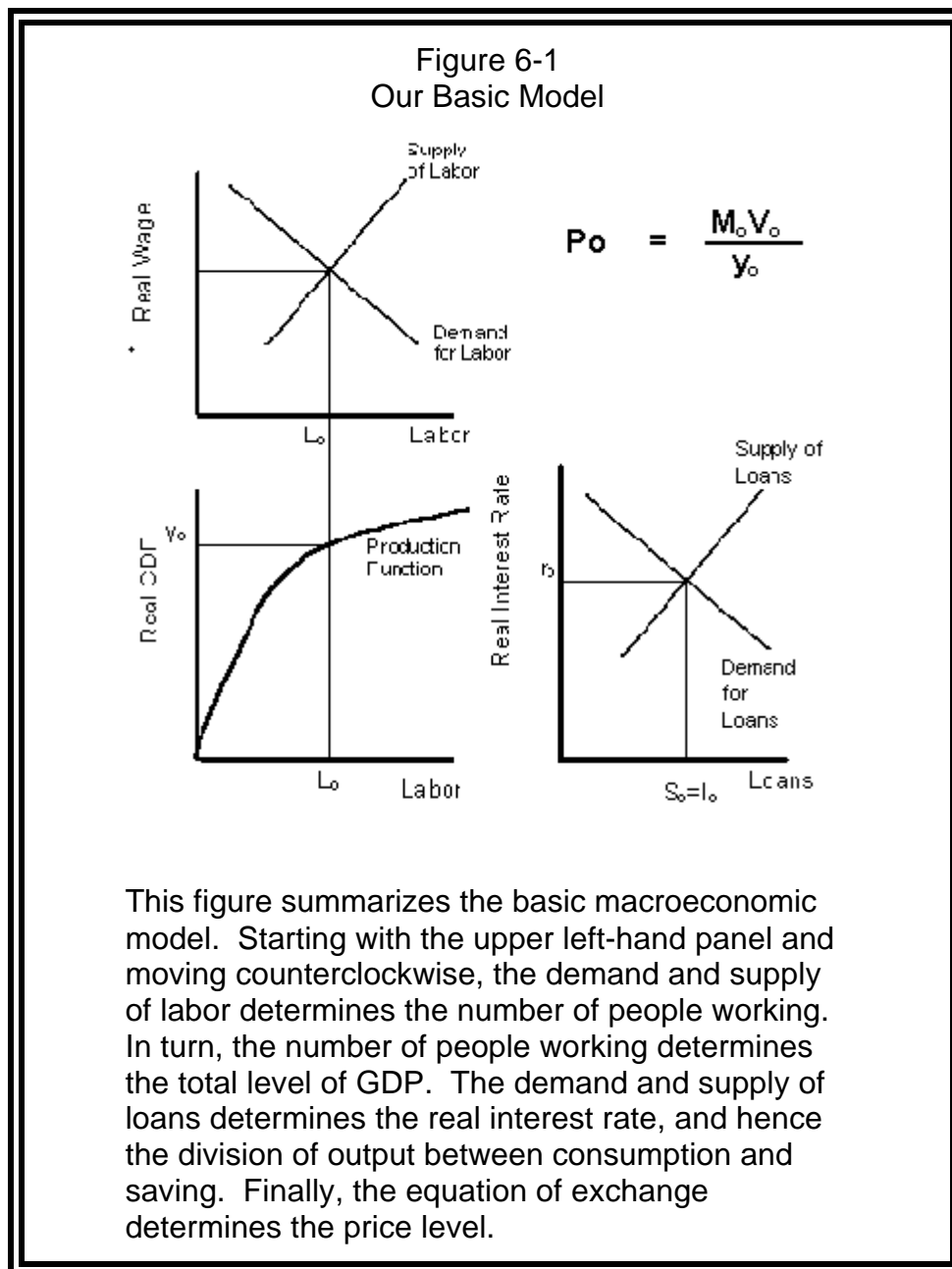


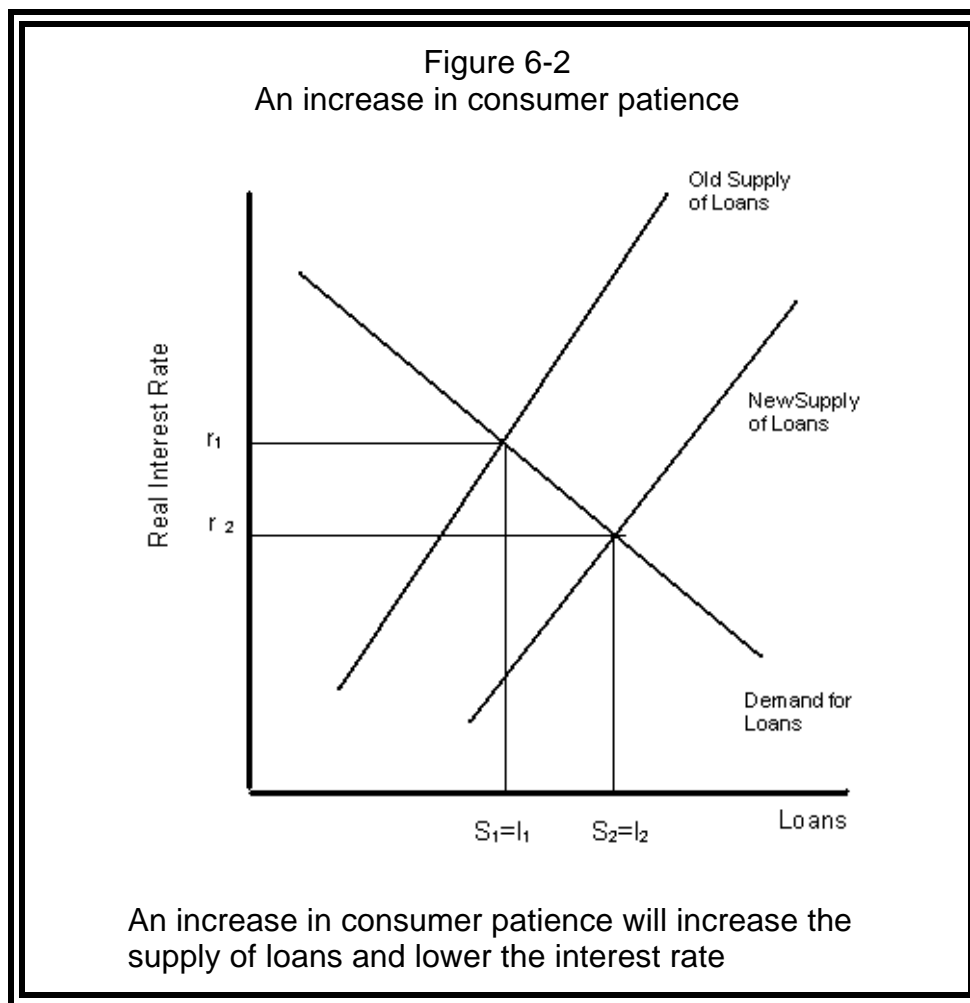
## Lecture 6: Applying the Model

Before we move to some of the expanded topics, let us apply the model to a couple of basic topics. In part, these topics are interesting in themselves, and in part, they show us how to use the model. For convenience, we will repeat Figure 5-5 here as Figure 6-1. This figure summarizes the basic model.



## An Increase in Consumer Patience

Suppose, for whatever reason, consumers decide to save more. Perhaps they decide that it is best to defer their consumption; perhaps the government has changed tax policies to increase incentives to save; perhaps consumers are less confident about the future and decide to save for a rainy day. In any event, the effect is to increase the supply of loans. Figure 6-2 shows what will happen. The quantity of saving and investment will rise, and the real interest rate will fall.



In time, the increased investment will lead to an upward shift in the production function, and hence a greater level of GDP, even without an increase in the number of people working.

Is this a good thing? Government policies may be able to bring about an increase in the saving rate. Many politicians would say an increase in the saving rate is good. However, let us be clear about the hidden cost of the

increase in the saving rate. The only way to increase the amount of GDP going to investment is to reduce the amount going to consumption. At both a macroeconomic and at an individual level, we face a choice between consumption now or consumption later. We know that if we consume less today and save more, we can consume more later (and similarly, if we consume more today and save less, we can consume less later). So too for the economy.

### ***Effects on other Markets***

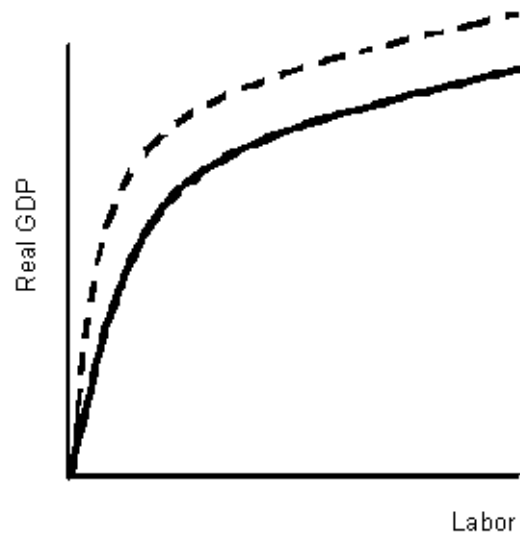
In this simple case, we would not expect immediate changes in other markets. In particular, we do not expect a shift in the production function. The production function can and does change over time, and increased investment will certainly cause a shift in the production function. However, this graph is for the production function now, and not later. It will take some time for the shift to occur. We take up the subject of economic growth and shifting production functions in the next lecture.

### **Technical Progress**

Without undertaking a complete discussion of economic growth, let us consider a simple case of an increase in technology. Perhaps the owner of Miller's Pizzeria suddenly discovers a way to become more productive so that it becomes possible to produce more output with the same resources. That is, holding labor and capital constant, we can get increased output.

Figure 6-3 shows the immediate effect. The production function shifts up, indicating the increased productive ability of the economy. That is not the end of the story; we will now see significant spillover effects in other aspects of the economy.

Figure 6-3  
Impact of Technological Progress on the Production Function



The immediate effect of technological progress is to shift out the production function. As we will see, that is not the end of the story.

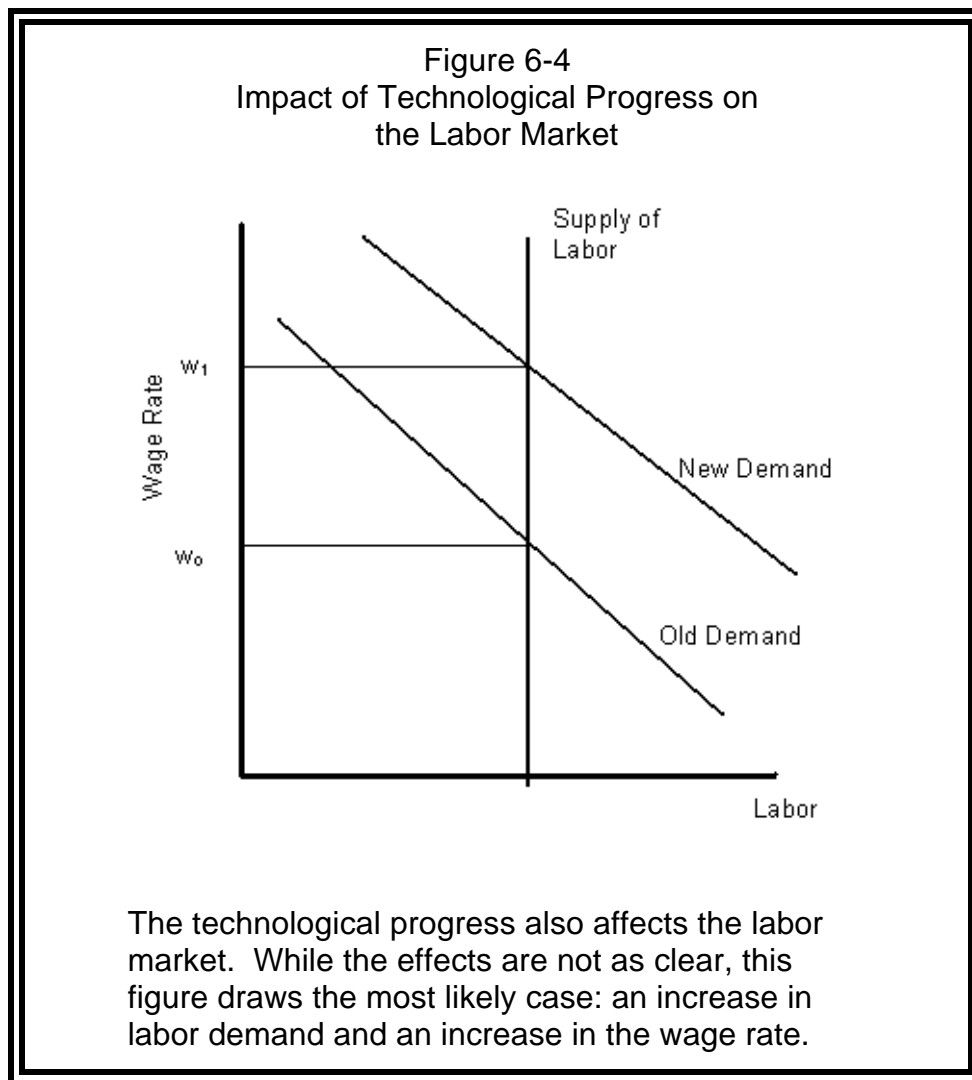
Let us trace through the rest of the markets and see how it affects the wage rate, the interest rate and the price level.

### ***The Labor Market***

We will draw the labor supply curve as perfectly inelastic. We can debate the shape of the labor supply curve, but it will simplify our story – without changing the basic results – if we simply assume that the labor supply curve is perfectly inelastic. Technical progress may well have an effect on labor demand. It is most likely that we will have an increase in labor demand, though it is possible that the effect will be to reduce labor demand. An example may explain why the effect may go either way. When the owner of Miller's Pizzeria has a bright idea increasing his productivity, he can now produce the same number of pizzas using fewer workers. If that were all he did, the effect of the technical progress would be to reduce the

demand for workers. However, he is most likely to respond to his bright idea by increasing output and sales; that effect will lead him to increase his demand for workers. Thus he will hire more sales and delivery people.

The textbook takes the "safe" way and assumes no increase in labor demand. (Remember, that means no shift in the labor demand curve). However, the record of technological progress over the past few centuries indicates that technological progress increases labor demand. Thus Figure 6-4 shows an increased labor demand, with a concomitant increase in the wage rate.

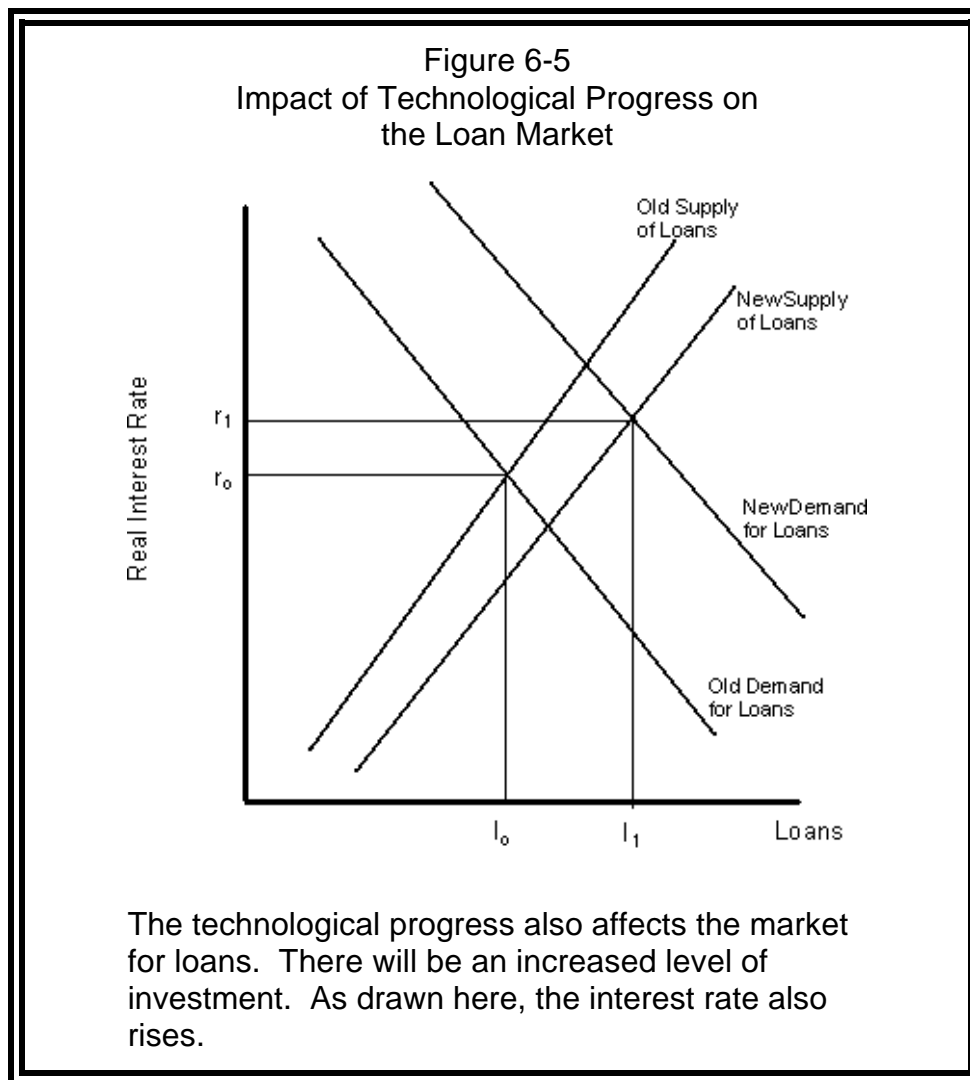


### ***The Market for Loans***

What about the impact on the market for loans? Here there are two important effects.

- The increase in technology will increase the demand for loans for investment. Now that capital is more productive, firms will want to increase the amount of capital they have, and that will mean an increase in the demand for loans.
- With output higher, income will also be higher. While individuals may well choose to spend most of their income, they will probably want to save part of it. Thus, there will be an increased supply of loans as well too.

Figure 6-5 shows the combined effects. There will be an increased amount of saving and investment. The effect on the interest rate is less clear. The most likely case is the one drawn here. The demand for loans has increased more than the supply of loans, driving the interest rate up.



### ***The Price Level***

There are also effects on the price level. Recall the equation of exchange:

$$P = MV/y$$

If  $y$  is increasing while  $M$  and  $V$  are constant, the price level must fall as well.

### **Effects of a Tax Cut**

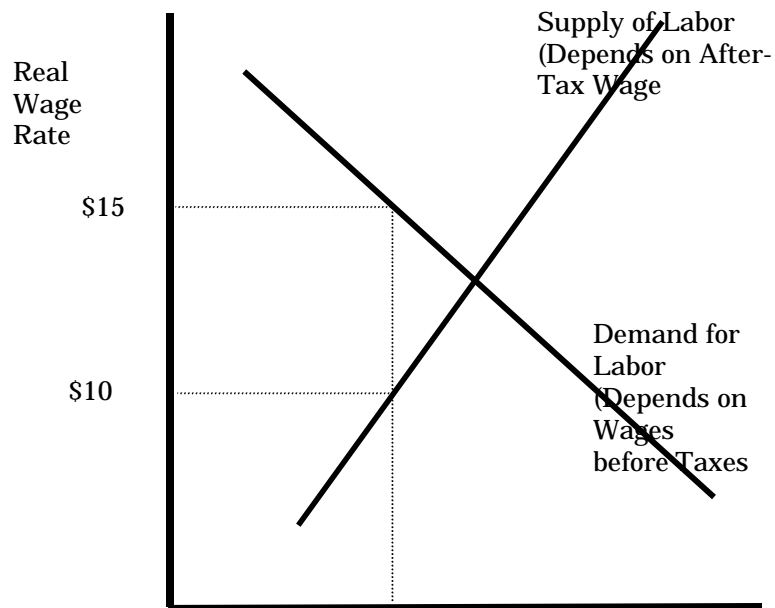
As our last case, we want to consider the impact of a tax cut. To be specific, let us suppose that right now the government is collecting an income tax of one third of all income. The government cuts the tax rate to 25 percent, without reducing the amount it spends. We want to use our basic macroeconomic model to trace through all of its implications. We will consider each of the markets illustrated in Figure 6-1.

### ***The Labor Market***

When we draw the supply and demand for labor, as in Figure 6-1, we have not considered taxes. Once we allow for taxes, the figure changes. Workers care about their after-tax wages, since that is what they take in, while employers care about the before-tax wages, since that is what they pay out.

The equilibrium will be something akin to that illustrated in Figure 6-6 with taxes driving a wedge between the amount workers receive and firms pay. Here demand and supply are in balance at (say) a before tax wage of \$15 per hour and an after tax wage of \$10 per hour. If neither employers nor employees had to worry about taxes, the amount of employment would rise, while the after tax wage rose and the before tax wage fell. However, taxes seem inevitable in our modern life, so we will be stuck with some equilibrium such as illustrated in Figure 6-6.

Figure 6-6  
Equilibrium in the Labor Market when  
Taxes are Considered.



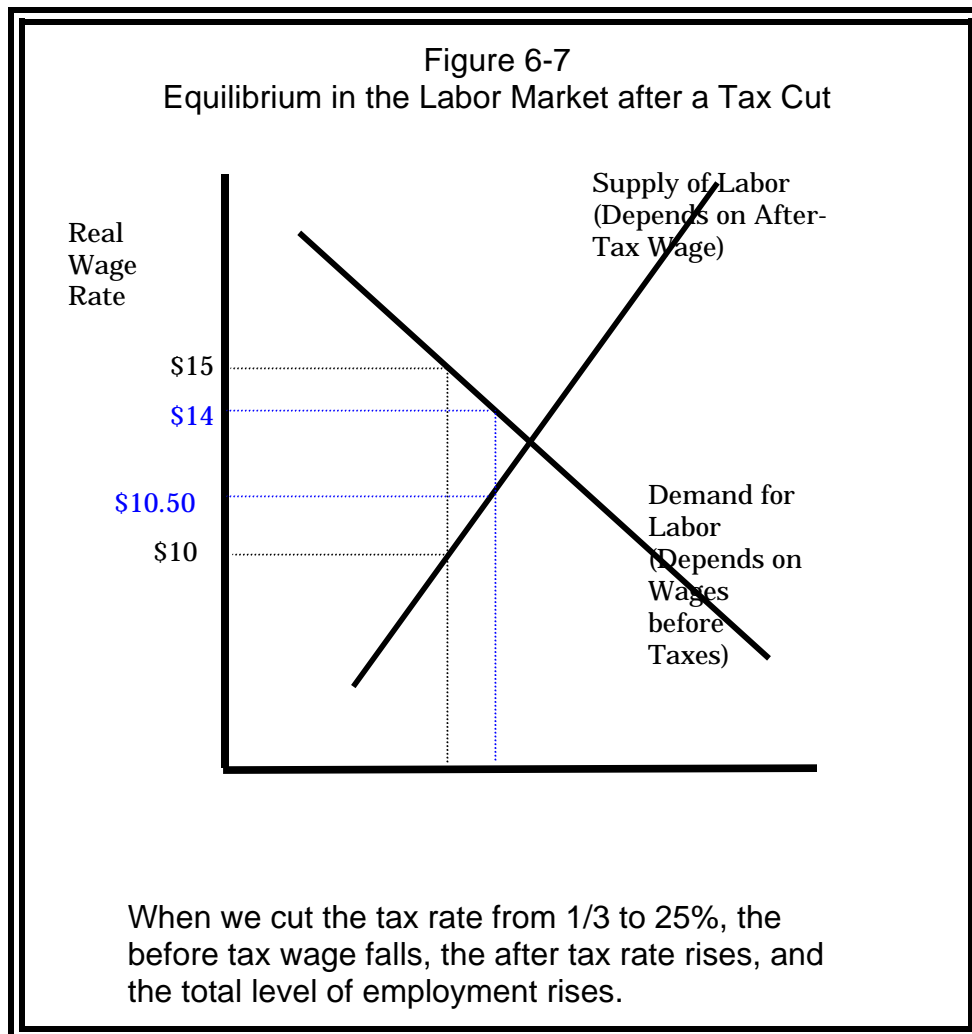
When we consider the impact of taxes on the labor market, then equilibrium will occur at a lower level of employment than would be the case without taxes. Here, we assume a 1/3 tax rate with equilibrium at a before tax rate of \$15 per hour and an after tax rate of 10 per hour.

When we cut the tax rate to 25 percent, we would expect three things to happen:

- The before tax wage rate would fall.
- The after tax wage rate would rise
- Total employment would rise

Figure 6-7 illustrates what *might* happen. Here, the before tax wage rate falls from \$15 an hour to \$14 an hour, while the after tax wage rate rises from \$10 to \$10.50 an hour. (As you can tell, the new effective tax rate is

25%). Total employment rises as well. The exact changes would depend on the elasticities of the supply and demand curves.



### **Total Output**

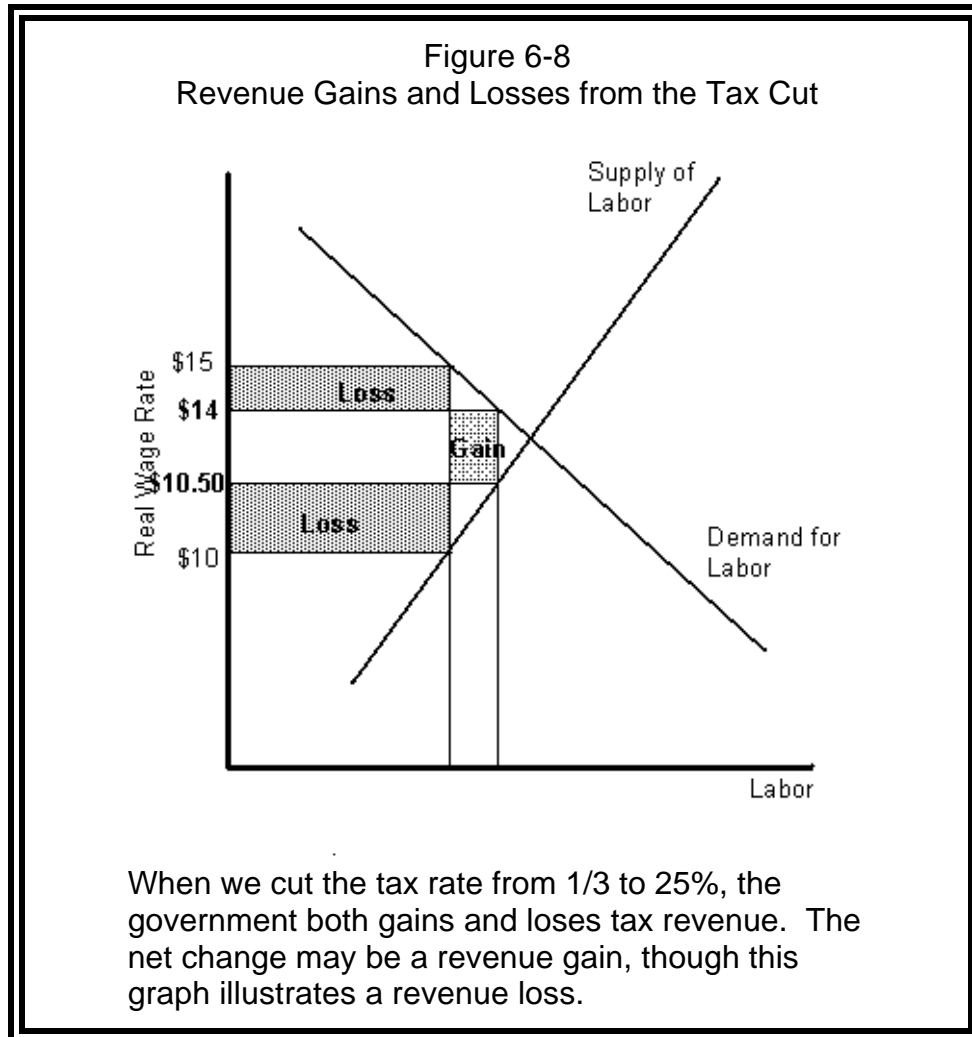
While there is no shift in the production function – Congress cannot change the laws of engineering – the increase in total employment does lead to an increase in output as we move along the production function.

### **The Loans Market**

We are also concerned about what happens to the demand and supply for loans. Here there are a number of controversies.

One might naively assume that a lower tax rate means lower tax revenue, it is possible that **the lower tax rate may raise tax revenue.**

More people are working, and it is possible that a 25% tax rate, applied to more workers, will increase revenue. Figure 6-8, which is a repeat of Figure 6-7, shows how this can come about. The government loses revenues on existing workers, areas indicated as **Loss** on Figure 6-8 but gains revenues on new workers, the area indicated as **Gain**. As this figure is drawn, it looks like the government loses revenue, but it could have gone the other way (see the graph in Stockman, where it does go the other way).



When we discuss fiscal policy later, we will say more about this subject. **Here, we make the simplifying assumption that the people do not increase the amount of work they do.** Thus, the government definitely loses tax revenue from the tax cut.

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

- People will work more. It is just that this case becomes too complicated to handle. Thus, we stick with the simple case where people do work more.

If the government loses revenue from the tax cut. It must borrow to make up for the loss, and we know the effect will be to push the demand curve for loans to the right. What happens to the supply curve for loans? Remember that people are making more money, since there has been an increase in the number of people working. In addition, because the government is collecting less in taxes, they have more in their pocket. There are three schools of thought as to what might happen.

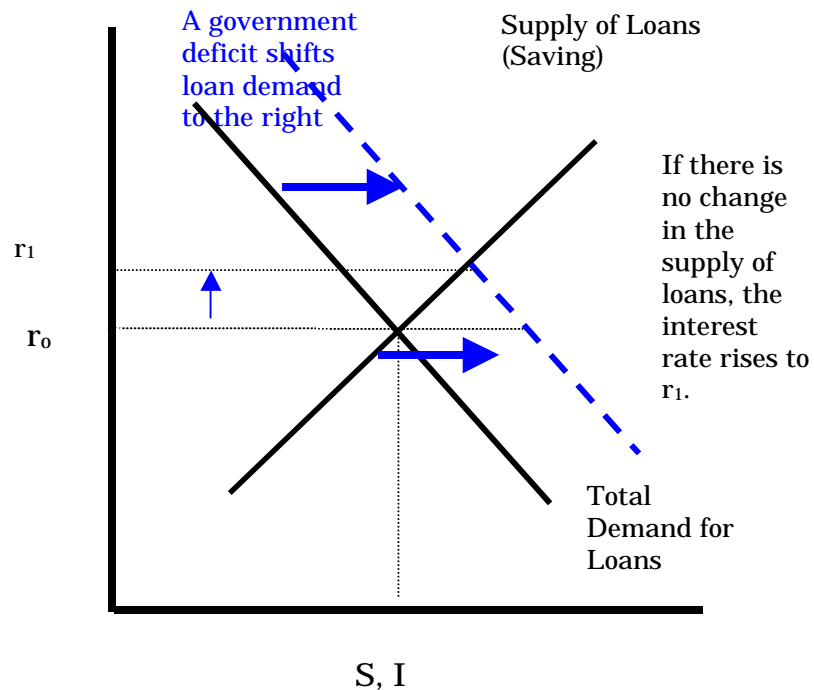
- One school of thought says that people will spend the entire tax cut so that there will no increase in the supply of loans.
- A second school of thought says that people will spend part of the tax cut, so that there will be an increase in the supply of loans, but less than the increase in the demand for loans.
- The third school of thought says that people will spend none of the tax cut. They know that ultimately they must pay back the money the government has borrowed, so that the tax cut is merely a sham. Thus, the supply curve will shift to the right by the same amount as the demand for loans.

Few believe in the first possibility. Almost all economists expect that additional saving will offset *at least some* of the extra government borrowing. There is disagreement between the last two panels. Similarly, most economists would doubt the third possibility, so that the extra saving would not fully offset the borrowing.

Other economists would disagree, arguing that there would be no increase in consumption. They would argue that government borrowing must eventually be paid back with interest. While people see the benefits of a tax cut, they also see the costs of a future debt payment whose present value exactly offsets the tax cut. On balance, they will see the tax cut as simply a loan to be paid back with interest. Since they are no better off, there is no basis to increase consumption.

Figures 6-9 through 6-11 show the three cases.

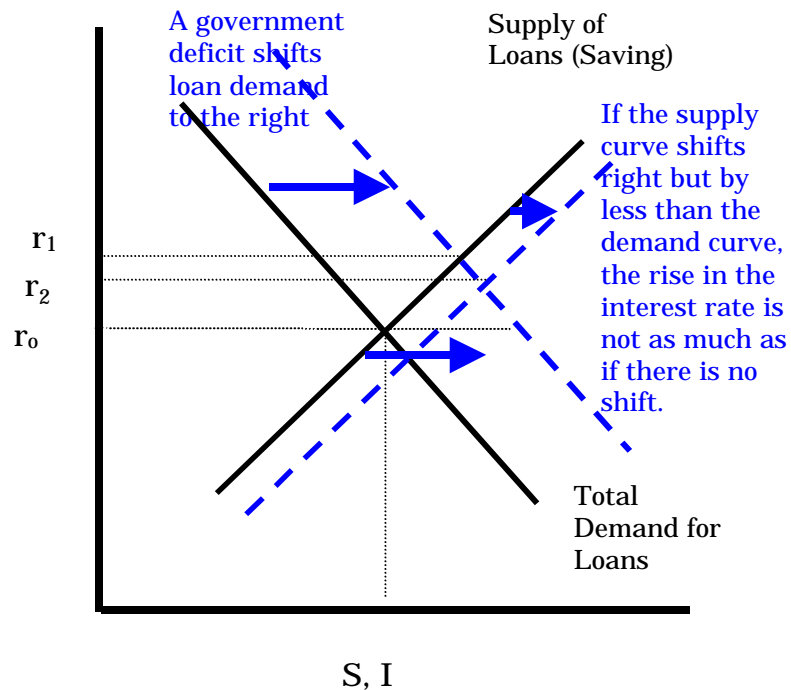
Figure 6-9  
Impact of a Tax Cut on the Demand and Supply of Loans with no additional saving



There are three views of how the supply of loans will respond to a tax cut. One view is that people will spend it all. There is no shift in the supply curve. The interest rate rises and we have "crowding out", with the deficit leading to a lower level of investment.

In the first case, where there is no increase in saving, the interest rate rises. In the second case, the case of a partial offset, the interest rate rises, but not as much as it would without the additional saving. In either case, there is some "crowding out" as the government deficit reduces the amount of investment.

Figure 6-10  
Impact of a Tax Cut on the Demand and Supply of Loans with Partial Offset

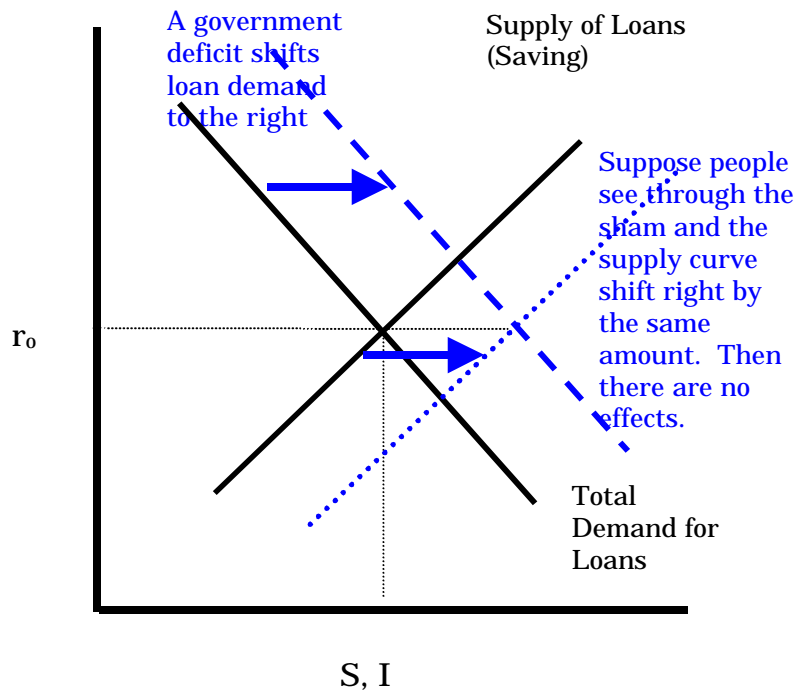


Suppose people will save part of the tax cut. The supply curve shifts to the right, but not as much as the demand curve. The interest rate rises, but not as much as it would without any increase in the supply curve. The interest rate rises and we have "crowding out", with the deficit leading to a lower level of investment, though the crowding out is partially offset by increased investment.

In the case where people see through the tax cut and see it as simply deferred taxation, then the supply of loans shifts to the right and there is a full offset. Thus there is no increase in the interest rate and no crowding out.

Is this case reasonable? Some example will make the point that it is.

Figure 6-11  
Impact of a Tax Cut on the Demand and Supply of Loans with a Full Offset



If people see through the tax cut they will save it all and the shift in the supply curve will match the shift in the demand curve. If so, then there will be no change in interest rates, no crowding out and no effect on investment.

#### Example One

- Fred owes \$20,000 to Key Bank, who sells his note to Huntington Bank. Would you expect Fred's consumption to increase/decrease/remain the same?

Most people would say that whom Fred owes the money to makes no difference.

#### Example Two

- Fred has a student loan obligation of \$20,000, payable to the United States Government. The Government sells his note to Key Bank and tells Fred to make his payments to Key.

Would you expect his consumption to increase/decrease/  
remain the same?

Most people would say that whom Fred owes the money to makes no difference.

#### Example Three

- Fred's "share" of the National Debt is \$20,000. The US Government forces Fred to borrow \$20,000 from Key Bank and to make principal and interest payments to the Bank. Would you expect his consumption to increase/decrease/  
remain the same?

Surprise. Does it really make any difference whom Fred owes the money to? In all of these cases, common sense says that, while the fact that Fred owes \$20,000 matters, to whom he owes the money does not matter. Thus, there should be no change in consumption.

#### Example Four

- The US Government decides to build a new \$10 Billion road system. Fred's "share" of the cost is \$1,000, and the government imposes a special tax of \$1,000. What will happen to his consumption?

His consumption will decline. The money to pay the tax has to come from somewhere, but we would also expect it to decline by less than \$1,000. Part of the bill will be paid by reduced saving, which of course will mean less consumption in the future.

#### Example Five

- The US Government decides to build a new \$10 Billion road system. Fred's "share" of the cost is \$1,000, and the government decides to pay for it by borrowing and then requiring Fred to pay taxes to service the debt.

This is the surprise. Fred really does not care which way the government finances the project. If it borrows, it is as if he was forced to take out a bank loan to pay his share. He can pay it off now or later. Suppose, for example, that Fred responded to the \$1,000 tax bill by cutting consumption by \$200 and cutting saving by \$800. That is, he decided to reduce future consumption by \$800. He can do the same thing if the government borrows \$1000 on his behalf. He can reduce consumption by \$200, put the money aside to pay debt service on \$200 of the new government debt, and pay for the service on the remaining \$800 by reducing future consumption.

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

- The impact of government deficits on saving and consumption decisions is complicated. In our analysis here, we have ignored the impact of the incentive effects on Fred's willingness to work. After all, the cut in the income tax from 33% to 25% means Fred will work longer and make more money. Aside from any tax effects, this will increase his income and both his consumption and saving. We will come back to this topic when we take up fiscal policy. The crucial point here is that simply that the tax cut is not "found money". Fred and others will have to pay later for any additional government borrowing.

### ***The Price Level***

Again, there are also effects on the price level. Recall the equation of exchange:

$$P = MV/y$$

If  $y$  is increasing, it is clear, holding  $M$  and  $V$  constant, that the price level must fall as well.

### **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?***

Section from Stockman	Coverage
Ch. 7, Applying the Model	Covered, though in perhaps more detail than in Stockman.

***What material is new?***

In the last two examples, we work through all four markets. The examples of Fred's consumption have been added.

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