

Economics of Banking and Finance Markets
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Lecture - 56
Policy Effects in IS-LM Framework - IV

Hi everyone, welcome. In this session, in addition to continuing what we have discussed in the previous session of shift in LM curve and IS curve, we will discuss the fiscal policy and monetary policy multiplier, and we will also discuss the derivation of aggregate demand curve from IS-LM model. So, let us begin with the discussion that we started in the previous class. In the previous class, we started how aggregate demand, or the income is going to change when there is a increase in money supply.

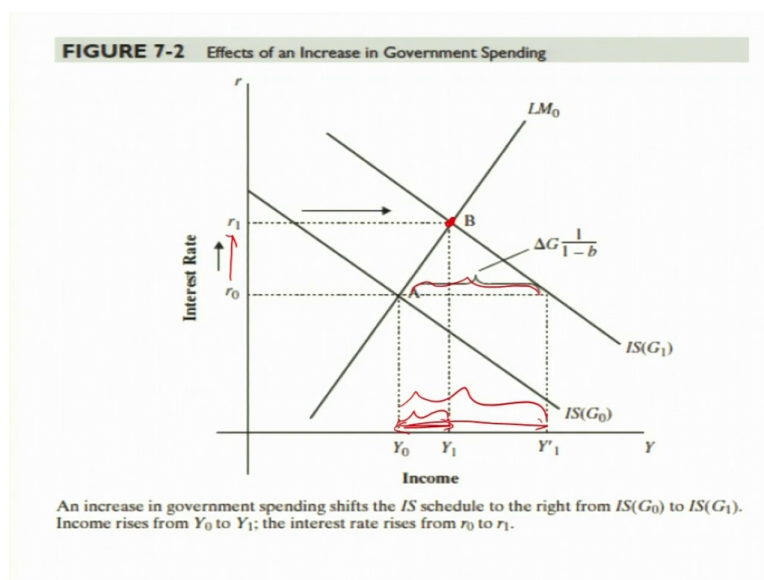
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2) Real Influence: Shifts in IS schedule

Fiscal policy ✓

And subsequently we started with fiscal policy; that means, increase in government expenditure, or increase in tax, how it is going to affect income in the macro economy.

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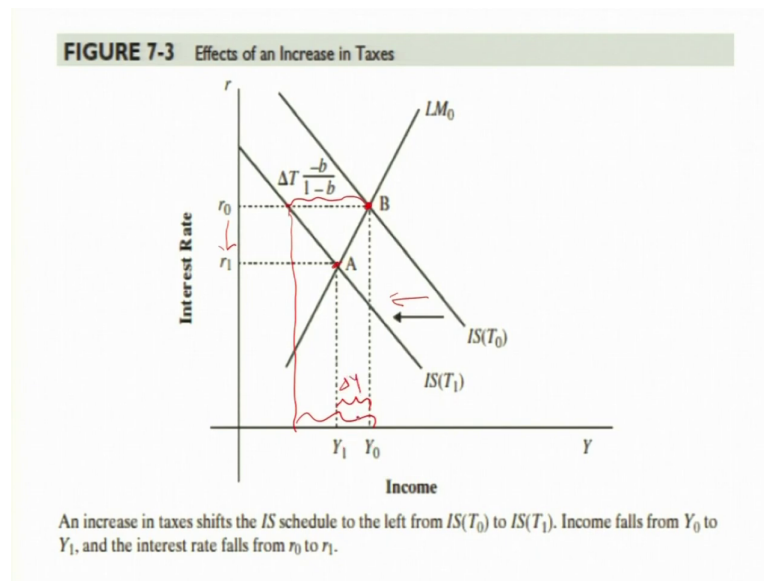
So, this one, I have shown you in the previous session; that means, when there is increase in government expenditure, we have seen that the IS curve will be shifting rightwards. This distance is the full Keynesian multiplier, that is simple Keynesian multiplier; however, because the reason that we have outlined in the previous session, rate of interest increases from r_0 to r_1 .

And, as a result, instead of increase in output till from Y_0 to Y_1^i , the increase in output is going to be only this much, that the Y_0 to Y_1 distance, the new equilibrium position is at B. So, what we have seen here is that due to increase in government expenditure we can see that the rate of interest has arisen from r_0 to r_1 .

As a result, because of the increase in rate of interest, it discourages a private investment; that means, a kind of a crowding-out effect happen; that means, increase in government expenditure increases rate of interest which further decrease or crowd-out private investment. As a result, we can see that income is supposed to be increased to increase in income this much but was only Y_0 to Y_1 .

So, this is due to the crowding-out effect of government expenditure on a private investment.

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Subsequently, what if there is increase in tax? So, increase in tax, the initial equilibrium position is here, look at the initial equilibrium position. So, the IS curve shifts leftwards. Then as a result you can see that this is the full negative impact supposed to happen due to increase in tax.

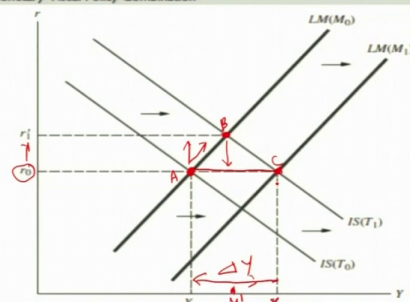
However, since due to decrease in tax; that means, is also you can say that look like you can interpret it as a decrease in government expenditure as well. So, here you can see that the rate of interest decreases from r_0 to r_1 . And as a result, this much decrease in output is supposed to happen, but due to the decline in rate of interest we can see that decline in output is only this much ΔY is this much, that the Y_1 Y_0 , this distance.

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3) Policy Mix: Fiscal and monetary policy

- Monetizing the budget deficit

FIGURE 7-5 Monetary-Fiscal Policy Combination



A tax cut from T_0 to T_1 shifts the IS schedule from $IS(T_0)$ to $IS(T_1)$. By itself, this fiscal policy shift would push the interest rate up to r_1 . If the tax cut were accompanied by an increase in the money supply from M_0 to M_1 , the LM schedule would shift to the right from $LM(M_0)$ to $LM(M_1)$. Together, the two policy actions would increase output to Y_1 , with the interest rate remaining at r_0 .

Suppose when there is government expenditure, we have seen that then the rate of interest will increase. And as a result, the increase in output is only this much. Here only actually this much this one only Y_1 , the main reason for this one is crowding-out effect on private investment because increase in rate of interest.

So, to compensate that, one option normally what if when there is an increase in government expenditure; obviously, there will be a budget deficit. So, to monetize that, to raise finance for that, sometime a policy mix happen; that means, an equivalent amount of money supply is injected into the economy; that means, increase in money supply to finance the budget deficit.

So, as a result, you know initially, suppose IS curve shifted from left to right; that means, is T_0 to T_1 . So, that is shifted to here and this is the new equilibrium position but suppose there is a policy mix; that means, an accommodative monetary policy; that means, when there is government expenditure, when money supply also increased to finance that, the budget deficit is monetized.

Then you can see that the LM curve will be shifting rightwards. So, when the LM is shifting rightwards, you can see a rate of interest will come down. Initially rate of interest increases, its impact is neutralized by an increase in money supply. So, to overcome the crowding-out effect if there is equivalent increase in money supply then you can see that the output is going to increase to Y_1 .

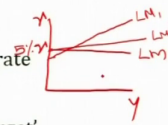
So, this is the initial equilibrium position A, B and finally, C; that means, initially increase in government expenditure equilibrium is going to happen from A to B with the increase in rate of interest. But if there is equivalent increase in money supply LM curve shift rightwards, and the C is going to be the new point of equilibrium and rate of interest will be restored at the initial position and (Refer time: 05:44) output increase to from Y to Y_1 . So, ΔY is this much.

This case is also related to interest rate targeting. Suppose when the policy makers do not want to see that rate of interest increase or decrease, they if they want to see a constant rate of interest, then, this kind of policy is also called as interest rate targeting rule.

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Interest rate target rule and shape of LM curve

- Increase in Money supply to ensure a constant interest rate
5%.....7% Increase in Ms...5%.....7%...
- Perfect elastic (horizontal) LM curve: if 'point interest target'
- Elastic (Flat) LM curve if 'range of interest target' instead of point interest rate target...



And in this case if that is the scenario, suppose if they do not want to see the rate of interest increasing at all or no change in interest rate.

And for example, if they want to see interest rate for example, at a constant rate of 5 percentage. And in that case, they must increase money supply in the same proportion, and similarly if they want to see a rate of interest at 7 percentage then they will be increasing money supply the at a 7-percentage rate.

So, that means, to ensure that the rate of interest is constant. Accordingly, money supply will be adjusted. So, in this case you can say that if they clearly want a particular rate of interest, then in this case you can see that the LM curve is going to be horizontal. This is the LM

curve if they clearly want the rate of interest is at a fixed rate; that means, for example, 5 percentage, right.

So, in this case is going to be perfectly elastic curve. In contrast to this, if they want to allow some flexibility. So, in that case some range, some confidence interval at the lower and upper level; that means, they are not looking for a point interest rate targeting, instead with a confidential interval. In this case the LM curve is going to be like this, LM1 or if range is very low then the curve is going to be a little bit flatter, right.

So, that means, if they use a range of interest rate target, then it is going to be more and if they do point interest rate target then LM curve is going to be a perfectly elastic.

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Now, let us proceed with deriving fiscal policy multiplier and monetary policy multiplier.

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Fiscal policy multiplier (of G and T) in IS-LM

$$Y = \left[\frac{1}{(1-b) + i_1 C_1 / C_2} \right] * [(a - bT + T + G) + i_1 / C_2 (M^s - C_0)]$$

1) Expenditure Multiplier: Effect of ΔG on ΔY (keeping other exogenous variables constant)

$$\Delta Y = \frac{1}{(1-b) + i_1 C_1 / C_2} \Delta G$$

$$\frac{\Delta Y}{\Delta G} = \frac{1}{(1-b) + i_1 C_1 / C_2} > 0$$

G multiplier in IS-LM = ΔY due to simple Keynesian multiplier - ΔY lost due crowding out effect

2) Tax multiplier: Effect of ΔT on ΔY (keeping other exogenous variables constant)

$$\Delta Y = \frac{1}{(1-b) + i_1 C_1 / C_2} (-b \Delta T)$$

$$\frac{\Delta Y}{\Delta T} = \frac{-b}{(1-b) + i_1 C_1 / C_2} < 0$$

This is the IS-LM equilibrium that we have derived when equating the equilibrium income and equilibrium rate of interest.

We have derived this equation from IS equation and from LM equation. So, finally, we got this equation; that means, Y is equal to this, the left-hand side is called the multiplier component, and the other side is the autonomous component and this one is further due to the money market in the picture.

So, here what we are going to do here is what if the government expenditure is increased by for example, 100 million? So, you know for example, see government expenditure is going to be, for example, 100 million. Then we see that output also increase, but how much? If output increase for example, if the output has been increased by 200 million due to increase in government expenditure.

Then in this case we can see that the government expenditure multiplier is going to be 2, right. Government expenditure multiplier is going to be 2 here because 200 divided by 100. So, we are going to get 2 that is the multiplier. So, what does it mean that when government expenditure with 100 million we can see that there is 2 times increase in output.

So, this is the basic intuition behind the multiplier idea. So, in the IS-LM framework let us see what are the factors that determine the values of government expenditure multiplier. So,

the here the expenditure multiplier we are going to see what the quantitative effect of a government expenditure on ΔY is, keeping other exogenous variables constant.

So, you can look at change in GDP due to change in government expenditure; if you take the first derivative you are going to get this value. This is the fiscal expenditure, that is, the fiscal policy or government expenditure multiplier.

So, in the simple Keynesian model without money market the government expenditure multiplier was ΔY by ΔG is equal to 1 by 1 minus b ; that means, that is full multiplier in the simple Keynesian model. But since we know that due to the crowding-out effect, we can say that increase in output or ΔY due to ΔG is less than in the IS-LM model as compared to the simple Keynesian model.

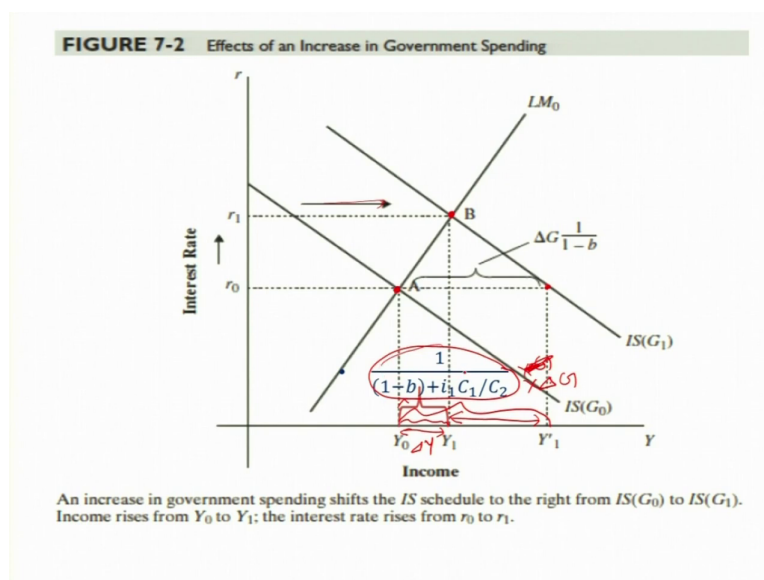
So, the government expenditure multiplier in IS-LM is less than the simple Keynesian multiplier; that means, we can see this is going to be ΔY due to simple Keynesian multiplier time minus a ΔY loss due to crowding-out effect, due to increase in interest rate that we have seen in the previous diagram as well. So, that means, here we need to add this component in the fiscal policy multiplier in the IS-LM model.

In the simple Keynesian model, we have only this much. Then coming to the tax multiplier, we are going to see what the effect on ΔT on ΔY is. Here the formula is: you can take the first derivative of ΔY (Refer Time: 11:45) ΔG with respect to ΔY . So, you are going to get this value.

In the simple Keynesian model, the tax multiplier was minus b by 1 minus b . But in the IS-LM model we are going to get the crowding-in of the negative effect. The values here are negative, you can see that because of tax the output is going to decline, but in the simple Keynesian model there is large decline in output, but in the IS-LM model that there would not be large decline, the decline in output in IS-LM model is less than that of simple Keynesian model.

Because of the money market effect when there is increase in tax you can see that there will be decline in the rate of interest, that will induce a private investment. As a result, the expected decline in ΔY in IS-LM model is less than that of the simple Keynesian model.

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So, look at this, it is the government expenditure multiplier, that is, fiscal policy multiplier. When there is increase in government expenditure the IS curve shifts from left to right, you can see it is shifting from left to right. So, the new equilibrium position with the intersection between IS curve and LM curve is going to happen at this point.

And you know that if there was no LM1 money market at all then the increase in government expenditure would result in increase in GDP from Y_0 to Y_1^i , but due to money market the rate of interest will increase due to an expansionary fiscal policy. So, as a result the actual increase in actual increase in output is only Y_0 Y_1 .

This much loss in GDP is due to crowding-out effect. So, the actual increases this distance that the Y_0 to Y_1 , this happens with this value times ΔG . This much increase in that ΔY this is equal to ΔG times this fiscal policy multiplier.

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Monetary policy multiplier (of M^s) in IS-LM

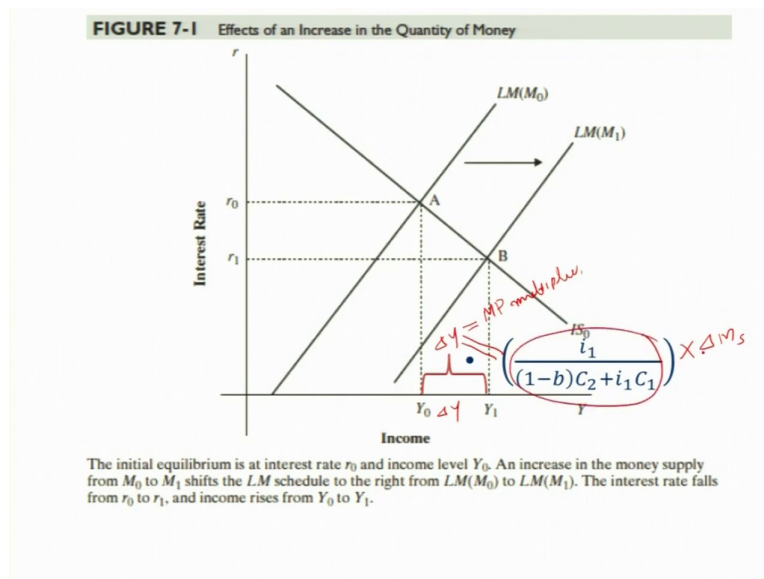
✓ $Y = \left[\frac{1}{(1-b) + i_1 c_1 / c_2} \right] * [(a - bT + T + G) + i_1 / c_2 (M^s - C_0)]$

- $\Delta Y = \left(\frac{1}{(1-b) + \frac{i_1 c_1}{c_2}} \right) \frac{i_1}{c_2} \Delta M^s$
- $\frac{\Delta Y}{\Delta M^s} = \left(\frac{1}{(1-b) + \frac{i_1 c_1}{c_2}} \right) \frac{i_1}{c_2} > 0$
- $\frac{\Delta Y}{\Delta M^s} = \left(\frac{i_1}{(1-b)c_2 + i_1 c_1} \right)$ ✓ $\times \Delta M^s = \Delta Y$

Let us now talk about monetary policy multiplier. In the monetary policy multiplier, again let us start using the IS-LM combined equation. So, del Y. So, let us see ΔY due to change in money supply. So, when you take the first derivative, you are going to get this value, this is the monetary policy multiplier.

This one is the further simplified version of the monetary policy multiplier. So, that means, due to change in money supply the GDP will increase these times multiplied by ΔM^s is equal to the ΔY . This is the multiplier effect of the monetary policy in a macro economy in the IS-LM framework.

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So, presenting this one graphically, we can see that this distance, this ΔY is due to monetary policy. So, this that we are going to get ΔY is equal to the monetary policy multiplier that we had derived.

So, you can see that because of increase in money supply output increase from Y_0 to Y_1 this ΔY this is the multiplier times money supply.

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TABLE 7-1 Effects of Monetary and Fiscal Policy Variables

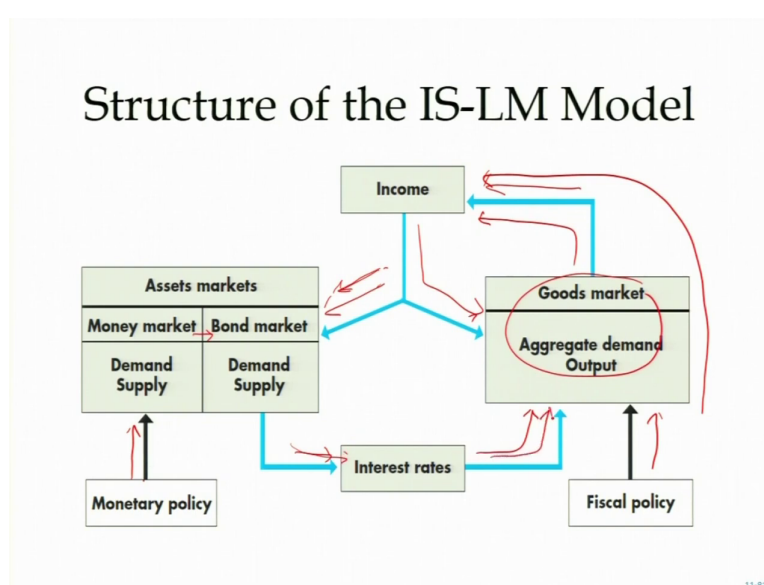
Effect of:	M ✓	G ✓	T ✓
on Y	+ ✓	+ ✓	- ✓
r	- ✓	+ ✓	- ✓

Note: M , money stock; G , level of government spending; T , taxes. A (+) sign indicates that a change in the policy instrument causes the variable in that row (Y , income, or r , the interest rate) to move in the same direction. A (-) sign indicates the reverse.

So, this is the summary of the effects of monetary and fiscal policy variables; starting with the effect, this is money supply, this is government expenditure, this is tax.

Suppose there is increase in money supply, you can see that effect on Y . First start with the effect on Y , the Y will increase, but rate of interest will decrease. Similarly, increase in government expenditure, you can say that output will increase, and rate of interest also will increase. In contrast you can see that increase in tax will reduce output, it will reduce rate of interest as well.

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So, this is the larger picture about the structure of IS-LM model. So, what we have discussed so far putting in the IS-LM model, plugging or introducing monetary and fiscal policy, these are the two important components of economic policy. So, the monetary policy affects in this way; that means, it will affect money market; that means, it also affects bond market. This has an implication on interest rate.

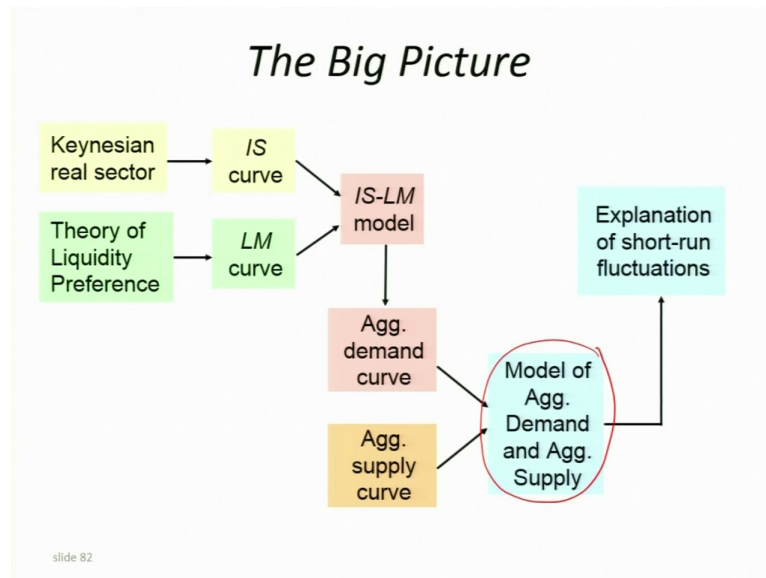
Similarly, and this would further affect aggregate demand. That is about the goods market, this further leads to increase in income and further increase in income, high impact on goods market as well as assets market also. Similarly, in fiscal policy is going to directly impact the goods market.

Then it will increase the income in the economy, and then you can see that because of the increase in income we can say that it has impact on money market and bond market. So, we

have seen the change in interest rate that coming from fiscal policy in this way; that means, increase in income for a transaction demand for money; assuming money supply is constant then you can see that rate of interest is going to increase.

Again, change in rate of interest will have further impact on output.

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So, this is the broader picture we can further present this one in this way; that means, the IS-LM model is a real sector and the money market, that is the IS curve and LM curve, that is IS-LM model, this is going to affect aggregate demand.

And subsequently, the IS-LM models' impact is on the aggregate demand curve, not on the aggregate supply curve. And then the macroeconomic equilibrium you can see that aggregate demand should be equal to aggregate supply. So, that macro economy is at equilibrium. So, this used for as an explanation for short run fluctuations in the macro economy.

So, in that way to understand the macroeconomic fluctuation at the short run and as well as a risk management to correct the economy or restore the economy back to its initially equilibrium in the short run, we can use the IS-LM curve as a tool to understand; especially to understand the policy effects, particularly fiscal and monetary policy effects in the macro economy in the short run.

So, in the IS-LM model is used to understand the short run fluctuations in the economy, especially the policy effects in the short run.

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Deriving Aggregate Demand Curve

$$AD \rightarrow C + I + G$$

So, let us now move to the further related topic in the IS-LM. Suppose if there is increase in government expenditure, we have seen that there is increase in income.

And similarly, when there is increase in money supply; that means, an expansionary monetary policy, there also we have seen there is increase in income, but what I meant was an increase in aggregate demand. So, that means, increase in income means aggregate demand.

So, equivalently we also mentioned increase in aggregate output, aggregate income, or aggregate demand, but what we meant here is aggregate demand. We did not discuss, or we did not mention aggregate supply. Because aggregate supply that is the productive sector of the economy must produce goods and services.

It depends on so many other factors. What we mean here is that the demand for goods and services from the economy; that means, increase in C plus I plus G , that is what we mean when we say that when there is increase in income.

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Towards flexible prices

- IS schedule

$$\underline{I(r)} + G = S(\underline{Y}) + T$$

\bar{P} \bar{M}

So, let us elaborate this point further. In the IS and LM schedules, one of our assumptions was that price remaining constant and, similarly money supply also remaining constant. So, in the IS schedule we mentioned it like this; that means, investment is a function of rate of interest and saving is a function of Y.

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LM schedule with flexible prices

- $\underline{M_s/P} = L(\underline{Y}, r)$
- Real money supply = M_s/P
- What if price level changes (increases from $\underline{P_0}$ to $\underline{P_1}$ to $\underline{P_2}$), keeping $\underline{M_s}$ fixed?
- Real money supply: $(\underline{M_0/P_2}) < (\underline{M_0/P_1}) < (\underline{M_0/P_0})$

In LM schedule also, we assume that price remains constant, and money supply also remains constant. So, the demand for money is a function of income and rate of interest. So, when we

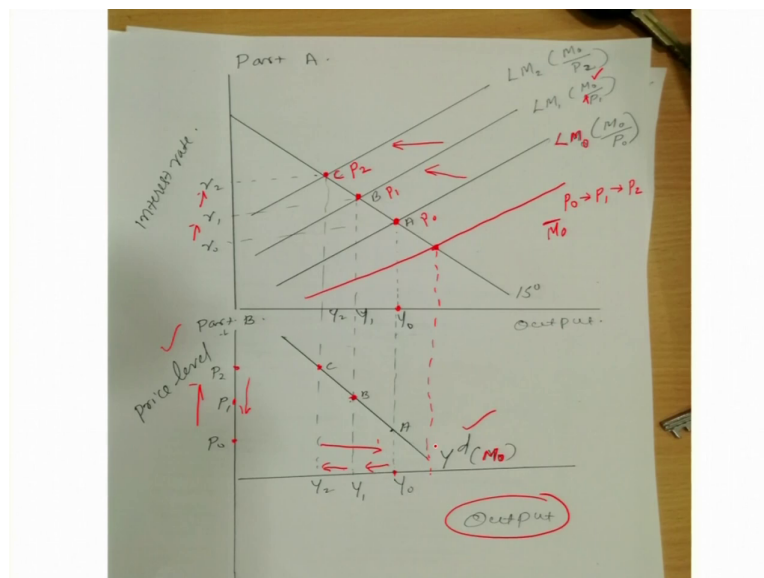
discuss money supply, we mean real money supply; that means, a money supply divided by the price level.

So, what if we change the price level, that is, what if price level changes? That means, increases from P_0 to P_1 to P_2 like that, keeping the nominal money supply by the central bank fixed. And what if we change a price level? That means, for the sake of simplicity, let us increase price level from P_0 to P_1 then P_1 to P_2 , then, how does it affect our IS-LM model?

So, in this case, suppose the money supply is fixed assume that money supply is M_0 , when price level is increased from P_0 to P_1 and further P_1 to P_2 . Now what we can see that, suppose this is the initial situation that the price level is P_0 , and keeping money supply at fixed level.

When price level is increased, then you can see that the nominal money supply remaining same, but in real terms, the money supply has decreased. Because the purchasing power of money has declined as the price level has increased. So, similarly when price level further increases to P_2 , keeping the initial nominal money supply same, then you can further see that in real terms, money supply has decreased.

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So, translating this one in a figure, look at here, look at this the initial equilibrium position, this is the initial IS curve and this is the initial LM curve, and the money market and goods

markets are at equilibrium. So, this is the condition when we assume that the price level remaining same, but now let us change the price level from P_0 to P_1 to P_2 .

But we assume the money supply in nominal terms remaining constant; that means, if price level is increased, we will discuss how price level will increase, for the time being assume that we are deliberately, arbitrarily increasing the price level.

When the price level is increased, then you can see that the same fixed money supply when the price level is increased to P_1 then; that means, real money supply declines, there is a fall in the real money supply. We have seen in the previous session that when there is increase or decrease in money supply LM curve shift. When increase in money supply we have seen that LM curve shift rightwards.

But here since there is decrease in real money supply, then you can say that LM curve will be shifting leftwards. So, that means, when the price level is P_0 , the equilibrium position is A when the price level increases, keeping the nominal money supply constant; that means, real money supply decrease, the new equilibrium position is B; that means, this is at a price level P_1 , this is at a price level P_0 .

Further if we increase the price level to P_2 keeping nominal money supply M_0 constant, then you can see that further the LM curve will be shifting further leftwards. Then you can see that this is going to be the new equilibrium. So, that means, you can also see that the rate of interest is increasing from r_0 to r_1 and r_1 to r_2 .

So, taking this price level on the y axis in the part A diagram, and taking this one in the part B diagram keeping price level on the y axis you can see that at P_0 price you can see this is the corresponding output. When the price level is increased, the equilibrium position you can see that point equilibrium position B and equilibrium position C.

So, here what we are seeing that on the right-hand side we are having income, that is aggregate demand at nominal money supply at M_0 . And at a different price level you can see that income is declining, when the price level increases the demand decreases; that means, we are seeing an inverse relationship between a price level and aggregate demand.

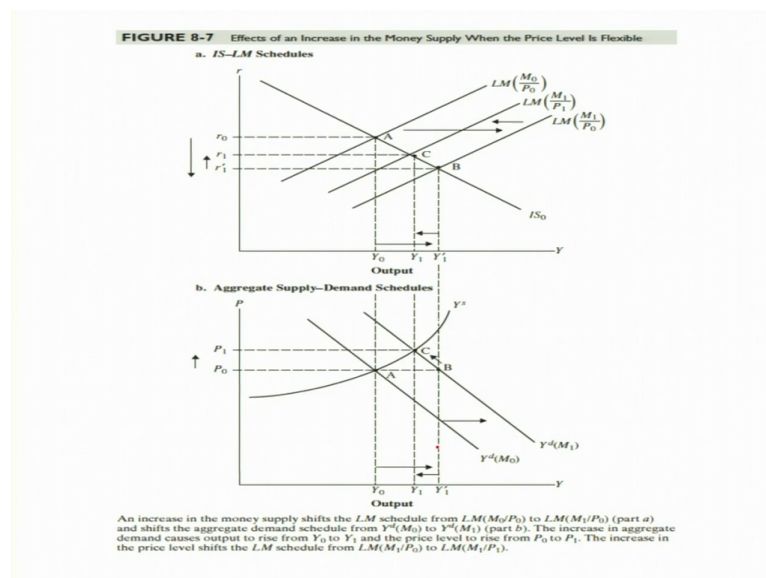
So, this is this is the way that we can derive an aggregate demand curve from the IS-LM model; that means, when we take a flexible price, when we increase price, then you can see

LM curve is shifting leftwards; that means, new equilibrium position. So, accordingly, translating this one to part B diagram, you can see that at the increasing price level there is decrease in output.

Otherwise, decrease in price level you can say there is increase in output. For example, if the price level is decreased, further you can see that LM curve will be shifting rightwards. So, this is going to be further equilibrium position. What we have seen here is that the inverse relationship between price and quantity demand at the aggregate level, this is nothing but the aggregate demand curve.

So, we can derive aggregate demand curve from this diagram.

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Let us discuss this in far more details in the (Refer Time: 27:36) next session.

Thank you, thank you so much. See you in the next session.

Keywords: IS-LM models, fiscal policy multiplier, monetary policy multiplier, rate of interest, crowding-out effect, GDP, money supply, government expenditure, money supply, aggregate demand, flexible price, real money supply