Economics of Banking and Finance Markets
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Lecture - 55
Policy Effects in IS-LM Framework - III

Hello everyone. Welcome to this session, we are going to discuss the factors that shift the IS schedule.
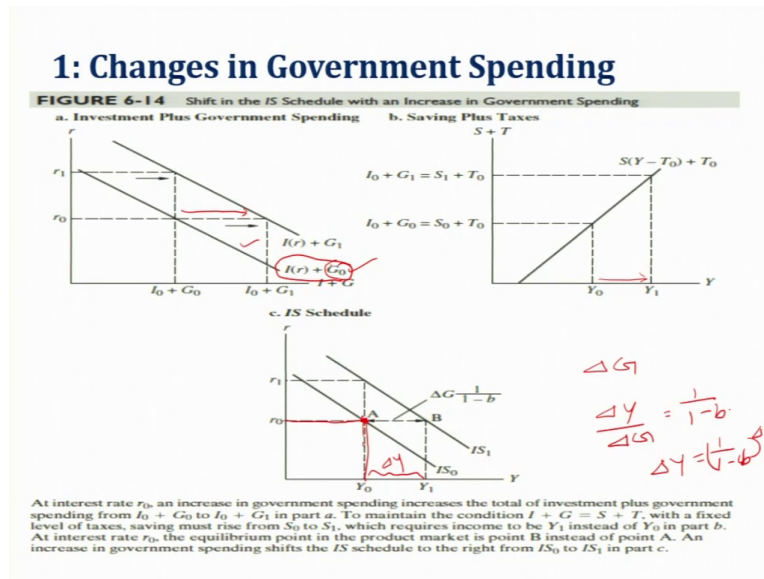
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There are several factors that affect the IS schedule. We narrow down to three major factors. One is changes in government spending and second one is changes in taxes and third one is autonomous changes in investment.

1: Changes in Government Spending

FIGURE 6-14 Shift in the IS Schedule with an Increase in Government Spending

At interest rate r_0, an increase in government spending increases the total of investment plus government spending from $I_0 + G_0$ to $I_0 + G_1$ in part a. To maintain the condition $I + G = S + T$, with a fixed level of taxes, saving must rise from S_0 to S_1, which requires income to be Y_1 instead of Y_0 in part b. At interest rate r_0, the equilibrium point in the product market is point B instead of point A. An increase in government spending shifts the IS schedule to the right from IS_0 to IS_1 in part c.

So, coming to the first part: changes in government spending, in this diagram the initial level of government spending is this much that; that means, G_0 and the initial level of investment is also this much. So, accordingly our initial IS curve is this one, the first one that red mark, this one. This is the initial IS curve and when there is increase in government expenditure and then the curve will be shifting rightwards.

So, you can see that the curve will be shifting this much, and as a result you can also see that saving and tax also must increase and the corresponding level of increase in income is this much. What we have shown here is that the initial position, suppose the rate of interest is this much, initial level of income is this much, and then what we can see that when there is increase in government spending, for example, denoted by G, then using the IS equation you can see that when del G change, then the Y will increase. You can see that del Y del G is equal to 1 by 1 minus b. So, that means, del Y is equal to 1 by 1 minus b times del G. This is what we have seen in the equation.

So, here you can see that when the rate of interest decreases, the that is fine that the rate of interest here remaining constant or the decrease here remaining constant. Then you can see that when there is increase in government spending the GDP Y will the del Y will increase 1 by 1 minus b times right 1 by 1 minus b times del G. So, that distance is this much. So, Y will be increasing this much. This is the del Y.

You can see that IS curve will be shifting rightwards if there is an increase in government expenditure. In contrast to this if there is decrease in government expenditure or suppose compared to the previous year, there is a decrease in government expenditure or there is increase in tax, then the curve will be shifting left wards.

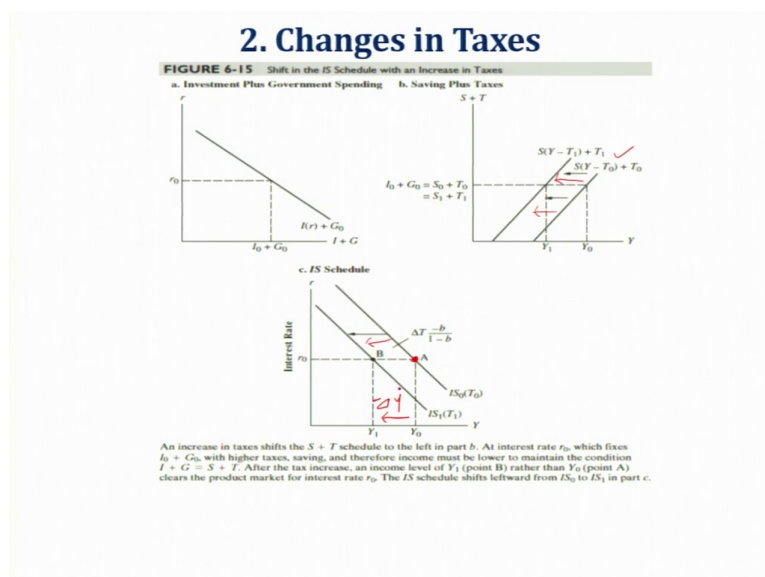(Refer Slide Time: 03:12)

Changes in Government Spending

$$Y = (1/1\text{-}b)\,(a + \bar{I} + G - bT) - i_1 r\,/\,1\text{-}b$$

$$\Delta Y = \frac{1}{1-b}\Delta G$$

$$\left.\frac{\Delta Y}{\Delta G}\right|_{IS} = \frac{1}{1-b} > 0$$

So, coming to here which I have just shown in the previous slide; due to changes in government expenditure there is increase in income del Y is this much, 1 by 1 minus b times del G.

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2. Changes in Taxes

FIGURE 6-15   Shift in the IS Schedule with an Increase in Taxes

An increase in taxes shifts the $S + T$ schedule to the left in part b. At interest rate r_0, which fixes $I_0 + G_0$, with higher taxes, saving, and therefore income must be lower to maintain the condition $I + G = S + T$. After the tax increase, an income level of Y_1 (point B) rather than Y_0 (point A) clears the product market for interest rate r_0. The IS schedule shifts leftward from IS_0 to IS_1 in part c.

Second factor is changes in taxes: Suppose there is increase in taxes when government increases the tax, then you can see that this curve will be shifting left wards.

Now when the government increased tax then the saving plus tax curve will shift left wards, and correspondingly you can see that del Y will be declining.

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2. Changes in Taxes

$Y = (1/1\text{-}b)(a + \bar{I} + G - bT) - i_1 r \,/\, 1\text{-}b$

$$\Delta Y = \frac{1}{1-b}(-b\Delta T)$$

$$\left.\frac{\Delta Y}{\Delta T}\right|_{IS} = \frac{-b}{1-b} < 0$$

How much will be the decline in del Y, this can be denoted by this. The change in del Y is equal to 1 by 1 minus b times minus b del T. So, that means, this much is the decline in income. So, decline in income is going to be this much, this area. This decline in income, that is the del Y we can see, that is negative now. There is a decline in Y this amounts, this much 1 by 1 minus b times minus b times delta T.

3: Autonomous Changes in Investment

Due to changes in business expectations

i) Favorable expectations: shifts the IS to rightwards
(similar to ΔG)
ii) Adverse expectations: shifts the IS to leftwards
(similar to ΔT)

Another factor that affects the IS schedule is the autonomous changes in investment. For example, due to changes in business expectations, for example, if there is a favorable expectation. So, then you can see that at the given rate of interest there will be an increase in autonomous component of investment. So, as a result the IS curve will be shifting rightwards. This is almost like del G because del G is also an autonomous variable; increase in government expenditure is autonomous variable.

Similarly, here also the changes in business expectation, the autonomous investment also increases, the IS curve shift rightwards. If there is adverse expectation for example, war or any other kind of uncertainty in the economy, then the autonomous component of investment will decline and then the IS curve will be shifting left wards.

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1. The *IS* schedule slopes downward to the right.
2. **2.** The *IS* schedule will be relatively flat (steep) if the interest elasticity of investment is relatively high (low).
3. The *IS* schedule will shift to the right (left) when there is an increase (decrease) in government expenditures.
4. The *IS* schedule will shift to the left (right) when taxes increase (decline).
5. An autonomous increase (decrease) in investment expenditures will shift the *IS* schedule to the right (left).

To summarize, these are the key points that we discussed in this session. That means, one IS schedule slopes downward. These are the other factors that we discussed in this session; these are the major summary points.

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- IS LM models combined

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Now, let us bring both IS and LM models together, combine the IS-LM models. I am showing here the IS equation where product market is in equilibrium. That means, I is equal to S, investment is equal to saving, this is the IS equation. In the LM equation, money supply is equal to money demand, that is the money market equilibrium. You are now familiar with both equations.
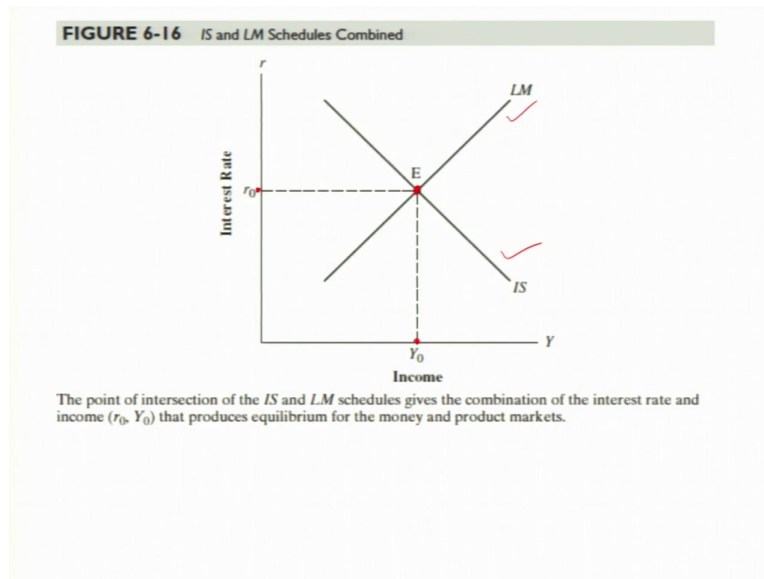
In the macroeconomic equilibrium both product market and money market, that is IS and LM, are at equilibrium. To find out both markets are in equilibrium, you can find out the equilibrium level of rate of interest and equilibrium level of income, where both product market and LM markets are in equilibrium. To find out what you can do that equate IS equation equal to LM equation.

That means, you can directly either estimate IS and LM separately, and then equate or you can directly equate like this, and find out what is the equilibrium level of income.

There are two ways you can solve it: in terms of equilibrium level of income that is Y_0 equating this IS equation with LM equation, you will get the equilibrium level of income.

Alternatively, you can solve it for equilibrium level of rate of interest then you will come up with this equation. This is algebraically, we can find out the IS-LM model come together when both product market and money market in equilibrium.

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FIGURE 6-16   IS and LM Schedules Combined

The point of intersection of the IS and LM schedules gives the combination of the interest rate and income (r_0, Y_0) that produces equilibrium for the money and product markets.

So, diagrammatically, we can show in this way, the LM curve and the IS curve and this is the equilibrium position. At this position, you can see that both product market and money market are equilibrium, and the equilibrium level of rate of interest is r_0 and equilibrium level of income is Y_0. So, at this rate of interest r_0 and Y_0, we can see that both product market and money market are in equilibrium.

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1. Suppose that

$$C = 60 + 0.8Y_D$$
$$I = 150 - 10r$$
$$G = 250$$
$$T = 200$$
$$M^s = 100$$
$$M^d = 40 + 0.1Y - 10r$$

a. Write the equations for the IS and LM schedules.
b. Find the equilibrium values for income (Y_0) and the interest rate (r_0).

Answer: The IS curve is $Y = 2,300 - 50r$
The LM curve is $Y = 600 + 100r$.
The equi value of output is $Y_0 = 1,733$ & the equi is $r_0 = 11.33$

2. Suppose we change the model in problem 1 such that investment is assumed to be completely interest inelastic; investment does not depend on the rate of interest and we have $I = 150$.

a. Write the new equations for the IS and LM schedules. Show the schedules graphically.
b. Find the new equilibrium values for income and the interest rate.

Answer: Now the IS curve is vertical at $Y_0 = 2,300$. The LM curve remains unchanged, and given the equilibrium value of output, the equilibrium interest rate is $r_0 = 17$. ($2300 = 600 + 100r$; $=1700 = 100r$; $r = 17$)

You can also do some numerical exercise to find out the equation for the IS curve and the LM schedule, and as well as for calculating the equilibrium value. So, here I have given some

values for relevant variables and write the equation for the IS and LM schedules, and similarly find the equilibrium values for income and interest rate. The IS curve can be written as Y is equal to this IS curve written in terms of income and the LM curve can be written like this.

You can plug these values in the IS equation and LM equation then you will find out the final IS equation, this equation, and this LM equation, reflecting all these values. So, the equilibrium value of output here is that you need to equate IS curve to LM curve.

Then finally, you will come up with equilibrium level of income, this much, 1733 and the equilibrium interest rate is 11.33. This is the some more problem set. This is the answer for that, in this solution that the IS curve is vertical that Y is 2003. So, LM curve remains unchanged and given the equilibrium value of output the equilibrium rate of interest is 17 percentage.

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Disequilibrium in IS and LM
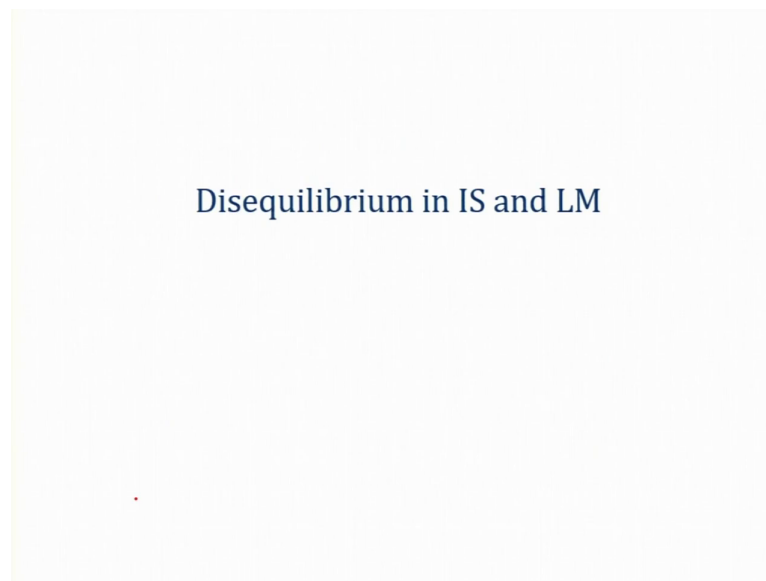
What if there is some disequilibrium in the IS LM model?

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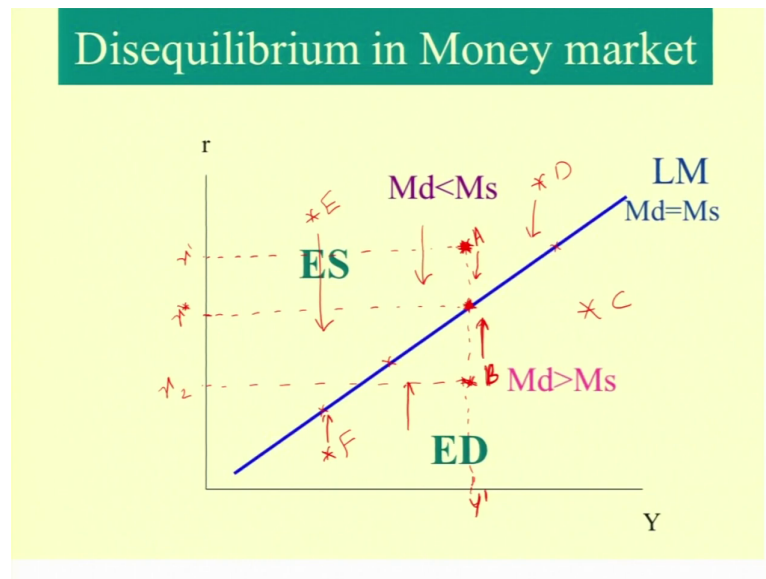
So, to understand let us review both LM curve and IS schedule separately. So, you know that each point along the LM curve you can see that money supply is equal to money demand. That means, money market is at equilibrium. What if we look at any other points other than this equilibrium point, either above this LM schedule or below this LM schedule.

Suppose look at this point, suppose this is the corresponding value of rate of interest, for example, r1, this one is the corresponding Y1. So, in this point what you can see that in this LM schedule we are going to say that this point, that for example, point A is never going to be the equilibrium point.

You know why? Because you look at this point you can say that the equilibrium point should be here, but you can see that at this point the money demand is less than money supply.

Because what you can see here is that at this point A, the rate of interest is greater than the given level of income that Y1. For the equilibrium of the money market the corresponding level of rate of interest is r*. But what you can see here is that the rate of interest is r1 is above the equilibrium rate of interest.

And we have seen that when the rate of interest is relatively high, it means the opportunity cost of holding money or opportunity cost of demanding money is very high. Because when the market is providing high rate of interest there is no point in keeping more money for

transaction purpose because the opportunity cost is very high, instead they would prefer to keep their money in the bond market. So, as a result you can see that there will be decline in the demand for money.

So, as a result the equilibrium position will be attained in this point, you can see that money demand is less than money supply and finally, this point cannot be equilibrium point. Look at any point below this LM curve, for example this point. So that means, here we can see that point B this also not going to be the equilibrium point.

Look at for example, the corresponding rate of interest; that means, relatively the rate of interest is low; that means, the opportunity cost of holding money or demanding money is low. So, as a result people will demand more money for transaction purpose. So, you can see that when people are demanding more money for transaction purpose, demand for bond will come down. Demand for bond will come down, bond price will decrease then the rate of interest will increase. So, finally, with the point B, this point is not going to be the equilibrium, there will be an upward pressure for the rate of interest to increase.

So, similarly point A which we just discussed a couple of minutes before, this also not going to be the equilibrium position, at this point you can see money demand is less than money supply and people will be demanding more bonds, the bond price will increase as a result rate of interest will decrease. So, that means, there is a downward pressure on rate of interest. So, finally, this is going to be the equilibrium position where money demand is equal to money supply.

So, any point for example, this C this D or any point for example E, these are not going to be the equilibrium position. You can see that if this is the point, there is upward pressure on rate of interest or any other point above the LM curve there is downward pressure on rate of interest. So, that money demand is equal to money supply.
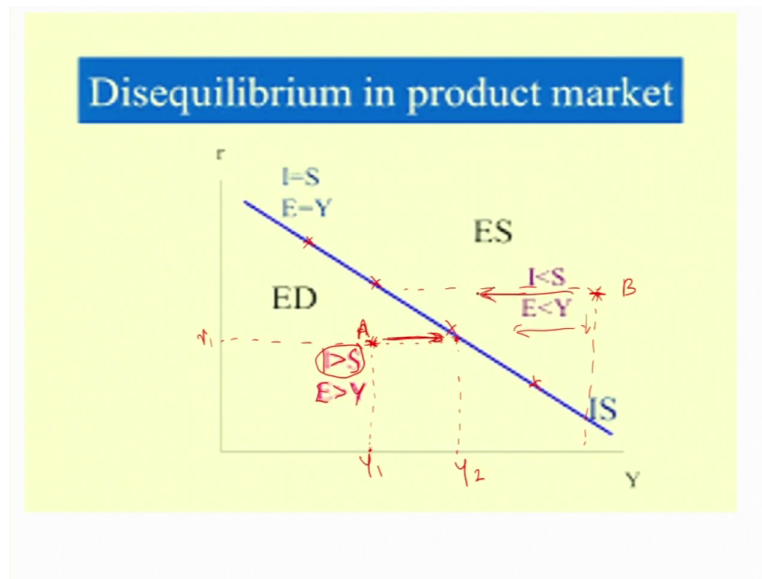
Look at the IS curve now. So, in the IS curve, all points along the IS per curve, you know that each of these are the equilibrium position where investment is equal to saving. Now, look at for example, this position for example, this position point A. In this position you can say that rate of interest is low corresponding that you can see the rate of interest is low, when the rate of interest is low you know that the investment will increase there is increase in investment.
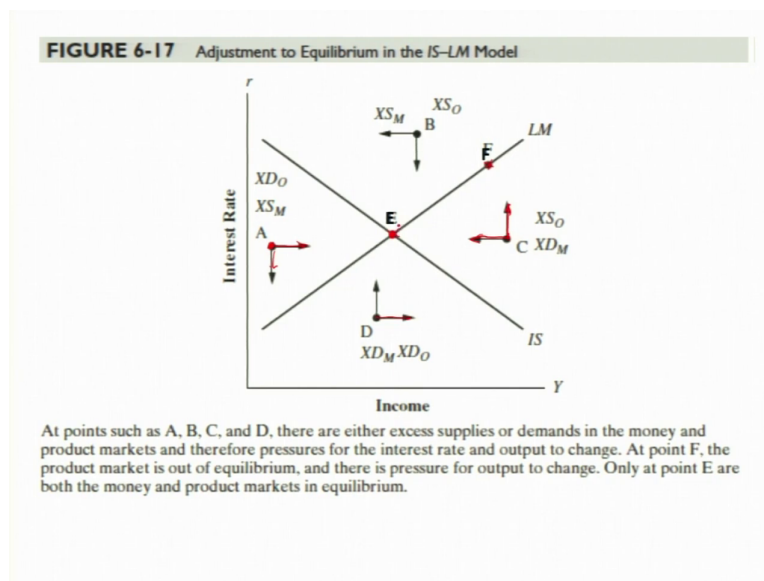
But you can see that at low rate of interest, the investment is high, then to become investment is equal to saving, we need more income, this much income is required. But here we can see that income is only here Y1 only, the required increase in income is Y2. So, when looking at this point below, when the rate of interest is r1, there is increase in investment. Then actually we need more saving, but at the given level of income Y1 you can see that saving is less than investment, that is alternatively investment is greater than saving here. So, here you can see that, at this point, we can see that investment is greater than saving. So, investment we already said that investment is called expenditure; that means, expenditure is greater than income or aggregate supply.

As a result, there will be pressure on income to increase, then you can see that at this point, investment is greater than saving. So, the saving must be increased which can be generated by increase in income. So that means, market will put more pressure on income to increase. So, that required amount of saving can be generated. So, there is going to be a horizontal pressure for the market for the income to be increased.

So, look at for example, any other position for example, here position B. Here what we can see that the corresponding rate of interest is very high. So, as a result you can see that investment is less than saving any point above this IS curve, investment is less than saving. So, that means, expenditure is less than Y. So, there is a downward pressure on income.

So, there is more savings on the upward any position, above this IS curve you can see that saving is greater than investment.

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FIGURE 6-17 Adjustment to Equilibrium in the IS–LM Model

At points such as A, B, C, and D, there are either excess supplies or demands in the money and product markets and therefore pressures for the interest rate and output to change. At point F, the product market is out of equilibrium, and there is pressure for output to change. Only at point E are both the money and product markets in equilibrium.

Putting everything in one diagram; so, here you can see that the equilibrium position is E where both IS curve and LM curves, both product market and money market, in equilibrium. Any other point, you can look for example, A point A where you can see that just look at LM schedule where you can see that here money demand is less than money supply and look at the leftward side of IS curve where you can see that investment is greater than saving.

So, there will be downward pressure on rate of interest and upward pressure; that means, horizontal pressure on income to increase. So, that finally, we will be coming to this position. So, similarly, you can see that any position you can look at here, you can just apply the ideas that we discussed in the previous two diagrams and accordingly we can say that there is pressure. For example, here there is upward pressure for the rate of interest to increase and income to decrease here.

So, we are we can see that point F for example, is not an equilibrium position. Here only you can see that point F the money market is in equilibrium. Money market is in equilibrium, but product market is not at equilibrium. So, when at point F what you can see here is that the product market is out of equilibrium and there is pressure for output to change. There is pressure for output to change. So, only at point E both the product market and money market markets in equilibrium.

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- **Policy Effects in the IS LM model**

Let us now continue our discussion about the policy effects for example, an expansionary monetary policy, what are the effects of monetary policy on income, using IS LM model. And similarly, what are the effects of fiscal policy on income, using IS LM model.

First let us start with the monetary policy, let us assume there is increase in money supply; that means, the central bank is following an expansionary monetary policy. So, when there is an increase in money supply then we are going to see that the LM curve will be shifting to the right as we have seen in the previous discussion; that means, when there is increase in money supply LM curve will be shifting rightwards.

How are rate of interest and income are affected, let us use this two-stage transmission mechanism. We are familiar with this one, we have discussed this in detail in one of the previous sessions.
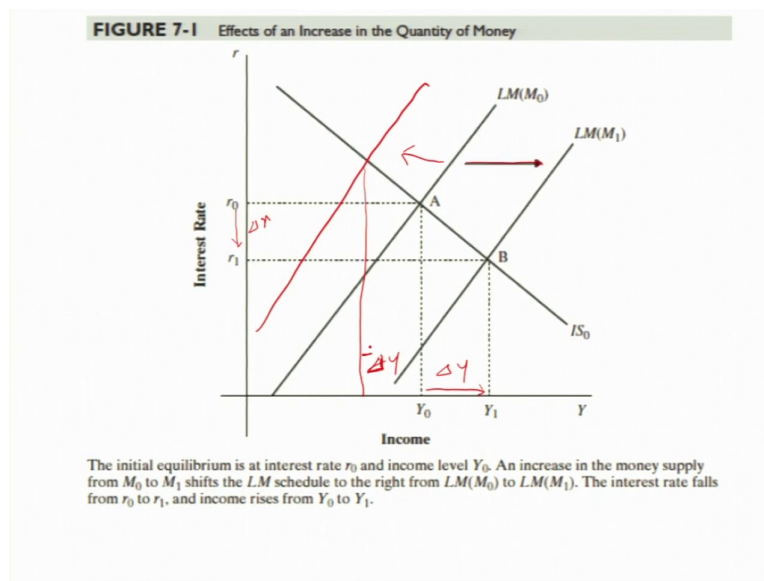
The transmission mechanism here is that when there is increase in money supply in the economy people will be content with more money, there will be portfolio disequilibrium. There is excess supply of money in the market. So, because of excess supply of money in the market, people will invest their money in bond market, then they will demand more bond.

So, as a result the price of bond increases, and as a result the rate of interest decreases, because of the portfolio disequilibrium. So, when the rate of interest decreases, we are now much familiar using the second channel investment channel, when the rate of interest decreases then you know that investment will be increasing, when the investment is increasing then you know that saving must also increase.

Then due to the increase in investment, you also know that income is going to increase. So that means, decrease in rate of interest, then Y increases.

So, Y increases in both channels, one is increase in investment demand, another is due to declining rate of interest. Here investment demand means demand by firms for capital goods. The households also demand more durable goods. So, as a result Y will be increasing.

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FIGURE 7-1 Effects of an Increase in the Quantity of Money

The initial equilibrium is at interest rate r_0 and income level Y_0. An increase in the money supply from M_0 to M_1 shifts the LM schedule to the right from $LM(M_0)$ to $LM(M_1)$. The interest rate falls from r_0 to r_1, and income rises from Y_0 to Y_1.

So, representing this using a diagram, we can see that when the LM curve shift rightwards, you can see that rate of interest will decrease from r_0 to r_1, then as a result income will be increasing from this point to this del Y. So, to del r you can see that del Y this much increase in income will happen, the income will increase from Y_0 to Y_1.

1.2. Shifts in money demand function

- Effects of shifts in the money demand function
- Increase demand for money for a given Y and r (means a portfolio shifts away from bonds to money)
- LM shifts to left
- As people try to increase their money holding, interest rate will rise
- High r....I falls....Y declines...
- Equi interest increases and income falls

So, similarly shifts in demand function, what if there is more demand for money. So, here more demand for money means people are keeping, other things remaining constant, when people due to uncertainty when they are demanding more money, then you can see that LM curve will be shifting leftwards. And in this case, instead of this way, you can write the LM curve will be shifting leftwards when there is increase in liquidity preference.

So, as a result you can see that the corresponding decrease in income is this much; that means, del Y is this much that is decline in Y. So that means, this much decrease in income will be there due to shift in money demand function.
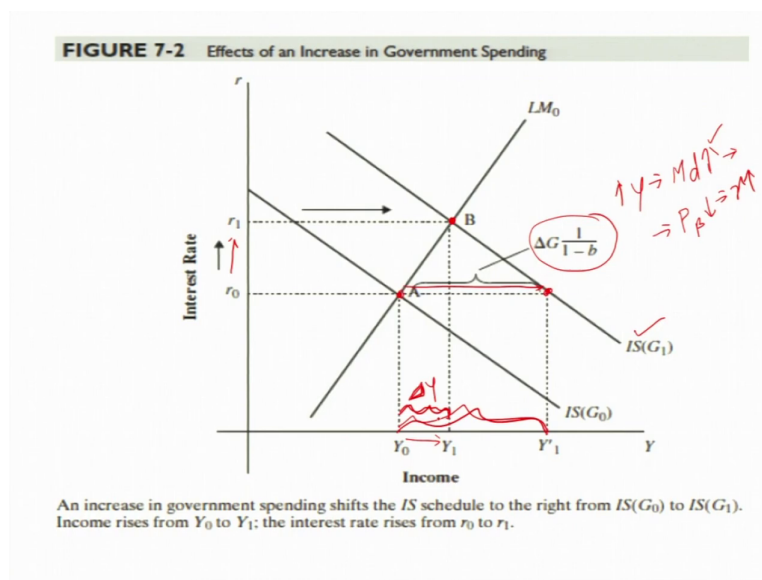
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And another point, what about the real influence when there is a shift in IS schedule, what is going to happen? Due to fiscal policy, you know that, for example, due to increase in government expenditure, you know that, IS curve will be shifting rightwards.

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FIGURE 7-2   Effects of an Increase in Government Spending

An increase in government spending shifts the IS schedule to the right from $IS(G_0)$ to $IS(G_1)$. Income rises from Y_0 to Y_1; the interest rate rises from r_0 to r_1.

So, here what we are showing is the IS curve is shifting rightwards, the initial equilibrium position is A when there is increase in government expenditure, the IS curve will be shifting rightwards. And the new equilibrium position is going to be here, where the new IS curve will be intersecting with our initial LM curve at this point.

So, you can see two things here; suppose if there was no LM curve at all, what you can see that increase in income from here, it should be this much. This should be the increase in income, that is, this distance it should be the del Y, but since there is money market is there what we can see here is that, when there is increase in government expenditure, we are going to see that the interest rate is going to increase.

How is interest rate going to increase? What is the reason? Why increase in rate of interest here? So, when IS curve shift the rate of interest also increase here. There are two reasons why the rate of interest increase. So, you can see the rate of interest increase from r_0 to r_1 when there is government expenditure. The income is increasing from Y_0 to Y_1 to Y hat 1.

The reason why income increase is that is due to the increase in aggregate demand, both directly as government demand rises and then indirectly because of an income induced increase in consumer expenditure. Our theoretical reasoning that why income is increasing. But we also see here is that there is increase in rate of interest because the force pushing up interest rate requires some explanation here, because we assume here that LM curve is not shifting.

So, in this case we can see that at a given level of income equilibrium in the money market and therefore in the bond market was undisturbed by changes in the government spending because there is no disturbance in the LM market, that means, there is no change in money supply and money demand. And it is the rise in income in response to fiscal policy that necessitates the interest rate adjustment.

Note the point here, as income increases the transaction demand for money raises. So, we are going to explain why rate of interest increase here; clearly there is no disturbance in the LM market, but due to increase in government expenditure the income increases; as a result, transaction demand for money raises. So, when the transaction demand for money raises, the attempt to increase transaction balance requires a decline in demand for bonds.

So, remember here that because of increase in income we can see that there is increase in transaction demand for money. So, when transaction demand for money increases you can see that demand for bond decreases, when demand for bond decreases the rate of interest increases. Because here when the income increases, transaction demand for money increases; that means, demand for bond decreases that means, price of bond decreases which leads to increase in the rate of interest.

Attempt to increase transaction balances requires a decline in the demand for bonds thereby decline in the price of bonds and subsequently increase in rate of interest. So, the income-induced increase in money demand and decline in bond demand causes the interest rate to rise. So, these are the two main factors: that is, one is income induced increase in money demand and second a decline in bond demand caused interest rate to rise from r_0 to r_1, due to an expansionary fiscal policy.

The increase in income the del Y is supposed to be this much, this distance, but due to the increase in rate of interest, there will be decline in investment decline in investment. So, as a result the actual increase in del Y is going to be only this much.

In the next session, we will continue this discussion we will offer more explanation to this why there is increase in income is only this much from Y_0 to Y_1.

Thank you for watching this video and in the next session let us continue this discussion.

Thank you.