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**IS-LM Model of a Closed Economy – Part II**

Introduction

In the notes file *macro-ISLM1*, we used the IS-LM model to forecast how events change equilibrium in the **short run** in a closed economy (no foreign trade). In these notes, we will:

1<sup>st</sup>:

Claim that in the **long run**, equilibrium real GDP cannot be different from full employment real GDP.

2<sup>nd</sup>:

Therefore, if equilibrium real GDP differs from its full employment level in the short run, then there must be a *transition* from the short run to the long run in which real GDP returns to its full employment level.

3<sup>rd</sup>:

Describe 3 possible transitions from the short run to the long run—a *natural* transition and 2 *government-induced* transitions.

4<sup>th</sup>:

Graph the transitions using an IS-LM model, with a *full employment line* added to it.

5<sup>th</sup>:

Use the IS-LM model to trace all of the parts of the business cycle, from start to finish, and discuss changes to the composition of aggregate expenditures that can occur in the long run.

And Now, a Note

Macroeconomists are not in full agreement regarding how the economy works. Our descriptions in this set of notes try to follow the mainstream view—the view that you will most likely encounter in the business world. (The textbook calls this view the “Keynesian” view.) Time limitations prevent us from discussing other views of how the economy works.

Why do economists believe that real GDP must eventually return to its full employment level?

Consider an economy in which real GDP is (temporarily) **above** its full employment level. This means that the economy’s factors of production—land, labor, and capital—are being used beyond their long term ability to produce stuff, and that some event must therefore bring the economy back to long run equilibrium. (Consider the starship Enterprise; it can temporarily cruise at speeds of warp 10, but too long at that speed and the ship will overheat, forcing it back down to a slower speed.)

Now consider an economy in which real GDP is temporarily **below** its full employment level. This means that there are factors of production that are unemployed or underemployed. Economists believe that producers will not let these valuable factors lay idle forever (and the unemployed will not let themselves stay out of work forever), and that conditions will eventually arise which will get the unemployed factors working again. And when they work, production rises back to its full employment level.

We'll discuss these transitions from the short run to the long run in more detail below. But first, let's correct an oversimplification that we made in the notes file macro-ISLM1—the assumption that prices never change. In fact, we know that prices do change.

### Another Look at Prices in Our Closed Economy IS-LM Model

**We will now assume the following (still a simplification, but not as bad):**

- In the short run (roughly speaking, 0 to 6 months), prices do not change**
- After the short run (roughly speaking, 6 month or more) prices do change**

This captures the fact that prices do adjust slowly when some event affects the economy; that is, other variables adjust more quickly than prices do in a typical economy.

How does allowing for flexible prices affect our closed economy IS-LM model? The direct effect is on the LM curve.

Recall that the real money supply = nominal money supply / average price level

Note that if the average price level changes, the real money supply changes. In particular, in our closed economy ISLM model:

1. If prices rise, then the real money supply shrinks. This causes the LM curve to shift up (resulting in higher interest rates). The idea is that money is harder to come by, so borrowers must pay higher interest rates in order to borrow some.
2. If prices fall, then the real money supply gets bigger. This causes the LM curve to shift down (resulting in lower interest rates). The idea is that money is easier to come by, so borrowers can pay lower interest rates in order to borrow some.

Combine 1 and 2 with what we already know about the LM curve and we arrive at the following knowledge:

Shifting the LM curve: The LM curve shifts if the Central bank changes the nominal money supply OR if the average price level changes.

Ok. Now back to our discussion of transitions from the short run to the long run

### **An overheated economy and the transition back to full employment GDP—a closer look**

Suppose an economy is operating above its full employment level of real GDP, with factors of production—especially labor—being used beyond their long run capacities. How will the economy cool down?

There are two possibilities—the economy will cool down *without* government interference, or it will cool down *with* government interference.

#### Cooling down **without** government interference: a *hard landing*

Consider an overheated economy, with an unemployment rate below the full employment rate. This means that there are shortages of labor and that workers are overworked.

#### *Transition, version 1:*

1<sup>st</sup>: Workers demand and get higher wages, driving production costs up.

2<sup>nd</sup>: Producers are forced to raise prices to cover their higher costs—*inflation rises*.

3<sup>rd</sup>: Higher inflation (and a passive Central Bank) causes the real money supply to fall.

4<sup>th</sup>: A smaller real money supply drives interest rates up.

5<sup>th</sup>: Higher interest rates reduce consumption and investment expenditures.

6<sup>th</sup>, part A: Producers respond to the lower expenditures by reducing production—*real GDP falls* back to its full employment level.

6<sup>th</sup>, part B: As real GDP falls, producers need less labor, so they lay off workers or cancel overtime or both—the *unemployment rate rises* back to its full employment level.

*Summary:* During the transition, inflation rises, real GDP and real national income fall, and unemployment rises. None of this stuff is very good, especially the higher inflation. We have a hard landing.

Cooling down with Central Bank interference: a *soft landing*

Consider an overheated economy, with an unemployment rate below the full employment rate. This means that there are shortages of labor and that workers are overworked. If government does nothing, then the transition (version 1) described above will occur. Suppose however, that the Central Bank wishes to avoid the inflation that would occur if the version 1 transition takes place. Observe:

*Transition, version 2:*

1<sup>st</sup>: (Before workers have time to demand higher wages) The Central Bank reduces the nominal money supply, causing the real money supply to fall

2<sup>nd</sup>: A smaller real money supply drives interest rates up.

3<sup>rd</sup>: Higher interest rates reduce consumption and investment expenditures.

4<sup>th</sup>, part A: Producers respond to the lower expenditures by reducing production—*real GDP falls* back to its full employment level.

5<sup>th</sup>, part B: As real GDP falls, producers need less labor, so they lay off workers or cancel overtime or both—the *unemployment rate rises* back to its full employment level.

*Summary:* During the transition, inflation remains constant, real GDP and real national income fall, and unemployment rises. The economy has cooled off without inflation! We have a soft landing.

Cooling down with fiscal policy interference: another version of a *soft landing*

Consider an overheated economy, with an unemployment rate below the full employment rate. This means that there are shortages of labor and that workers are overworked. If government does nothing, then transition version 1 described above will occur. Suppose further that the Central Bank remains passive, doing nothing. Well, we can still have a soft landing if the legislative and executive branches act properly. Observe:

*Transition, version 3:*

1<sup>st</sup>: The executive and legislative branches reduce government spending (G and/or transfer payments) and/or raise taxes (before workers have time to demand higher wages).

2<sup>nd</sup>: The tightened fiscal policy reduces aggregate expenditures.

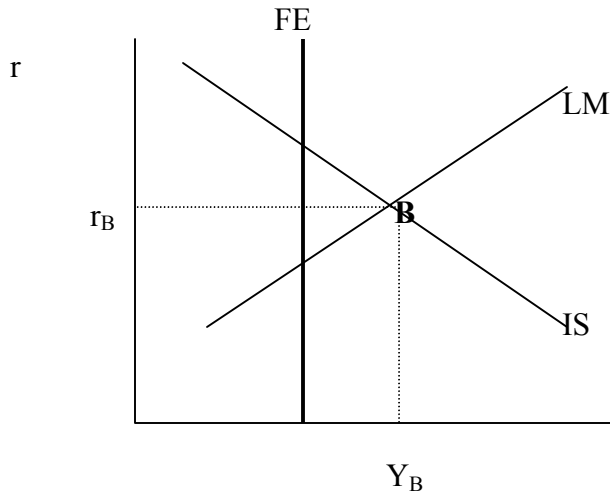
4<sup>th</sup>, part A: Producers respond to the lower expenditures by reducing production—*real GDP falls* back to its full employment level.

5<sup>th</sup>, part B: As real GDP falls, producers need less labor, so they lay off workers or cancel overtime or both—the *unemployment rate rises* back to its full employment level.

*Summary:* During the transition, inflation remains constant, real GDP and real national income fall, and unemployment rises. The economy has cooled off without inflation! We have another version of a soft landing.

Graphs of the three transitions described above, using an IS-LM model

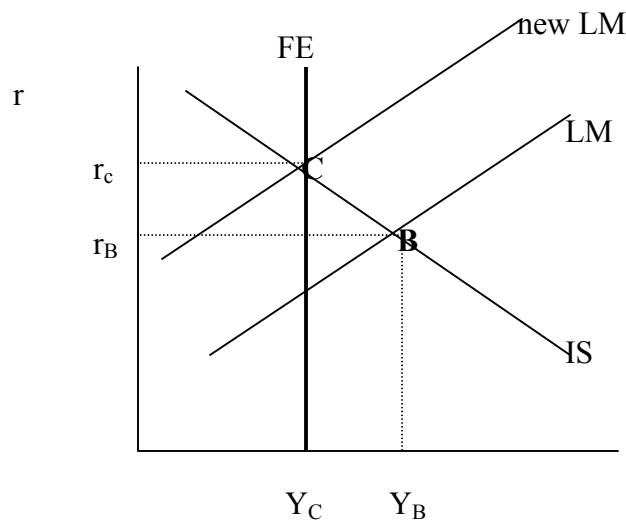
We know that equilibrium in the economy is where the IS curve intersects the LM curve. Let's add a vertical line, labeled "FE," indicating the level of full employment GDP. Point B on the graph below illustrates an economy in short run equilibrium above the full employment level of real GDP.



We know that output level  $Y_B$  is unsustainable in the long run;  $Y$  will fall in one of three ways (transition 1 or transition 2 or transition 3). Let's graph them all.

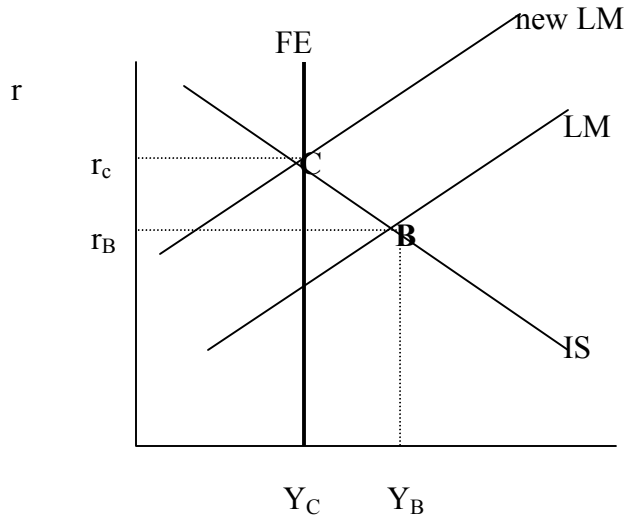
Transition 1 graphed:

Higher prices change money market equilibrium, forcing interest rates up. Graphically, this is an upward shift of the LM curve. Long run equilibrium is restored at point C:



Transition 2 graphed:

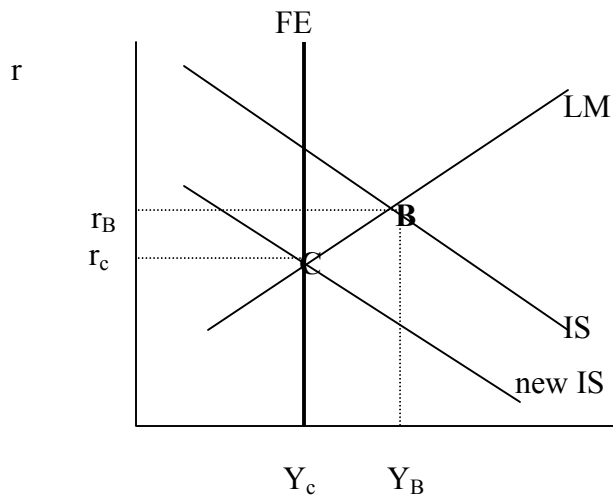
A reduced money supply changes money market equilibrium, forcing interest rates up. Graphically, this is an upward shift of the LM curve. Long run equilibrium is restored at point C:



Warning! Though the graphs of transition 1 and transition 2 are identical, all else is NOT identical! In particular, inflation is higher (at point C compared to point B) in transition 1, whilst it is unchanged in transition 2.

Transition 3 graphed:

The tight fiscal policy reduces aggregate expenditures; graphically, this is a downward shift of the IS curve. Long run equilibrium is restored at point C:



Note that interest rates are lower at point C (compared to point B) in transition 3.

### **A recessionary gap and the transition back to full employment GDP—a closer look**

The U.S. economy in November 1982 was operating below its full employment level of real GDP, with factors of production—especially labor—being used below their long run capacities. This is known as a recessionary gap. How will the economy move back to full employment GDP?

There are two possibilities—the economy will recover without government interference, or it will recover with government interference.

#### Recovery without government interference:

Consider an anemic economy, with an unemployment rate above the full employment rate. This means that there are unemployed and underemployed workers.

#### *Transition, version 4:*

1<sup>st</sup>: Unemployed workers accept lower wages (lower than their pre-unemployment levels of pay) to get work, driving production costs down and *reducing the unemployment rate*.

2<sup>nd</sup>: Producers are forced to reduce prices as competition drives prices down—*inflation falls*.

3<sup>rd</sup>: Lower inflation (and a passive Central Bank) causes the real money supply to rise.

4<sup>th</sup>: A larger real money supply drives interest rates down.

5<sup>th</sup>: Lower interest rates increase consumption and investment expenditures.

6<sup>th</sup>, part A: Producers respond to the higher expenditures by increasing production—*real GDP rises* back to its full employment level.

*Summary:* During the transition, inflation falls, real GDP and real national income rise, and unemployment falls.

Some economists believe that this natural recovery can take a long time to occur, since unemployed workers are often reluctant to take pay cuts (below their old pre-unemployment levels of pay) to regain employment.

Recovery with Central Bank interference:

Consider an anemic economy, with an unemployment rate above the full employment rate. This means that there are unemployed and underemployed workers. If government does nothing, then the transition (version 4) described above will occur. Suppose however, that the Central Bank wishes to avoid the possible long recovery time that would occur if the version 4 transition takes place. Observe:

*Transition, version 5:*

1<sup>st</sup>: (Before the unemployed get around to accepting pay cuts) The Central Bank increases the nominal money supply, causing the real money supply to rise

2<sup>nd</sup>: A larger real money supply drives interest rates down.

3<sup>rd</sup>: Lower interest rates increase consumption and investment expenditures.

4<sup>th</sup>, part A: Producers respond to the higher expenditures by increasing output—*real GDP rises* back to its full employment level.

5<sup>th</sup>, part B: As real GDP rises, producers need more labor, so they hire workers—the *unemployment rate falls* back to its full employment level.

*Summary:* During the transition, inflation remains constant, real GDP and real national income rise, and unemployment falls. The economy has recovered, perhaps more quickly than if government did nothing!

Recovering with fiscal policy interference:

Consider an anemic economy, with an unemployment rate above the full employment rate. This means that there are unemployed and underemployed workers. If government does nothing, then transition version 4 described above will occur. Suppose further that the Central Bank remains passive, doing nothing. Well, we can still have a fast recovery if the legislative and executive branches act properly. Observe:

*Transition, version 6:*

1<sup>st</sup>: The executive and legislative branches increase government spending (G and/or transfer payments) and/or cut taxes (before workers get around to accepting pay cuts).

2<sup>nd</sup>: The fiscal policy increases aggregate expenditures.

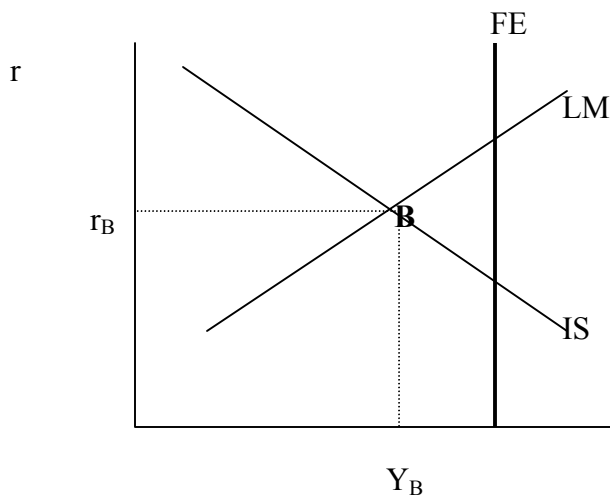
4<sup>th</sup>, part A: Producers respond to the higher expenditures by increasing production—*real GDP rises* back to its full employment level.

5<sup>th</sup>, part B: As real GDP rises, producers need more labor, so they hire workers—the *unemployment rate falls* back to its full employment level.

*Summary:* During the transition, inflation remains constant, real GDP and real national income rise, and unemployment falls. The economy has recovered quickly!

Graphs of the transitions 4-6 described above, using an IS-LM model

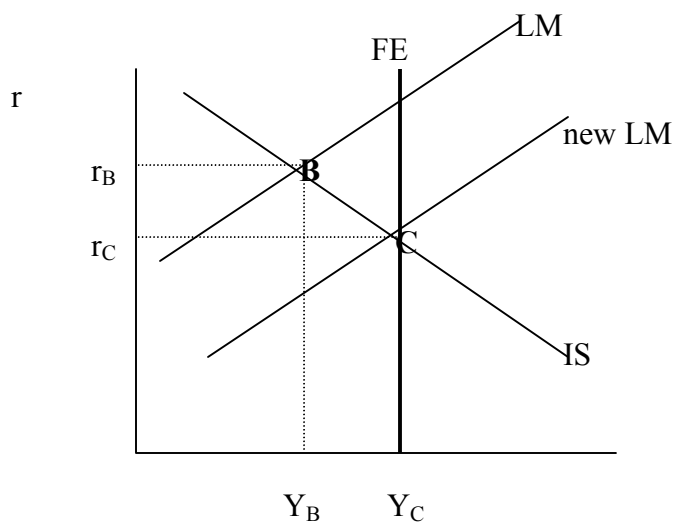
We know that equilibrium in the economy is where the IS curve intersects the LM curve. Let's add a vertical line, labeled "FE," indicating the level of full employment GDP. Point B on the graph below illustrates an economy in short run equilibrium below the full employment level of real GDP.



We know that output level  $Y_B$  is unsustainable in the long run;  $Y$  will rise in one of three ways (transition 4 or transition 5 or transition 6). Let's graph them all.

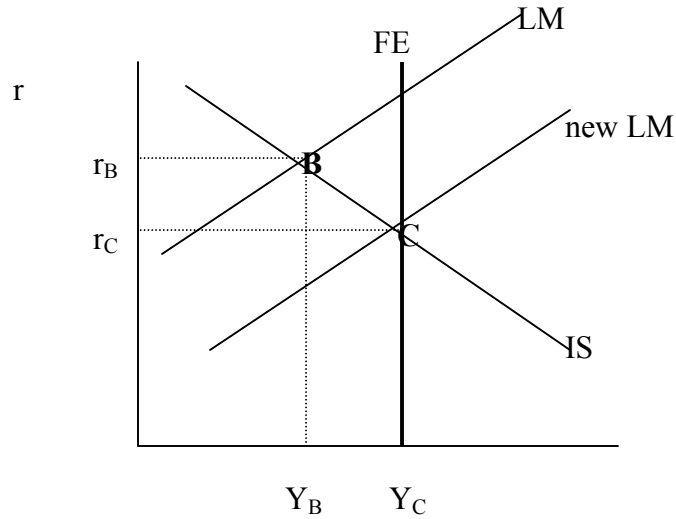
Transition 4 graphed:

Lower prices change money market equilibrium, forcing interest rates down. Graphically, this is a downward shift of the LM curve. Long run equilibrium is restored at point C:



Transition 5 graphed:

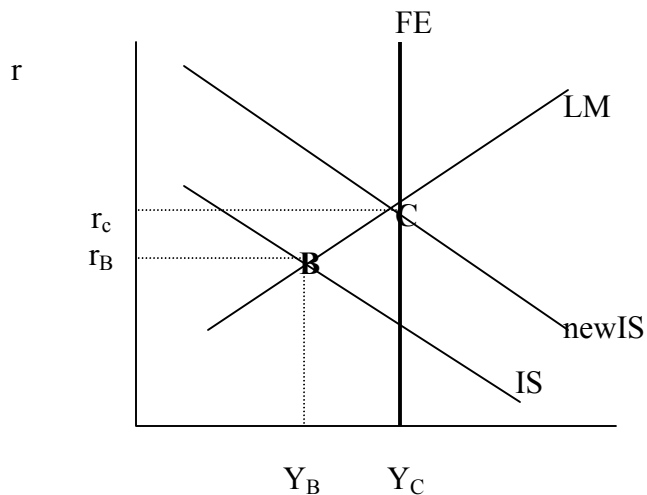
A larger money supply changes money market equilibrium, forcing interest rates down. Graphically, this is a downward shift of the LM curve. Long run equilibrium is restored at point C:



Warning! Though the graphs of transition 4 and transition 5 are identical, all else is NOT identical! In particular, inflation is lower (at point C compared to point B) in transition 4, whilst it is unchanged in transition 5.

Transition 6 graphed:

The loosened fiscal policy increases aggregate expenditures; graphically, this is an upward shift of the IS curve. Long run equilibrium is restored at point C:



Note that interest rates are higher at point C (compared to point B) in transition 6.

## **The Whole Enchilada: Analysis of Business Cycles in a Closed Economy Using the IS-LM model**

For our purposes, a business cycle occurs in the following sequence:

1<sup>st</sup>: The economy begins at rest in long run equilibrium (at point A on an IS-LM graph). Then, an event occurs.

2<sup>nd</sup>: Short run effects: The economy is affected by the event over 6-12 months, as  $Y$ ,  $r$  and other things change. (On an IS-LM graph, the economy moves from point A to point B.)

3<sup>rd</sup>: Transition: Over 12-24 months, other things (described in transitions 1-6) occur to bring the economy back to full employment real GDP. (On an IS-LM graph, the economy moves from point B to point C.)

4<sup>th</sup>: The economy has returned to full employment real GDP. But the COMPOSITION of aggregate expenditures (the portion of  $Y$  attributed to  $C$ ,  $I$ , and  $G$ ) may be different from its original composition.

There are tons and tons of different possible business cycles. It is impossible to review them all. Let's do a few to give you the idea. You should then be able to analyze all sorts of business cycles on your own.

### **Business cycle example #1: A permanent reduction in the personal savings rate. (No government intervention in the transition from short run to long run.)**

1<sup>st</sup>: The economy begins at rest in long run equilibrium. Then, households permanently reduce their savings rates (perhaps because Oprah told them to).

2<sup>nd</sup>: Short run effects.

Consumption rises, causing an increase in aggregate expenditures. The IS curve shifts to the right, and the economy moves from A to B.  $Y$  rises beyond its full employment level and  $r$  rises. Unemployment falls. Investment is lower due to the higher interest rates.

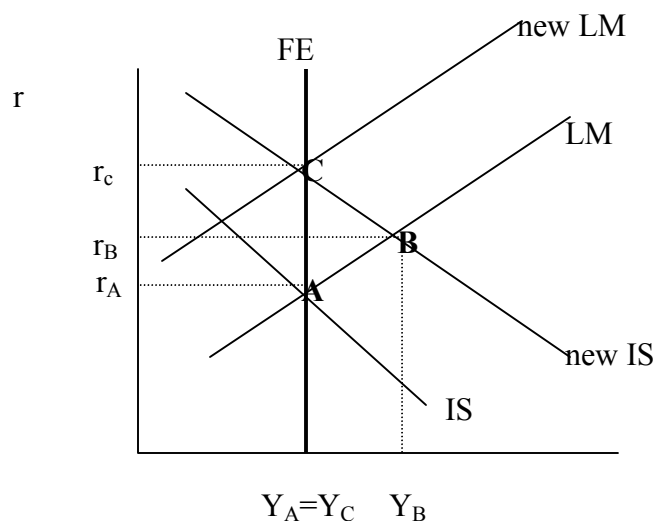
3<sup>rd</sup>: Transition:

Overworked workers demand and get higher wages, pushing up production costs. Producers are forced to raise prices. Higher prices push interest rates up even higher. Higher interest rates cause investment to go down even more. Even the higher consumption is tempered by the higher interest rates (though it is still higher than its original level at point A). Producers respond to the now waning spending by reducing production and workers. The economy moves from point B to point C.

4<sup>th</sup>: Output returns to its full employment level. But interest rates are higher, consumption is higher, inflation is higher and investment is lower.

More analysis: Since long run investment is reduced, the very long term growth prospects (according to the growth accounting equation and the Solow growth model) of this economy are dimmer.

Graph of business cycle example #1:



Business cycle example #2: Reverse mania causes the stock market to crash and remain low for a long long time. A few months after the crash, government intervenes by cutting household taxes to hasten transition from short run to long run

1<sup>st</sup>: The economy begins at rest in long run equilibrium. Then, the stock market crashes and stays low for a long long time.

2<sup>nd</sup>: Short run effects.

Consumption falls (the wealth effect), causing a reduction in aggregate expenditures. The IS curve shifts to the left, and the economy moves from A to B.  $Y$  falls below its full employment level and  $r$  falls. Unemployment rises.

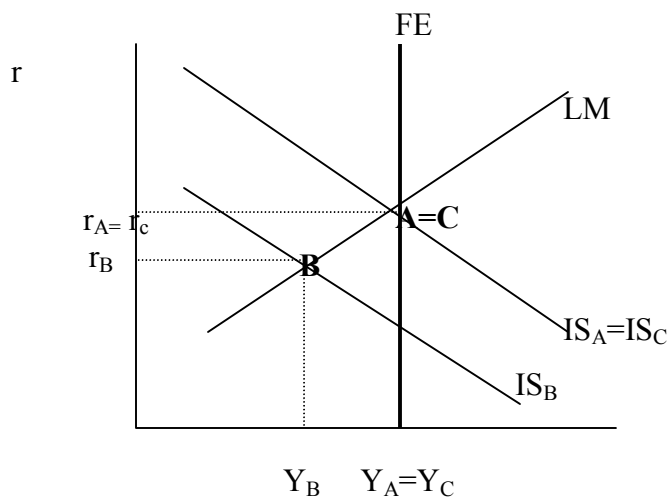
3<sup>rd</sup>: Transition:

Government cuts taxes, restoring consumption to its original level before the crash. The IS curve shifts back to where it was before the crash. Interest rates and  $Y$  return to their pre-crash levels.

4<sup>th</sup>: Output returns to its full employment level. Interest rates are unchanged from point A, consumption is unchanged from A, inflation is unchanged from A and investment is unchanged from A.

More analysis: The proper response by the fiscal and monetary authorities may have prevented the Great Depression and all of its associated suffering.

Graph of business cycle example #2:



Business cycle example #3: Government forces all employers to pay for all of their workers' health care costs. (No government intervention in the transition from short run to long run.)

1<sup>st</sup>: Economy begins in long run equilibrium as A. Then, the unfunded government mandate drives production costs higher.

2<sup>nd</sup>: Short run effects: Higher production costs force firms to raise prices. Higher prices (and a passive Central Bank) cause the real money supply to shrink and interest rates to rise. The LM curve shifts up. Consumption and investment fall. Firms respond by reducing output and laying off workers, so real GDP falls and unemployment rises. The economy moves from point A to point B.

3<sup>rd</sup>: Transition: The unemployed offer to work for less than their previous pay rates. Production costs fall back to their original levels, allowing firms to reduce prices to their original levels. Hence interest rates fall to their original levels (the LM curve shifting back to where it was originally), and consumption and investment rise back to their original levels. Real GDP returns to its original level.

4<sup>th</sup>: The economy is back at full employment. Workers have their health care "paid" by their employers, but workers' wages have fallen. (Indeed, if we were using equations to do this model then we would see that workers wages fall by exactly the cost of the health care. So who really pays?)

Here's a graph of business cycle #3:

