

## Lecture 11: Real Business Cycles

Most economists explain business cycles in terms of the sticky price model we have been discussing. That is, there is a short run aggregate supply curve so that when aggregate demand fluctuates, there is a fluctuation in total output. The model doesn't work perfectly, and economists would like an alternative. In recent years, many economists have begun to suggest an alternative model, that business cycles are due to fluctuations in the aggregate supply curve. For complicated reason this approach is called the *Real Business Cycle* theory of business cycles.

The real business cycle model claims that changes in technology, typically called *technology shocks*, cause most changes in real GDP, in both the short run and the long run. Advances in technology raise real GDP. The growth rate of real GDP rises when technology advances quickly and falls when it advances slowly, and, *when productivity falls, the growth rate of real GDP turns negative*, the actual sign of a business downturn.

### **Warning required by the Economist-General:**

- This idea of a real business cycle is relatively new and is still quite controversial. Most economists would disagree with this concept. However, there is strong evidence that real business cycles explain a great deal of economic fluctuation.

While factor productivity has grown enormously over time, it does not grow each year. Data on factor productivity show that some years are marked by very high rates of growth of factor productivity, while other years are marked by low, and sometime negative, rates of growth of factor productivity.

### **An Example**

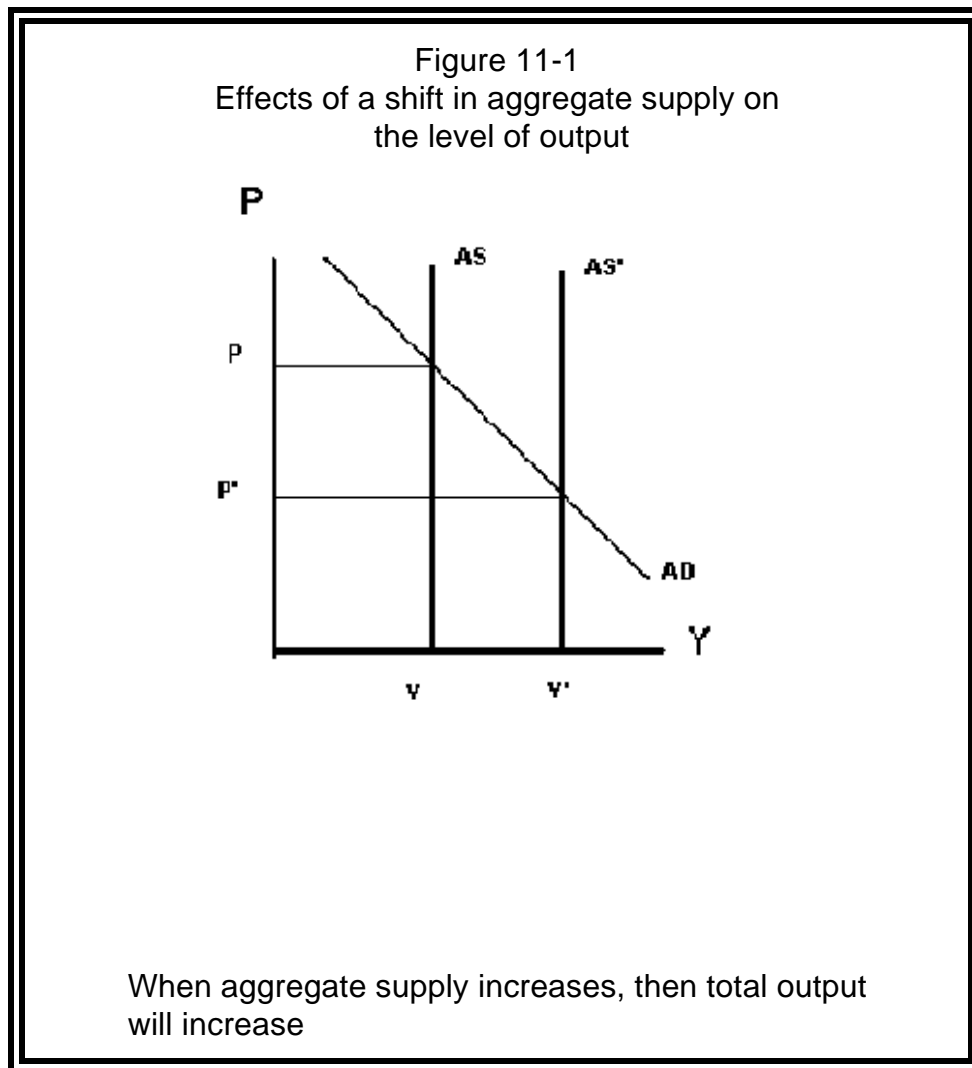
Consider a simple agricultural economy. The size of the crop is dependent on, among other things, the amount of rainfall. (While it depends on many other things, let's keep it simple.) In years when rain is plentiful; and crops are good. In other years, there is little rain and the crops are poor. In short, there are fluctuations in output due to supply considerations.

Economists who believe in real business cycles say the same thing happens in the American Economy. Our total output may not depend heavily on the level of rainfall, but it does depend on the level of total factor productivity. And, so the argument goes, while total factor productivity has

grown over time, there are fluctuations in the growth rate. In some years, it goes up a great deal. In other years, it goes up only a little or may actually decline.

## An Exogenous Increase in Factor Productivity

Let's trace out what happens when productivity increases faster than expected. Figure 11-1 shows what happens when an exogenous increase in total factor productivity shifts the long run aggregate supply curve from  $AS$  to  $AS'$ . As you can see, output rises from  $Y$  to  $Y'$ .



- **Conclusion (1): An increase in Factor Productivity leads to an increase in GDP.**

(You may also note that Figure 11-1 shows a fall in the price level, which seems inconsistent with what we know about business cycles. Have patience: we return to this issue in a moment).

## **Endogenous Secondary Effects**

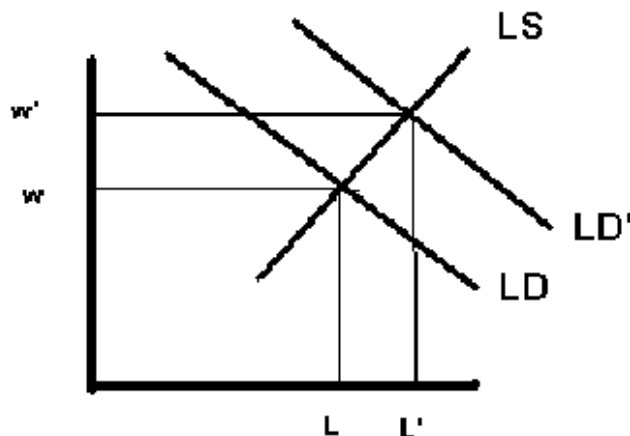
In fact, the increase in aggregate output may be greater than expected from the simple increase in factor productivity due to secondary effects.

### ***Effects in the Labor Market***

First, the higher level of economic activity increases labor demand from LD to LD', and as the Figure 11-2 shows, an increase in the demand for labor increases both the number of people employed from L to L', but also increases the real wage rate from  $w$  to  $w'$ .

- **Conclusion (2): An increase in Factor Productivity leads to an increase in wage rates and the number of people working.**
- **Conclusion (3): An increase in Factor Productivity has a greater impact on GDP because of the indirect effect on the number of people working.**

Figure 11-2  
Effect of technology induced increase in labor demand on wage rates and employment

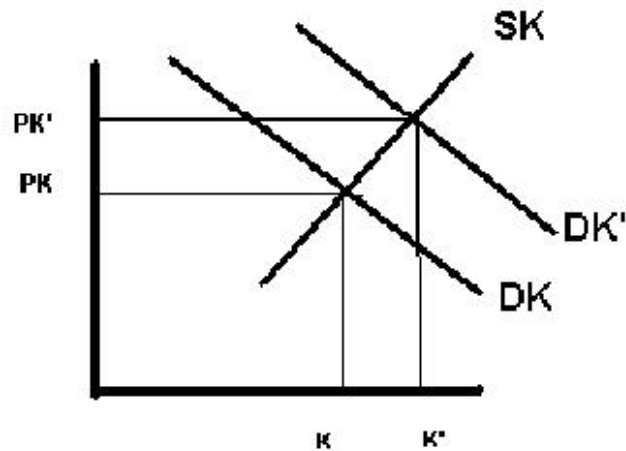


When technology increases aggregate supply, then labor demand increases. This will increase wages and the number of people working. There will also be a greater effect because of the indirect effect on the number of people working.

### ***Effects in the Capital Market***

The higher level of economic activity increases the demand for capital. Not all capital machinery is used all the time. For example, most firms have old, less productive capital that is not being put to use. Thus at any one point in time, the supply of existing capital  $KS$  being put to use is a downward sloping function of the price of capital services. In crude terms, old clunkers will not be put to use unless they can earn a very high rate of return. But the higher level of economic activity increases capital demand from  $DK$  to  $DK'$ , increasing both the quantity of capital in use from  $K$  to  $K'$  and the price of capital services from  $PK$  to  $PK'$ . These effects are illustrated in Figure 11-3.

Figure 11-3  
Effect of a technology induced increase on the demand for capital on capital prices and capital utilization rates



Similarly the increase in technology will increase capital demand, leading to a higher capital rental rate and capital utilization rate. This means more capital is used and corporate profits increase.

Economists compute something called the capital utilization rate, showing the amount of capital actually in use. Table 11-1 shows how the amount of capital being put to use changed from year to year.

Year	Percent of Capital Utilized
1980	82.1
1981	80.9
1982	75.0
1983	75.8
1984	81.1

- **Conclusion (4): An increase in Factor Productivity leads to an increase in the return on capital and the amount of capital used. The combination will mean that corporate profits will rise.**
- **Conclusion (5): An increase in Factor Productivity has a greater impact on GDP because of the indirect effect on capital utilization.**

### **Summary**

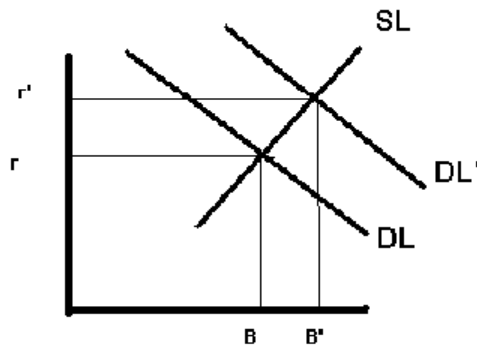
The long run aggregate supply curve shifts to the right because of three effects:

- An exogenous increase in factor productivity
- An endogenous (induced) increase in the number of people working
- An endogenous (induced) increase in the amount of capital being utilized.

### **The Impact on Investment**

Remember our graph for the demand and supply of loans for investment purposes. Not only does the higher level of economic activity increase the demand for existing capital, it also increases the demand for new capital. While firms are using old clunkers, it would be better to replace them with new equipment. As Figure 11-4 shows, this increases the Demand for Loans from DL to DL', thus raising the interest rate as well as the quantity of loans being made from B to B'. That is, of course, another way of saying that the level of investment is going up.

Figure 11-4  
Effects of a technology-induced increase in the demand for loans on the real interest rate and the level of investment



The higher productivity increases the demand for loans. This raises real interest rates and the amount of investment.

- **Conclusion (6): An increase in Factor Productivity leads to an increase in the level of investment. It also leads to a higher real interest rate.**

### The Impact on Consumption

There are two impacts on consumption. We also know that consumption demand is a function of both real income and the interest rate. The rise in real income will push consumption up, but the rise in the interest rate will lead to a reduced demand for consumption. It seems likely that the net effect will be that consumption goes up, but by not as much as output.

- **Conclusion (7): An increase in Factor Productivity leads to an increase in the level of consumption, but the percent increase in consumption is less than the percent increase in GDP.**

## The Impact on the Price Level

We now turn to the final issue: We know that velocity is a function of the real interest rate: the higher the real interest rate, the higher the level of velocity. As you recall, one of our equations for aggregate demand was

$$Y = MV / P,$$

where  $V$  measures velocity, the rate at which money turns over. The higher interest rate will cause people to decide to economize on their use of money (the cost of holding money, which does not earn interest as opposed to CD's and other interest bearing assets, rises).

Thus the higher consumption and real interest rate which increases velocity cause increases aggregate demand. The net impact may be like that illustrated in Figure 11-5, where the combined impact of the increase in aggregate supply and aggregate demand leads to a higher price level,  $P''$ .

Why didn't we get this effect first? Figure 11-1 illustrates only the shift in aggregate supply, and not the increase in aggregate demand.

- **Conclusion (8): An increase in Factor Productivity may or may not lead to an increase in the Price Level.**

## A Summing Up

Of course, these are the key facts that we know about business cycles. Thus we can restate our key conclusion.

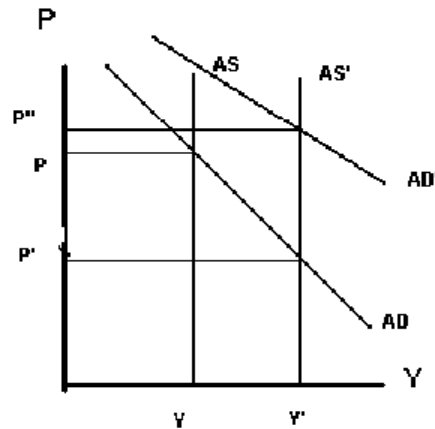
- **Conclusion (9): The real business cycle model will explain many of the key facts about fluctuations in the economy.**

Thus, we have a simple way of explaining fluctuations in the national economy. Some year, it rains more than in other years. While rain per se may or may not matter, there are a number of factors that can account for the economy being better in some years than others.

### **Warning required by the Economist-General:**

- Read conclusion (9) very carefully. It says that the real business cycle model can explain many of the key facts. It does not say that the real business cycle model is the way to explain fluctuations. We discuss whether real business cycles really account for fluctuations later.

Figure 11-5  
Effects of a Shift in Aggregate Supply  
and Changes in Velocity



The higher interest rate increases velocity, and thus increases aggregate demand. If it increases it enough, then the price level can rise.

## The Two Models of Business Cycles

We now have two explanations for business cycles:

- Aggregate Demand shifts, leading to movements along the short run aggregate supply curve.
- Aggregate Supply shifts, leading directly to fluctuations in real output.

When comparing the two approaches, it is common to frame the discussion as a debate between the two models. This seems misleading. Normally, when we discuss supply and demand, we know that prices and quantities can change due to either demand or supply changes. Some are due to demand shifts, while some are due to supply shifts. Nonetheless, there is enough discussion of the two approaches, that we ought to discuss some of the points of contention.

To see what this section is trying to do, suppose we see the price of apples going up while the quantity bought and sold increases. The only way

that can occur is if demand increases. While a decrease in supply might account for the price increase, it would predict a decrease in the quantity bought and sold. Similarly, an increase in supply would account for an increase in the quantity bought and sold, but would predict a price cut. In short, we use the evidence of what has happened to figure out what must have happened to the supply and demand curves.

This is what we want to do with aggregate supply and demand. We see what has happened, and we now want to figure out how to account for that in terms of supply and demand shifts.

### ***Seasonal Cycles***

First, we should know that there is uncontested evidence of cycles unrelated to the money supply and sticky prices. In the first quarter of each year (January – March), real GDP is typically about four percent lower than its average for the year. In the second and third quarters (April – September), real GDP is about equal to the year's average. In the fourth quarter (October – December) real GDP is about four percent above the year's average. (The government usually reports *seasonally adjusted* GDP, which means they make an adjustment for these seasonal fluctuations).

Economists do not attribute these seasonal cycles to changes in the money supply because of sticky nominal prices or wages or confusions of nominal and relative prices. Seasonal cycles occur for other, quite understandable reasons, such as the increased demand for goods before Christmas, less outdoor construction in cold winter months and so on. Cold weather acts like a slowdown in technical progress. It is more difficult to build in the winter. The main difference is that seasonal cycles are shorter, larger, and more predictable than business cycles.

### ***Sectoral Shifts***

We also know that the economy is subject to a number of sectoral shifts, as output increases in some sectors of the economy while decreasing in other sectors. For example, when compact disks emerged as a replacement for vinyl records, record companies reduced their output of vinyl records. These shifts are akin to a decrease in total factor productivity, wiping out skills and knowledge developed for a dying industry.

Economists who believe that supply shifts cause business cycles point to the importance of these sectoral shifts as evidence supporting their position.

***Warning required by the Economist-General:***

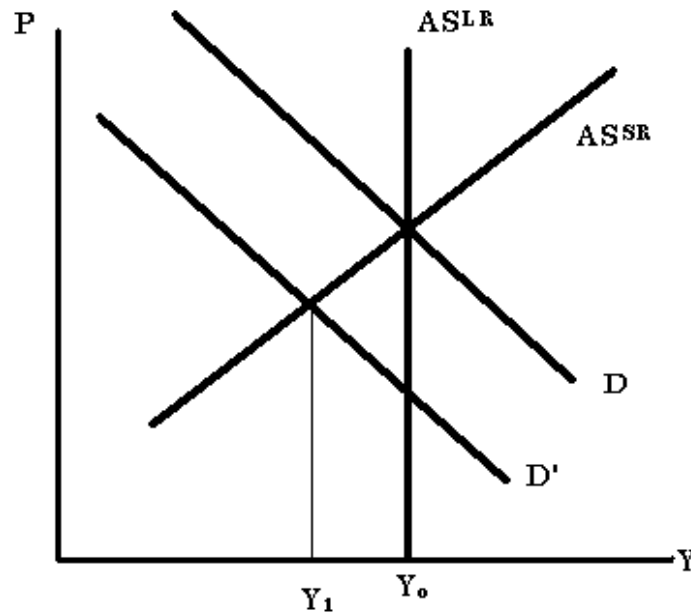
- There is a technical issue. We have not discussed the complexities of an economy producing multiple goods. A complete discussion of sectoral shifts requires that we address this complexity, but it would not substantially change the conclusions given here.

***Persistence***

Partisans of real business cycles point to data on the persistence of business cycles. Suppose recessions arise from a demand curve shift, causing movements along a short run supply curve. Then, as the short run supply curve rotates, an increase in economic activity will follow the decrease in economic activity. Figure 11-6 illustrates this process. Here, the economy is initially at equilibrium, with aggregate demand equal to long run aggregate supply. GDP equals  $Y_1$ . A decrease in aggregate demand leads GDP to fall from  $Y_0$  to  $Y_1$ . When the short run supply curve rotates, GDP will rise back to  $Y_0$ . By contrast, the model of real business cycles predicts that a decrease in economic activity caused by a decline in total factor productivity should be permanent, not followed by an increase in economic activity. That is, the decline is persistent.

While some recessions end with a period of rapid growth, most do not. In short, persistence seems to support the view that supply shifts cause most recessions.

Figure 11-6  
A Business Cycle due to demand shift



When aggregate demand declines from  $D$  to  $D'$ , the movement along the short run aggregate supply curve causes a reduction in GDP from  $Y_0$  to  $Y_1$ . As the short run supply curve rotates, we will find GDP rising back to  $Y_1$ . That is, there is no persistence to the recession.

### ***Can Factor Productivity Decline?***

This debate between the two models is not one-sided. To explain declines in GDP, the real business cycle model assumes that factor productivity can decline. Many economists argue that this statement does not pass the snicker test. Total factor productivity measures the amount of *potential* output with a given level of capital and labor. For total factor productivity to decline, therefore, we must unlearn skills that we had yesterday. In short, the argument goes, the real business cycle explanation

works only if the nation undergoes periodic bouts of senility, where knowledge is lost forever.

Partisans of real business cycles respond that is a pretty naïve view of total factor productivity. If we include changes due to sectoral shifts, government regulations, and the like, it is quite possible that total factor productivity, as measured by the GDP data, will actually fall. As an example, suppose the government instituted some new environmental requirements, reducing productivity at plants throughout the nation. While we might be better off, considering the improved environment, GDP accountants would measure a decline in factor productivity and a decline in GDP.

### ***Phillips Curves***

Perhaps the weakest point in the case for real business cycles is the possible existence of short run Phillips curves. Data from the United States and other countries show many examples where unanticipated deflation (or at least inflation less than anticipated) went hand in hand with business downturns. Perhaps some of these are spurious correlations. For example, the 1981-82 recession has another explanation besides that of the Federal Reserve System tightening the screws. However, there are many other cases, both here and abroad, where it is more difficult to ignore the connection.

### ***War and Peace***

A recession has followed every major American War. Both camps can claim these recessions in support of their view. The recession may be due to a decline in aggregate demand as the government cuts military spending, or it may be that the end of a war represents a sectoral shift. Defense industries are “downsized” and, there is a decrease in factor productivity as people and resources shift from one industry to another.

### ***The Money Supply***

The data are very clear: Money supply changes often immediately precede changes in real GDP. The 1929-33 depression is the best known of these incidents, but it is true for almost all recessions, fortunately to a smaller degree. These data lend support to the notion that business cycles come from shifts in demand. Advocates of real business cycles sometimes dismiss this as spurious causation. Specifically, they argue about the causation. To them, the money supply fluctuates because GDP is fluctuating; not that GDP fluctuates because the money supply is fluctuating.

This is, to say the least, a complicated and controversial argument. We should simply be aware of this dispute.

### ***Involuntary Unemployment***

The model of real business cycles does not explain involuntary unemployment, and makes no effort to do so. Advocates of real business cycles claim that all unemployment is voluntary.

### ***Conclusion***

Our ultimate test of any model is "does it fit the facts?" It would be nice if we could say that one model fits facts one through six, while the other model fits facts one through seven, and is thus better. We cannot do so.

Perhaps the best resolution is to note that both effects appear to be at work in most recessions. In some cases, demand factors dominate; in other cases, supply factors are dominant.

### **Relation to the Text**

Each lecture ends with a section relating it to the text. In some cases, material is omitted, either because the text covers it well enough or because it is not worth learning. In other cases, material is added. Each of these "lectures" will end with a brief note relating the lecture to the text, describing what material is left to the student to learn alone and what material may safely be skipped.

### ***Which Chapters does this lecture cover?***

This is all new material.

### ***What material is new?***

This is all new material.

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