price of a one-year, \$100 bond is \$97, the money supply is \$10,000 and the price level is 150. What is the interest rate in the economy?

**A**

2.9%

**B**

3.1%

**C**

3.5%

**D**

4.2%

### 7.17: Shocks to the Macroeconomy

Assume the economy is in a full-employment equilibrium. The full-employment level of output is \$1 million, the equilibrium price of a one-year, \$100 bond is \$97, the money supply is \$10,000 and the price level is 150. There is a decrease in aggregate expenditures. After the reduction in aggregate expenditures, equilibrium output will....., the aggregate demand will....., prices will ..... and the interest rate will.....

**A**

increase, increase, increase, increase, increase

**B**

decrease, increase, decrease, decrease

**C**

decrease; decrease, decrease, decrease

**D**

increase, decrease, increase, increase

### 7.18: Shocks to the Macroeconomy

After the decrease in aggregate expenditures in the previous question, what bond price is most likely?

**A**

\$96

**B**

\$97

**C**

\$98

**D**

Not enough information

### 7.19: Shocks to the Macroeconomy

The Federal Reserve would like to bring the economy back to the full-employment level of output at \$1 million and original price level of 150. This means that they want the money supply to be

**A**

Above 10,000

**B**

Below 10,000

**C**

Exactly 10,000

**D**

Not enough information

Answering the previous four questions may be easier if you draw out equilibrium in the three markets.

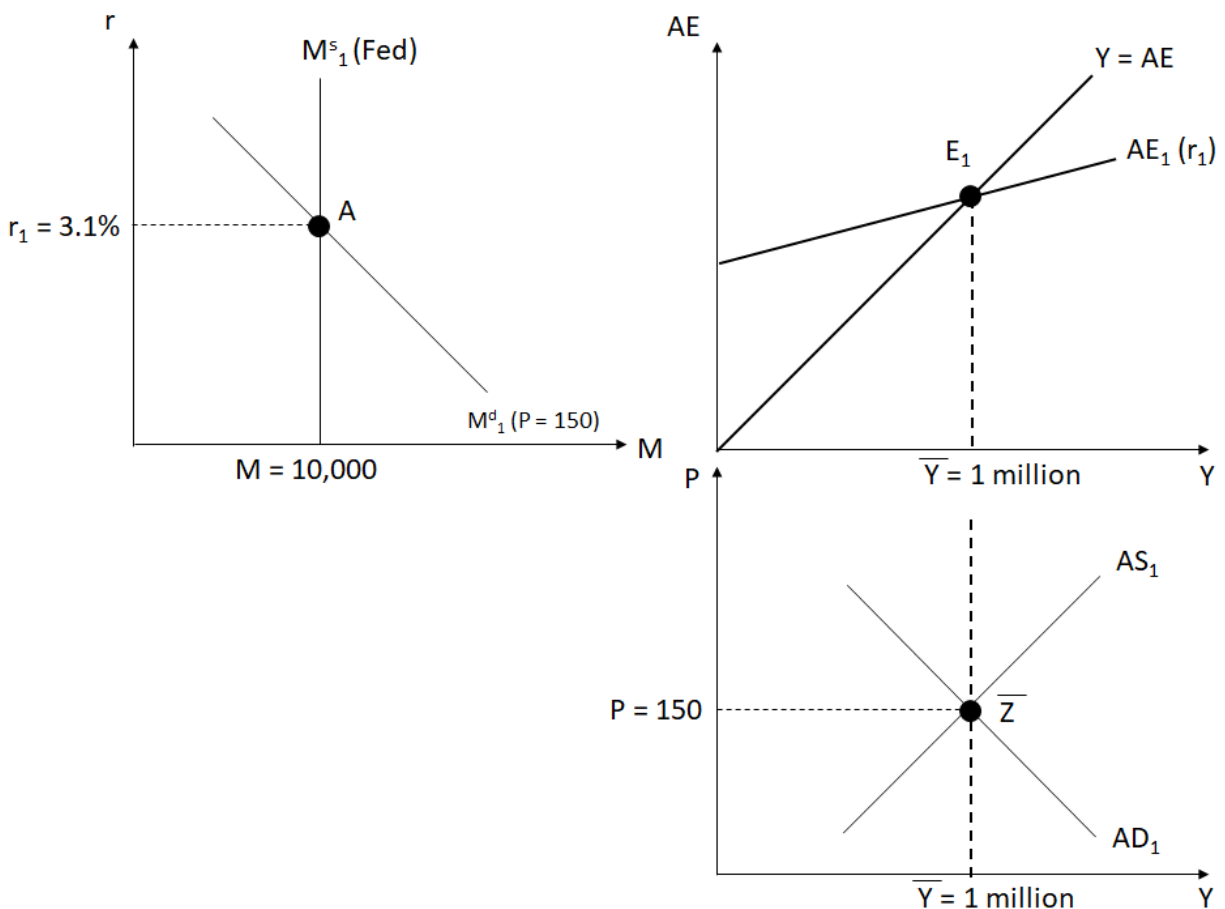


Figure 7.3.07

Question 7.16 is a review from the previous chapter covering the relationship between the price of bonds and interest rates. Remember that the interest rate is the return from bonds (value minus the price) divided by the price of the bond. The \$97 bond price translates into a 3.1% interest rate

In question 7.17, there is a decrease in aggregate expenditures. This will cause the aggregate demand curve to decrease and shift to the left. The new equilibrium will be at a lower level of output and lower price level.

To answer the last part of 7.17, notice that when prices decrease there will be a decrease in money demand and the new equilibrium in the money market will be at a lower interest rate. Because the interest rate is lower than before the shock, the bond price had to have increased below the initial price of \$97.

The decrease in aggregate expenditures in question 7.17 is classified more generally as a negative demand shock. The appropriate policy response by the Federal Reserve is to counter an AD shock and enact monetary policy that will bring the AD curve back to the original AD. Because the demand shock was negative, the Fed needs to carry out monetary policy that shifts AD to the right. By executing open market purchases, the Fed will buy bonds from the public, increase the money supply above 10,000, reducing the interest rate and increasing AE and the AD curve.

## Chapter 7.4: Real World Policy Responses

### 7.20: Supply or Demand Driven Recession

The economy is initially in a full-employment level of output and then the economy goes into a recession (output is less than full-employment level of output,  $\bar{Y}$ ). How do policy makers know whether the recession is primarily driven by a supply shock or a demand shock?

**A**

Price changes during a recession can help determine what primarily caused a recession.

**B**

Changes in the money supply during a recession can help determine what primarily caused a recession.

**C**

Changes in net exports during a recession can help determine what primarily caused a recession.

**D**

Changes in technology during a recession can help determine what primarily caused a recession.

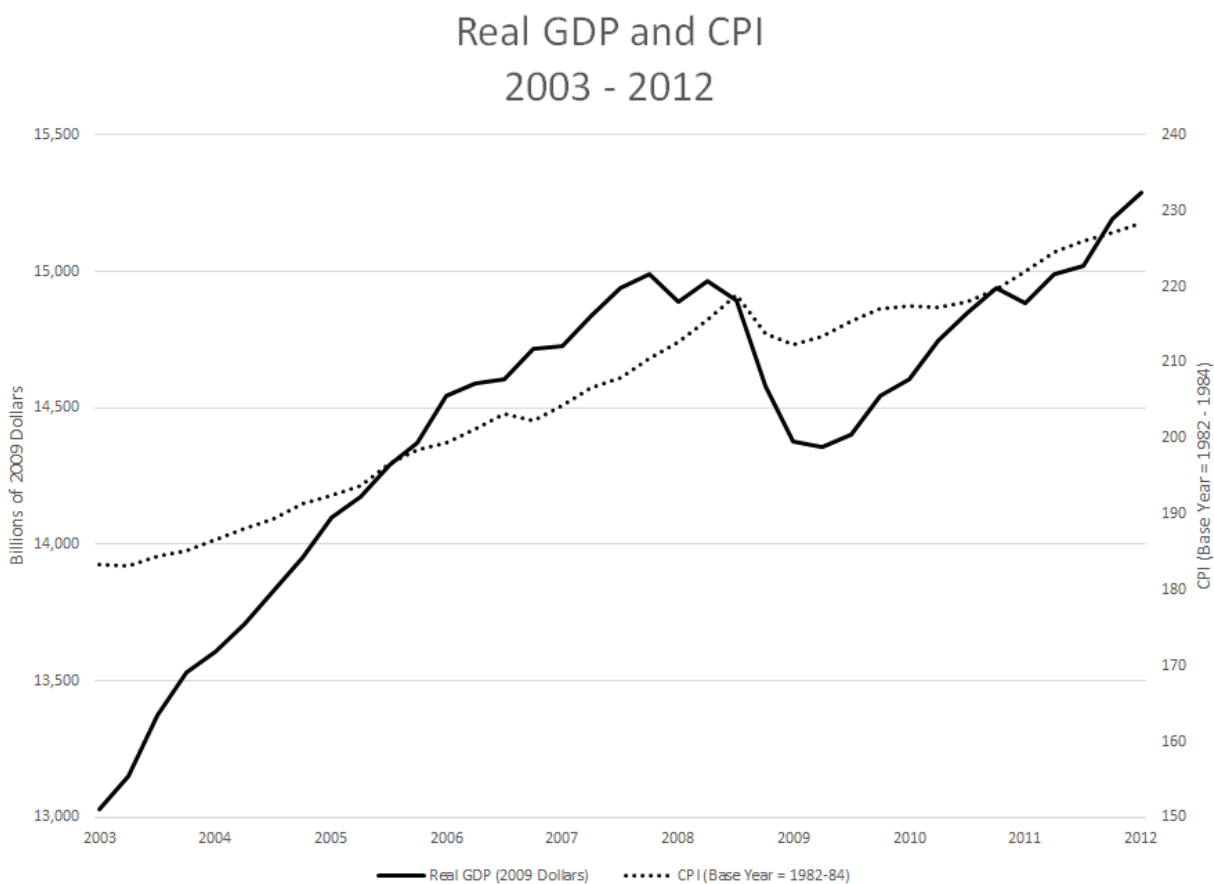
A powerful component of the aggregate demand and aggregate supply curve is that it is straightforward to figure out whether a recession is driven by a supply shock or a demand shock. When a supply shock causes a recession, we have seen in the previous section that prices will rise as output decreases. In a demand driven recession, prices will decrease as output decreases.

The question above says the economy is in a recession. If the economy is experiencing inflation as prices rise, then the recession is driven by a supply shock. If prices decrease during a recession, the recession is driven by a demand shock. By looking at just output and prices, policy makers can determine the appropriate policy response when the economy is not operating at full-employment.

## **The Great Recession**

At this point in the book, you should not be surprised that we will analyze whether policy makers responded appropriately to the Great Recession. First, we need to investigate whether prices increased or decreased during the recession.





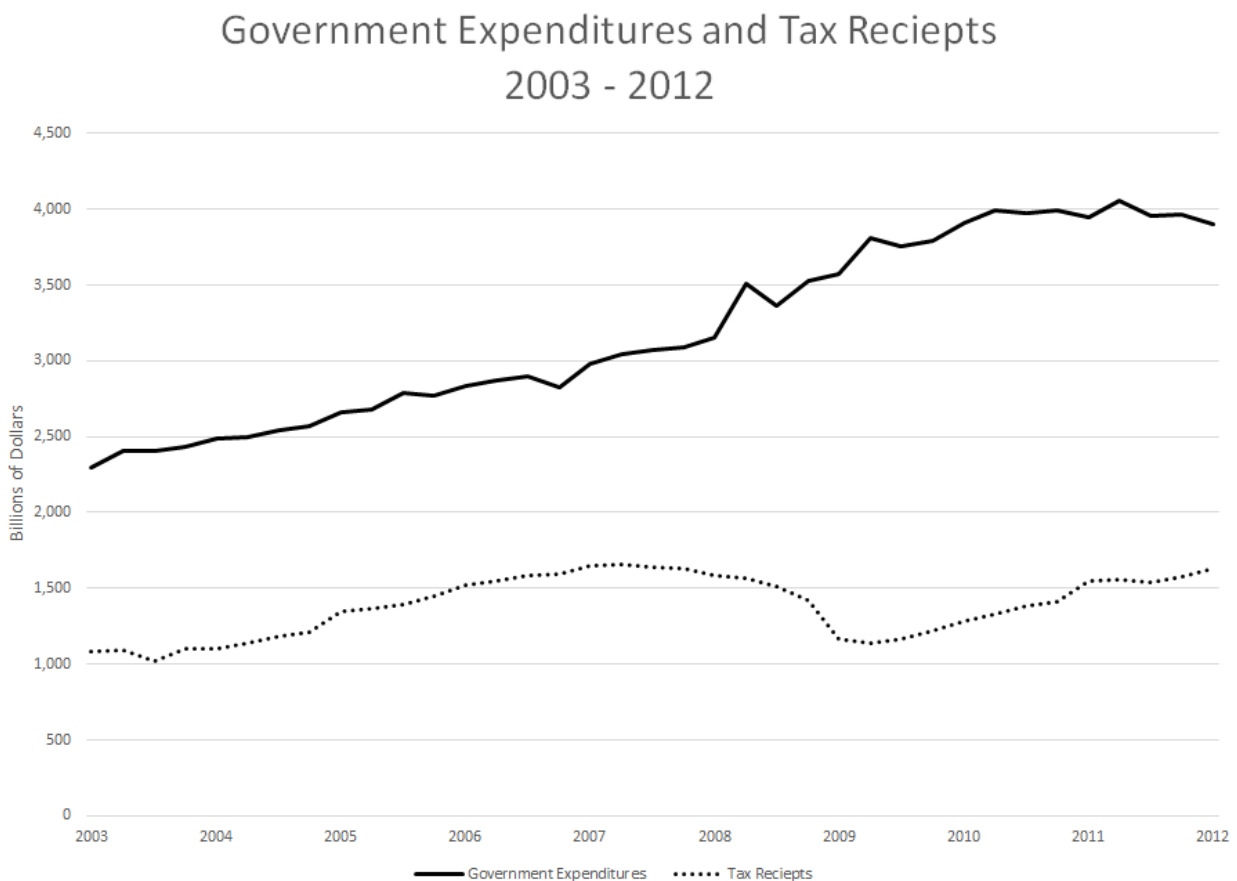
The figure above shows the Real GDP and CPI between 2003 and 2012. During the Great Recession in 2008-2009, the solid black line shows the decrease in production. The dashed line captures the CPI. The CPI was growing consistently between 2003 and 2008. Between 2009 and 2009, prices decreased and remained lower than 2008 levels for a few years.

The graph above provides evidence that the Great Recession was driven primarily by demand shocks. This is not surprising considering we have examined the consequences of the housing market crash that precipitated the Great Recession a number of times and found that it decreased the AD curve. There may have been other events taking place that altered the AS curve, but those events were not strong enough to increase prices or output.

We know from our analysis above, when there is a negative demand shock, policy makers should take actions that move the AD curve back to its initial

position. The two levers of monetary and fiscal policy were used during the Great Recession and we are able to assess whether policy makers made decisions that were consistent with our theory.

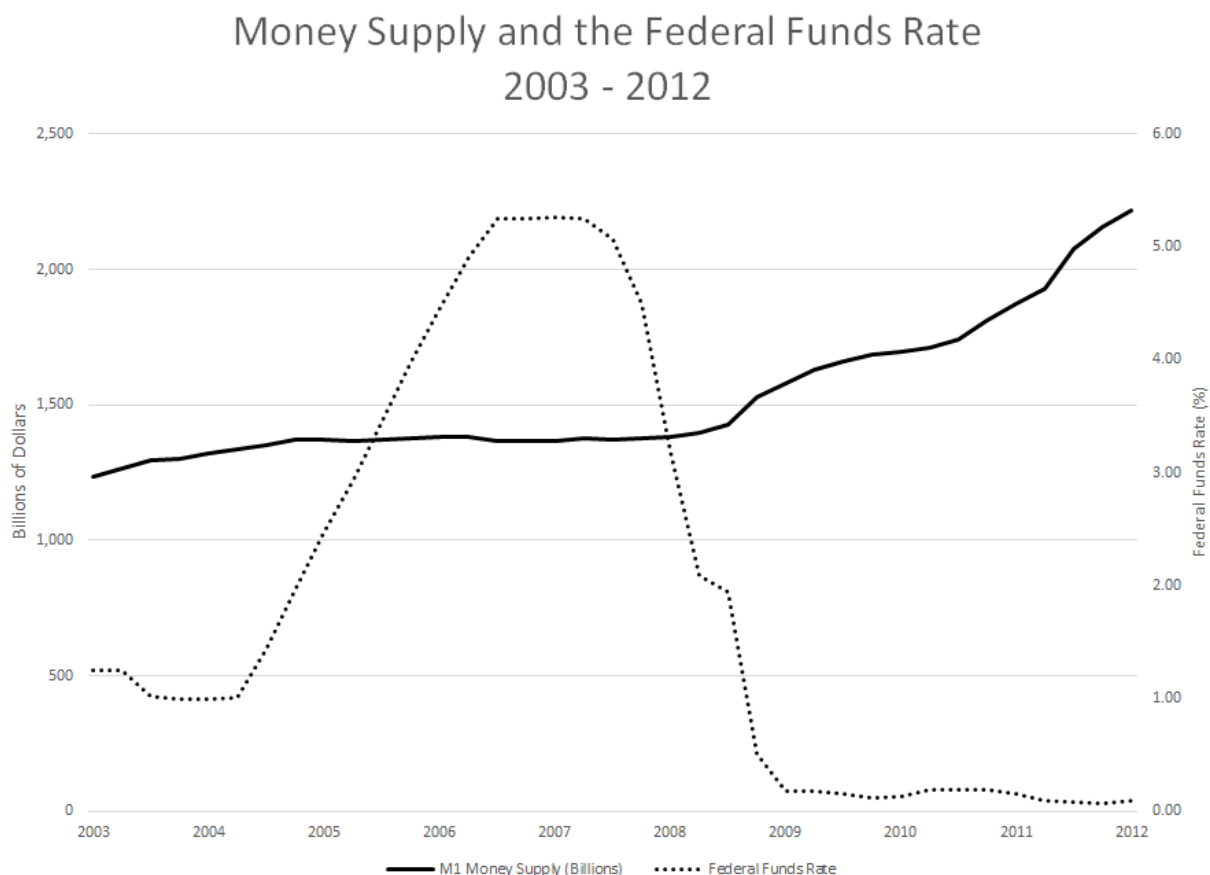
Given we want to increase the AD curve, fiscal policy should increase the AE curve. In order to do this, the government should increase  $G$  and/or decrease  $T$ . Is that what happened?



The figure above shows the value of government expenditures and taxes between 2003 and 2012. As we expected, the government had a relatively large increase in spending (solid black line) in 2008 and 2009 before leveling out more recently. The dashed line shows that tax revenue decreased starting in 2008 and the revenue amount did not return to 2008 levels until 2012.

Our goals as policy makers are to bring the economy back to full-employment and maintain stable prices. The changes in fiscal policy that the government implemented during the Great Recession are consistent with what we would have suggested in order to achieve our goals as macroeconomists.

Although fiscal policy is often difficult to enact, the severity of the Great Recession made Congress react swiftly and in the manner we would have predicted. Did the Federal Reserve also act in a manner consistent with our theoretical predictions? In other words, did the Fed increase the money supply and cause the interest rate to decrease?



The graph above shows the growth in the M1 money supply after 2008 (solid black line). The increase in the M1 money supply happened at a faster rate than previous years. Consequently, the Federal Funds Rate (dashed line) decreased from over 5% to just above 0% between 2008 and 2009.

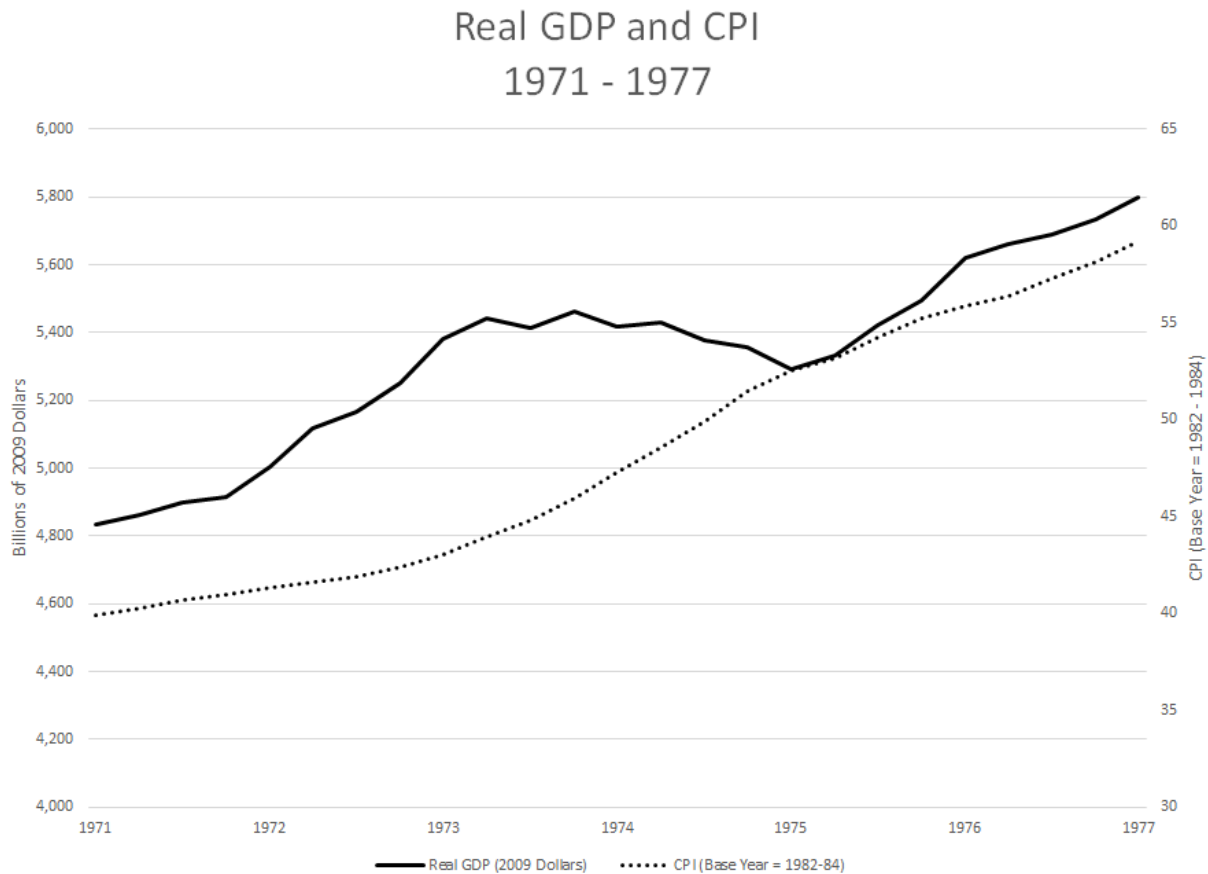
The Federal Reserve acted exactly as we would have predicted following the onset of the Great Recession. We saw earlier in this chapter that the appropriate response of the Fed to the housing market crash was to increase the money supply, decrease the interest rate, increase aggregate expenditures and shift AD to the right. Although our aggregate demand/aggregate supply model is relatively simple (in that it only contains two curves), the policy predictions we make from the model played out during the Great Recession. Being able to explain something as complex as the economy using a straightforward model is what makes our analysis valuable.

## **Recession from 1973 to 1975**

The policy response to demand shocks is relatively straightforward in our analysis. Because policy makers should counter the demand shock, there is not a lot of debate about what action should be carried out. (There is debate about whether the action of spending money or increasing the money supply is worth it, but that is a discussion for later.) So how have policy makers responded to supply driven recessions? Let's take a look.

Between 1973 and 1975, the United States experienced a recession. There were many potential catalysts to the recession. The price of energy increased significantly in 1973 as a result of the OPEC oil embargo (a negative supply shock due to an increase in production costs) but there was also a stock market crash that lasted from January 1973 to December 1974 (a negative demand shock due to a decrease in wealth).

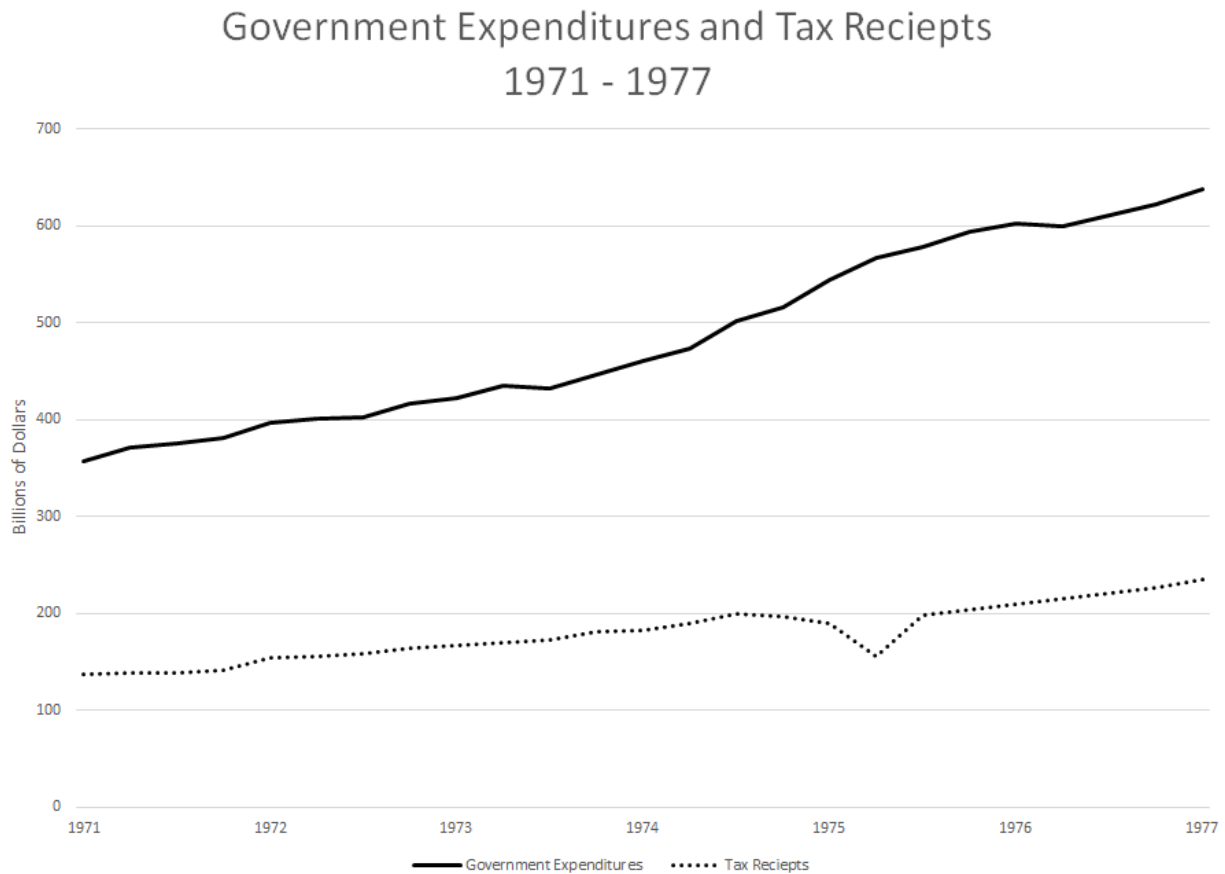
In order to determine whether the supply or demand shock was the primary driver of the recession, the figure below shows how prices and output changed in the 1970s.



Output is captured by the solid black line above and shows that from 1973 to 1975, real GDP decreased. The CPI (dashed line) increased faster between 1973 and 1975 than before or after the recession. This suggests that the supply shock from the higher oil prices had a bigger influence on the recession than any demand shock.

Unlike a demand driven recession, the appropriate response of policy makers is not clear. A hawk policy can be carried out, which is more aggressive since prices are kept stable at the expense of jobs. Carrying out a dove policy entails keeping employment levels up, but prices are higher as a result.

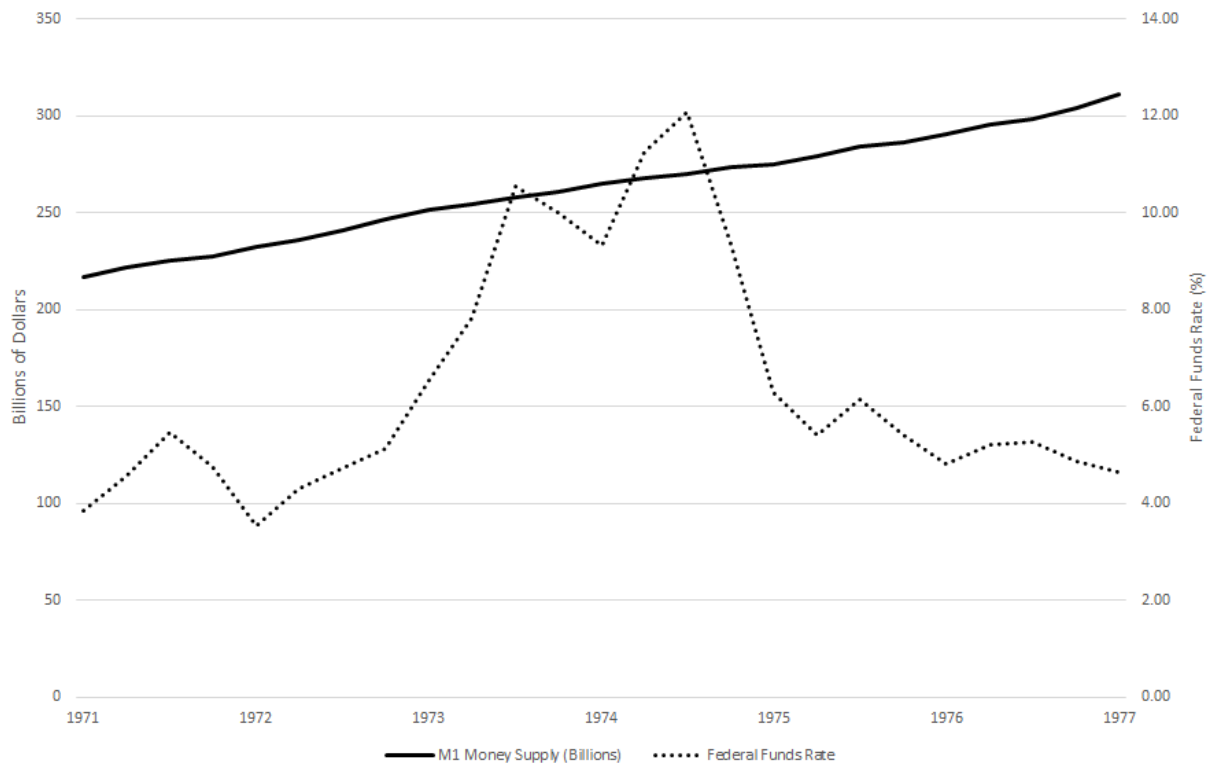
Let's first look at how fiscal policy responded to the negative supply shock.



Government expenditures, depicted by the solid black line, increased slightly during the recession years of 1973 to 1975. Tax revenue (dashed black line) had small, predictable increases in the figure above, with the exception of early in 1975. Although there were fiscal policy changes being implemented during this time, they were relatively small compared to fiscal policy response to the Great Recession.

The monetary policy response was more noticeable during the recession of 1973 to 1975.

## Money Supply and the Federal Funds Rate 1971 - 1977



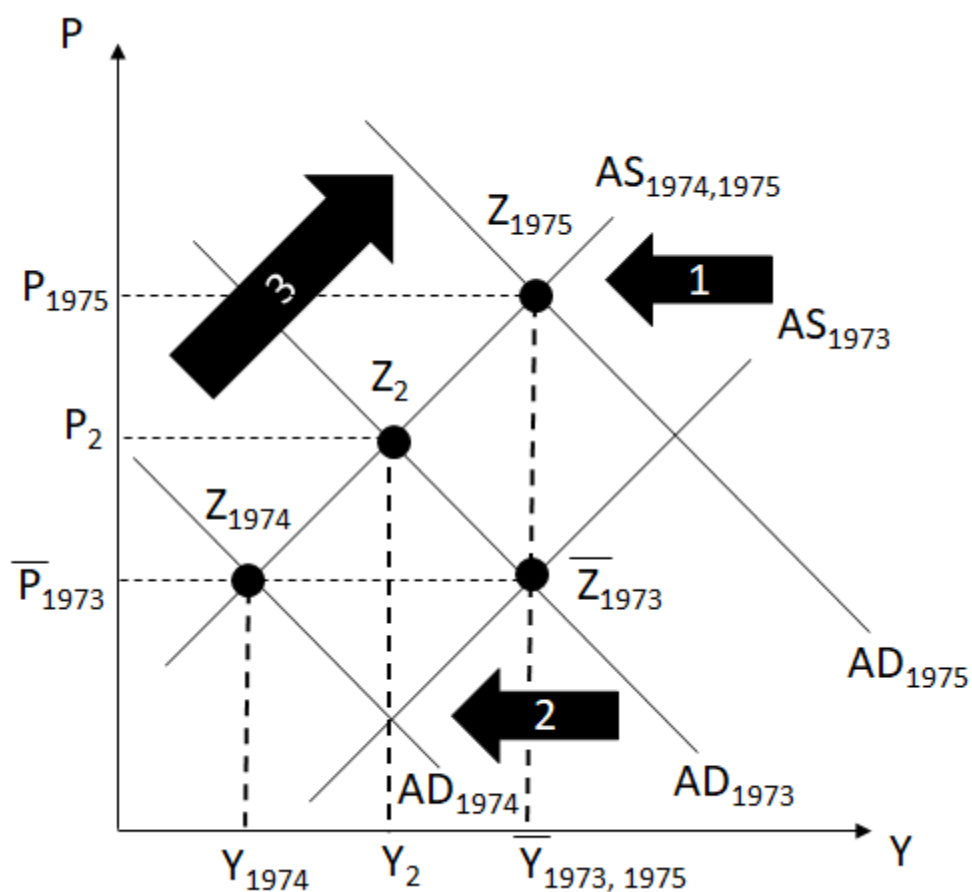
After the recession started in 1973, the Federal Reserve took actions that increased the Federal Funds rate (dashed line). In 1973, the Federal Funds rate was around 4%. By the middle of 1974, the rate had increased to 12%. According to our analysis, an increase in the interest rate leads to a reduction in aggregate expenditures and shifts AD to the left.

This is an example of the Fed enacting a hawk policy, which is meant to keep prices stable at the expense of jobs. By the middle of 1974, the Fed changed their approach and implemented a dove policy, decreasing the Federal Funds rate to just over 4%. By the end of 1974, the Fed no longer wanted to sacrifice jobs and were willing to see prices increase in the economy.

Part of the change in the Fed's policy at the start of the recession compared to the end may have to do with the origin of the recession. Ask someone who was driving in 1973 about the oil embargo and it will bring up bad memories

of long gas lines and spikes in the price of gasoline. Assuming the high gas prices were at the forefront of everyone's mind as the recession started, it is reasonable for the Fed to make limiting the rise in prices a priority.

The figure below shows how what the Fed hoped for in enacting a hawk policy as the recession started in 1973. Assume that at the start of 1973, the economy was operating at a full-employment level of output ( $\bar{Y}$ ) and ideal price level ( $\bar{P}$ ).



After the negative supply shock, the AS curve shifted left from  $AS_{1973}$  to  $AS_{1974}$ . This moves the equilibrium from  $Z$ -bar to  $Z_2$ . Because the Fed reacted relatively quickly, they hoped to keep prices stable and shift AD left from  $AD_{1973}$  to  $AD_{1974}$ . The equilibrium at  $Z_{1974}$  is a situation where prices are stable, but output decreases, resulting in more unemployment.



By the end of 1974, the Federal Reserve presumably believed that producing at the full-employment level of output was more important than maintaining stable prices. The recession would have likely lasted longer had the Fed not carried out a dove policy and moved the AD curve from  $AD_{1974}$  to  $AD_{1975}$ . After the decrease in the Federal Funds rate at the end 1974, the economy returned to producing at the full-employment level of output,  $Y\text{-bar}$ , but prices had increased even further to  $P_{1975}$ .

Although the supply driven recession in the mid-1970s is a bit more complicated to analyze than the demand driven Great Recession, our aggregate demand and aggregate supply curves can help explain the behavior of policy makers.

In the case of a supply shock, there is not a right or wrong policy response. Any attempt to eliminate unemployment comes at the cost of inflation. Trying to maintain stable prices after a negative supply shock will lead to higher unemployment.

The tension between unemployment and inflation that you have learned about is one of the core trade-offs faced in economics. After reading this book, you are now better equipped to help people better understand trade-offs and how to assess the costs of decisions. The tools you have learned in this course apply directly to the macroeconomy, but they can be used in any context that involves decision making, opportunity cost and trade-offs.

### **Economics**

When you hear the term economics, what comes to mind? Is it different than when you started this course?