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Macroeconomics

A Short Run Model of a Large Open Economy with Floating Exchange Rates
and, at the end of the notes,
The Principle of Comparative Advantage

Prologue:
So far in the semester we have built these models of an economy:

Long run model of a closed economy
Long run model of a small open economy
Long run model of a large open economy
(Very long term) Solow growth model
(IS/LM) model of a closed economy

We will now build this model:
(IS/LM) model of a large open economy with floating exchange rates

Introduction:

Our task in this set of notes is to modify the closed economy IS/LM model that we've used previously. We shall:

Discuss foreign exchange rates
Discuss the link between interest rates, foreign exchange rates, and net exports
Add net exports to aggregate expenditures
Do some forecasting with our new model

Foreign exchange rates

The *nominal* foreign exchange rate measures the number of units of one economy's currency that can be exchanged for a number of units of another country's currency on foreign exchange markets.

Example 1: 120 yen per dollar Example 2: 1 yen per .0083333 dollars

Note: Examples 1 and 2 above actually depict the **same** nominal exchange rate

Example 3: 5 francs per dollar Example 4: 1 franc per .20 dollars

Note: Examples 3 and 4 above actually depict the **same** nominal exchange rate

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Nominal foreign exchange rates: floating or fixed?

The governments of most economies allow their nominal exchange rates to rise and fall with market conditions. This is called a *floating* exchange rate regime. (Actually, few governments have a completely hands off approach to foreign exchange rates. Governments occasionally intervene to try to affect foreign exchange rates; this is called a *managed float*.)

Example of floating exchange rates:
The U.S. government almost always allows the value of the dollar to float.

A few governments try to keep their foreign exchange rates fixed relative to another currency (usually the U.S. dollar). This is called a *fixed* exchange rate regime.

Example of fixed exchange rates:
The Chinese government tries to maintain a (fairly) constant dollar/yuan exchange rate.

In this set of notes we build a model of an economy with **floating** exchange rates.

Real foreign exchange rates

A real foreign exchange rate is a theoretical attempt to measure the relative purchasing power of two currencies, each in its home country.

Example: Suppose a 2-bedroom apartment, a car, a year's worth of food, and a TV cost $20,000 in the U.S. and 80,000 pesos in Mexico. The real peso/dollar exchange rate equals

80,000/20,000 = 4 pesos per dollar.

Idea: 4 pesos can buy the same amount of stuff in Mexico as $1 can in the U.S.

It is very difficult to measure real exchange rates in practice.

Fortunately, real exchange rates and nominal exchange rates tend to be moved by the same forces, so for simplicity in modeling we will just use the term "foreign exchange rate."

Causes of changes in foreign exchange rates

In a floating exchange rate regime, foreign exchange rates fluctuate virtually continuously, 24 hours per day.

A currency *appreciates* when it trades for more units of a foreign currency.

Example: The U.S. dollar appreciates relative to the German mark if the mark/dollar foreign exchange rate changes from 1.5 marks per dollar to 1.6 marks per dollar.

A currency *depreciates* when it trades for fewer units of a foreign currency.

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Example: the British pound depreciates if the dollar/pound foreign exchange rate changes from $1.70 per pound to $1.65 per pound.

Many things cause a currency to appreciate or depreciate. Two very important things are:

--average **interest rates**
--**inflation** rates

Example: If U.S. inflation is higher than German inflation, then this puts downward pressure on the value of the U.S. dollar relative to the German mark—i.e. it puts pressure on the dollar to depreciate. (Why? Well, when inflation is high in the U.S. it takes more dollars to buy the same amount of U.S. stuff, so it goes to reason that it would also take more dollars to buy German marks.)

Example: If U.S. interest rates rise relative to Japan's interest rates, then this puts upward pressure on the value of the U.S. dollar relative to the Japanese yen—i.e. it puts pressure on the dollar to appreciate. (Why? Well, higher interest rates in the U.S. make the U.S. a more attractive place for financial investment by the Japanese, increasing their demand for U.S. dollars, driving up the value of the U.S. dollar relative to the yen.)

A simplification for our model: Inflation fairly stable

We will assume for modeling purposes that inflation plays a smaller role in exchange rate fluctuations than interest rates. (This is usually true in the real world in the short run.) So we will IGNORE inflation in foreign exchange rate determination:

higher interest rates in an economy→ economy's currency appreciates
lower interest rates in an economy→ economy's currency depreciates

How Currency Appreciation or Depreciation Affects Net Exports

(Recall that net exports, NX, equals a country's exports of goods and services minus its imports of goods and services.)

An Appreciated Currency causes the economy's net exports to fall

Explanation (using the United States as an example): Suppose that the dollar appreciates relative to foreign currencies. This means that the dollar is more powerful—it can buy more units of foreign currency. Since the dollar can buy more foreign currency, it can also buy more units of foreign products—foreign products become cheaper to Americans. As a result, U.S. imports rise.

Now consider foreign countries. If the dollar appreciates, it takes more units of foreign currency to buy a dollar. This means that it will also take more units of foreign currency to buy U.S. products. As a result, U.S. exports fall.

Result: If U.S. imports are higher and its exports are lower, then U.S. net exports have fallen. (Indeed, if net exports were already negative—a trade deficit—then an appreciated dollar will make them even more negative—increase the trade deficit.)

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A Depreciated Currency causes the economy's net exports to rise
Explanation (using the United States as an example): Suppose that the dollar depreciates relative to foreign currencies. This means that the dollar is weaker—it can buy fewer units of foreign currency. Since the dollar can buy less foreign currency, it can also buy fewer units of foreign products—foreign products become more expensive to Americans. As a result, U.S. imports fall.

Now consider foreign countries. If the dollar depreciates, it takes fewer units of foreign currency to buy a dollar. This means that it will also take fewer units of foreign currency to buy U.S. products. As a result, U.S. exports rise.

Result: If U.S. imports are lower and its exports are higher, then U.S. net exports have risen. (Indeed, if net exports were initially negative—a trade deficit—then an depreciated dollar will make them less negative—reduce the trade deficit.)

Link: Interest rates → foreign exchange rates → net exports

Combining results of the previous analysis, we have developed a link between interest rates, foreign exchange rates, and net exports, as follows:

interest rates fall → currency depreciates → net exports rise

interest rates rise → currency appreciates → net exports fall

We will add this information to our IS/LM model

An IS/LM Model of a Large Open Economy with floating exchange rates

Equilibrium in a large open economy in the short run:

In short run equilibrium, two important conditions are met:

- Condition 1. real Aggregate demand = real GDP, or **C + I + G + NX = Y**

  --This is known as *product market equilibrium*.

- Condition 2. real Money demand = real Money Supply, or **L(r,Y) = M^s/P**

  --This is known as *money market equilibrium*

It is sometimes useful to view the short run economy using a graph, known as an *IS-LM diagram*. The IS-LM diagram lets us view the product market separately from the money market on one graph; this may help us to better understand the short run effects of fiscal and monetary policy on the economy.

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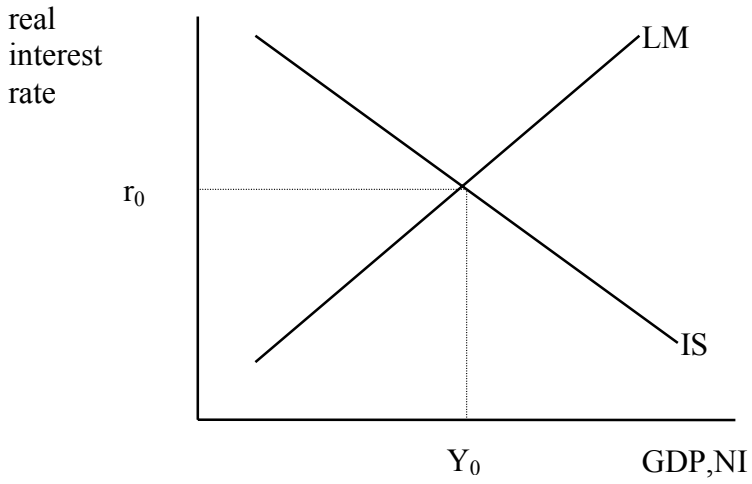
And Now, the IS-LM Model
(for a large open economy with floating exchange rates)

Preview:



The IS Curve: The IS curve depicts all combinations of the *real interest rate* and *real GDP* at which aggregate demand equals output. It depicts *product market equilibrium*.

The IS curve depicts all (r, Y) combinations such that C + I + G + NX= Y.

The IS curve slopes downward. Why? Pick a point on the upper portion of the IS curve—say, point A depicted below. Notice that the real interest rate is at level r_A, and the GDP level is at Y_A.

Now suppose that something happens in the economy (say, an increase in the money supply) that reduces the real interest rate to r_B. What must happen to GDP in order to keep aggregate demand equal to GDP—to maintain product market equilibrium? Answer: GDP must increase, bigger than its level at Y_A. Here's why:

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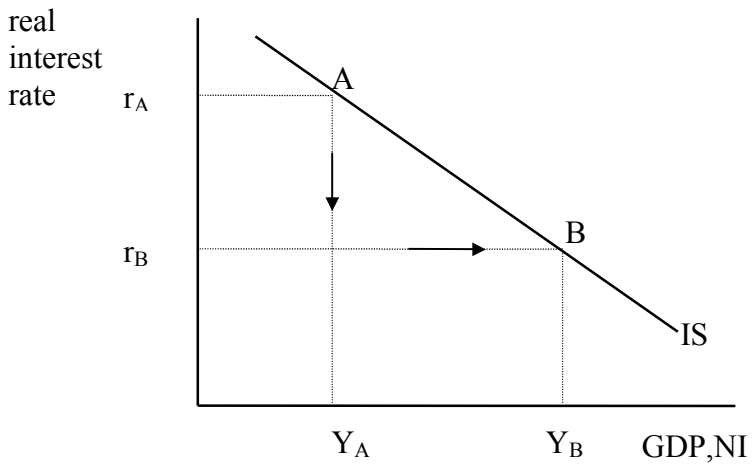
Why The IS Curve Slopes Downward

real interest rate falls from r_A to r_B (say, due to money supply increase) → Consumption and investment rise. (It's cheaper to borrow.) Also, net exports rise due to a depreciated currency → Aggregate demand rises (since C and I and NX are important components of AD) → GDP must increase from Y_A to Y_B to keep production equal to aggregate demand



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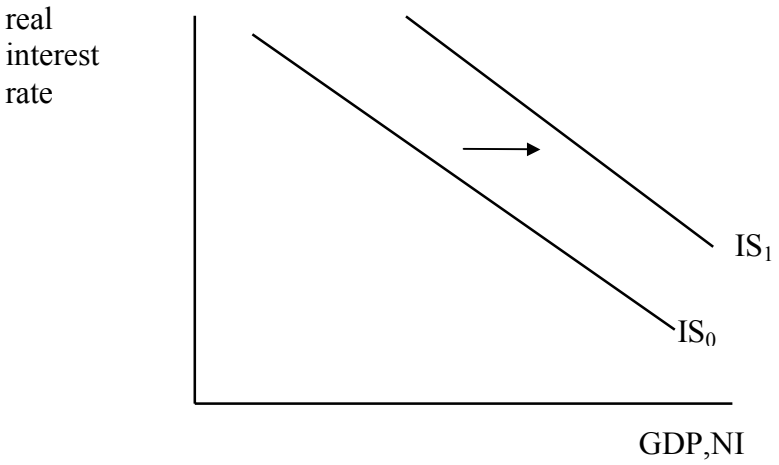
Shifting the IS Curve: Events that increase or decrease aggregate demand at any real interest rate cause the IS curve to shift—leftward if aggregate demand diminishes, rightward if aggregate demand increases. Here's a list:

Events that shift the IS curve to the right:
1. A cut in household tax rates
2. An increase in household transfer payments
3. An increase in government purchases
4. Increased consumer confidence
5. Increased "animal spirits" confidence of CEOs
6. Increased wealth
7. Increased income in foreign countries (causing higher exports)

(Symmetrically opposite events would cause a leftward shift of the IS curve.)



And Now, the LM curve

The LM curve shows all combinations of the real interest rate and real GDP at which the *real money supply* equals *real money demand*. (Note: real money demand is sometimes called the *demand for real balances*.)

In order to understand the LM curve, we must understand the money market—real money supply and real money demand. So let's review:

Real Money Supply : First, a definition. The real money supply equals the nominal money supply divided by the average price level:

real money supply = nominal money supply / average price level

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$$= \frac{M_s}{P}$$

Note 1: We assume that the nominal money supply is precisely controlled by the Central Bank

Real Money Demand (a.k.a. the demand for real balances): Real money demand is the demand for the ability to make transactions—to buy stuff. If one wants to buy stuff in an economy, one needs money—currency, checks, and the like. Hence, the real demand for money is primarily a demand for the ability to buy stuff—products if one is a consumer, and resources if one is a producer.

Important things that influence real money demand in the short run:

1. The real interest rate.
   Ceteris paribus, the higher the real interest rate, the lower will be the economy's real money demand. Reason: the lure of high returns on bonds, CDs, and other non-money assets encourages people to trade their cash and checks for these assets.

2. The level of real national income (Y)
   Ceteris paribus, the higher the level of real national income, the higher will be the economy's real money demand. Reason: households with more income desire to buy more stuff, necessitating more real money holdings.

And now, back to the LM curve:

The LM curve depicts all (r,Y) combinations such that $L(r,Y) = \frac{M_s}{P}$, for a given level of the nominal money supply

The LM curve slopes upward. Why?

Pick a point on the lower portion of the LM curve—say, point A depicted below. Notice that the real interest rate is at level r_A, and the GDP level is at Y_A.

Now suppose that something happens in the economy (say, an increase in government purchases) that causes producers to increase output to Y_B. Meanwhile, the nominal money supply remains constant. What must happen to the real interest rate in order to keep real money demand equal to the real money supply—to maintain money market equilibrium? Answer: the real interest rate must increase, higher than its level at r_A. Here's why:

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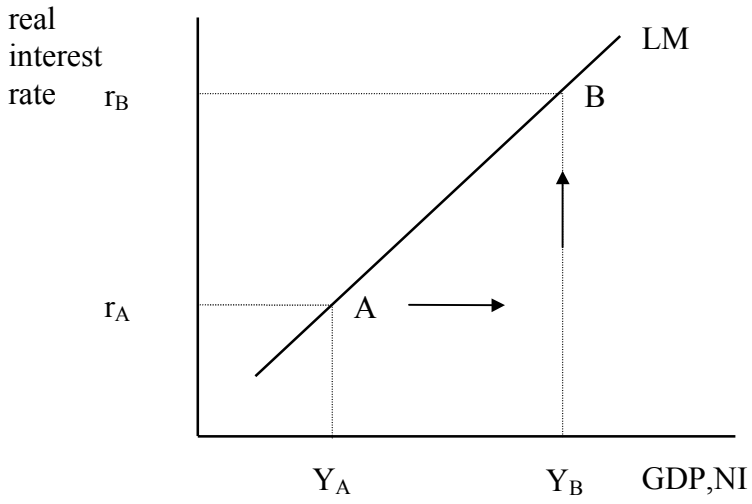
Why The LM Curve Slopes Upward

GDP rises from Y_A to Y_B (say, due to expansionary fiscal policy) → The real demand for money rises; people have higher income (Y_B is higher than Y_A), so they want to buy more stuff. → It's harder for banks and other borrowers to get people to lend them money; households want to keep it to buy more stuff. → Borrowers must offer higher interest rates to get households to part with their money; the real interest rate rises from r_A to r_B



Shifting the LM curve: Monetary policy—a change in the nominal money supply—causes the LM curve to shift. In addition, a change in the average price level causes the nominal money supply to shift.

Example 1: Suppose the Central Bank increases the nominal money supply. This fact, along with our assumption of a fixed price level, means that there's a greater amount of stuff with which to make transactions—cash, checks, and the like. Hence it becomes easier for borrowers to get households to part with some of their cash and checks, since the households have plenty of it. The real interest rate falls. *The LM curve shifts down, illustrating a lower interest rate at any level of GDP*

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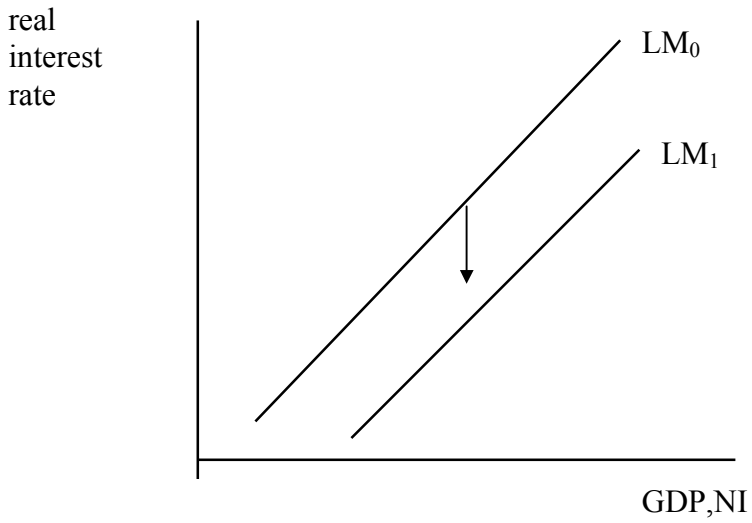
Example 2: Suppose producers cut product prices. This fact, means that the existing nominal money supply can buy more products. Hence it becomes easier for borrowers to get households to part with some of their cash and checks, since the households have plenty of it. The real interest rate falls. *The LM curve shifts down, illustrating a lower interest rate at any level of GDP*



(Note: A reduction in the nominal money supply or higher product prices will cause symmetrically the opposite result.)

The Whole Enchilada: Analysis of Business Cycles in a large open Economy with floating exchange rates Using the IS-LM model

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

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

2nd: 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.)

3rd: Transition: Over 12-24 months, other things (described in transitions 1-6 in the notes file macro-ISLM-part2) 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.)

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

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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.)

1st: The economy begins at rest in long run equilibrium. Then, households permanently reduce their savings rates.

2nd: 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. The currency has appreciated due to the higher interest rates, resulting in lower net exports.

3rd: 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. The currency appreciates even more, resulting in even lower net exports. 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.

4th: Output returns to its full employment level. But interest rates are higher, consumption is higher, inflation is higher, investment is lower and net exports are 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.

Even more analysis: If this economy had a trade deficit at point A, then it is even larger at point C. This means that such an economy would have a larger capital account surplus, resulting in more debt to foreigners and more foreign purchases of domestic assets.

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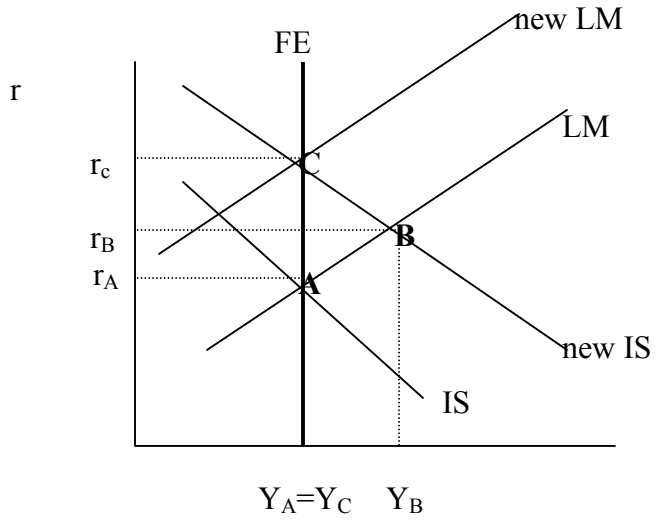
Graph of business cycle example #1:



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

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

2nd: 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. The economy's currency has depreciated, resulting in higher net exports.

3rd: 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, as do net exports

4th: 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 and net exports are 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.

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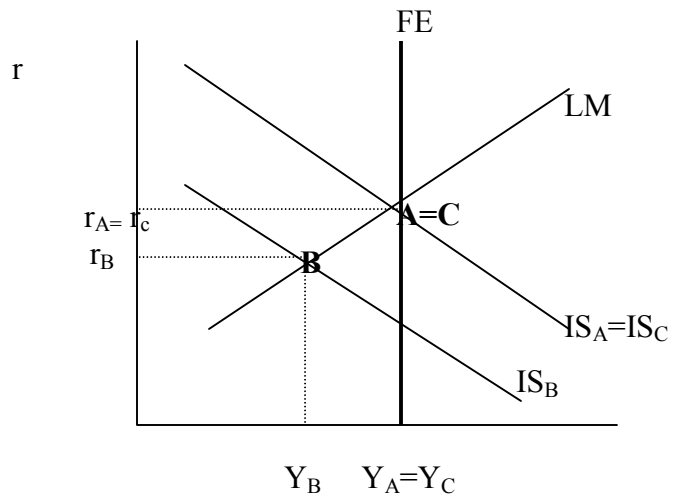
Graph of business cycle example #2:



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.)

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

2nd: 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, the currency appreciates and net exports 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.

3rd: 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. The currency returns to its original value on foreign exchange markets, causing net exports to also return to its original level. Real GDP returns to its original level.

4th: 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?)

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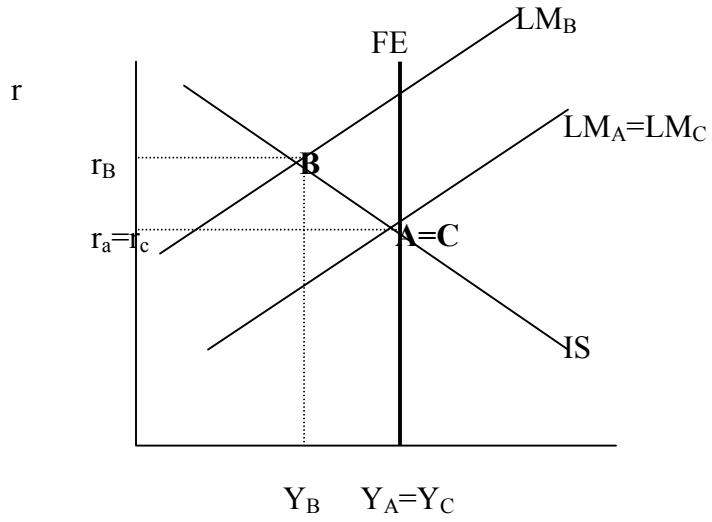
Here's a graph of business cycle #3:



And now for something quite different: The principal of comparative advantage

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Comparative Advantage: Justification of international trade

It would be silly for an individual to try to produce everything that he consumes himself. It is much better for the individual to specialize—doing one or two things himself (usually at his job)—and using the income earned from those things to buy other stuff (produced by other people). In this way, all of us are better off.

Exchange makes people better off

In effect, the individual described above is engaged in a trade; he is producing stuff and trading (the income earned from) it to get other stuff from other people.

Citizens of a country also benefit in the aggregate by trading with citizens of other countries. The principle of **comparative advantage** helps us to see this.

Comparative advantage is a logical framework with which we can see the gains from trade—how an individual or group can be better off by trading, relative to not trading. We will eventually use this principle to examine international trade. First, let's use it to examine trade between two hypothetical individuals.

Biff and Veronica, the only two people in the world, can engage in only two activities—producing food and/or producing clothing. How much can they produce per hour? See the information below:

Biff would take 12 hours to produce 1 unit of food

and/or

6 hours to produce 1 unit of clothing

Veronica would take 1 hour to produce 1 unit of food

and/or

3 hours to produce 1 unit of clothing

Notice that Veronica is 12 times better at food production than Biff and she is 2 times better at clothing production than Biff.

Common sense would tell us that there's no way that Veronica can benefit by trading with Biff. Right?

Wrong.

Veronica should concentrate on food production, trading some of it to Biff in exchange for clothing. Biff should concentrate on clothing production, trading some of it to Veronica for food. Why?

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Let's look at Veronica first:

If Veronica were dumb enough to produce her own clothing, it would distract her from what she does really really well—producing food. Indeed, for every unit of clothing that she is dumb enough to produce for herself, she gives up 3 hours of her valuable time—enough time to produce 3 units of food:

"Cost" of producing 1 unit of clothing for herself = 3 units of food

Veronica would be better off if she could trade some of her food for clothing from Biff—say, by trading 2 units of food for each unit of clothing.

Now let's look at Biff

If Biff were dumb enough to produce his own food, it would distract him from what he does a little better—producing clothing. Indeed, for every unit of food that he is dumb enough to produce, he gives up 12 hours of his valuable time—enough time to produce 2 units of clothing:

"Cost" of producing 1 unit of food for himself = 2 units of clothing

Biff would be better off if he could trade some of his clothing for food from Veronica—say, by receiving two units of food for each unit of clothing that he produces. Notice that both people are better off by trading at the rate of two units of food for one unit of clothing.

Now let's use two countries to illustrate the theory of comparative advantage.

The U.S. and China, the only two countries in a hypothetical world, can engage in only two activities—producing computers and/or producing dolls. How much can they produce per hour? See the information below:

China would take 10 hours to produce 1 computer

and/or

5 hours to produce 1 doll

The U.S. would take 1 hour to produce 1 computer

and/or

4 hours to produce 1 doll

Notice that the U.S. is 10 times better at computer production than China and the U.S. is 1.25 times better at doll production than China.

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Common sense would tell us that there's no way that the U.S can benefit by trading with China. Right? Wrong.

If the U.S. did not trade with China, what is the cost of producing each thing?

U.S. cost of producing 1 computer for itself = 1/4 of a doll

U.S. cost of producing 1 doll for itself = 4 computers

If the China did not trade with the U.S, what is the cost of producing each thing?

China cost of producing 1 computer for itself = 2 dolls

China cost of producing 1 doll for itself = 1/2 of a computer

Analysis of the above cost information

The U.S. has the comparative advantage in computer production, because it sacrifices fewer dolls than China does for each computer that it produces. (The U.S. sacrifices ¼ of a doll; China sacrifices 2 dolls.)

China has the comparative advantage in doll production, because it sacrifices fewer computers than the U.S. does for each doll that it produces. (The U.S. sacrifices 4 computers; China sacrifices ½ of a computer.)

Implication of the theory of comparative advantage

Each country should produce and export things in which it has a comparative advantage, and import the other things.

In our example, the U.S. should export computers and import dolls. China should export dolls and import computers.

In this way, citizens of both countries can consume more of both goods

Let's examine our example further.

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Let's look at the U.S. first:

If the U.S. were dumb enough to produce its own dolls, it would distract the U.S. from what it does really really well—producing computers. Indeed, for every unit of dolls that the U.S. it is dumb enough to produce, it gives up 4 hours of its valuable time—enough time to produce 4 computers:

"Cost" of producing 1 unit of dolls for itself = 4 units of computers

The U.S. would be better off if it could trade some of its computers for dolls from China—say, by trading 2 computers for each doll.

Now let's look at China

If China were dumb enough to produce its own computers, it would distract it from what it does a little better—producing dolls. Indeed, for every unit of computers that China is dumb enough to produce, it gives up 10 hours of his valuable time—enough time to produce 2 units of dolls:

"Cost" of producing 1 unit of computers for itself = 2 units of dolls

China would be better off if it could trade some of its dolls for computers from the U.S.—say, by receiving two computers for each doll that it produces.

Notice that in the aggregate, people are better off in both countries by trading at the rate of two units of computers for one unit of dolls.

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