

Micro Foundations of Macroeconomics
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Lecture - 28
New Keynesian Sticky Prices II

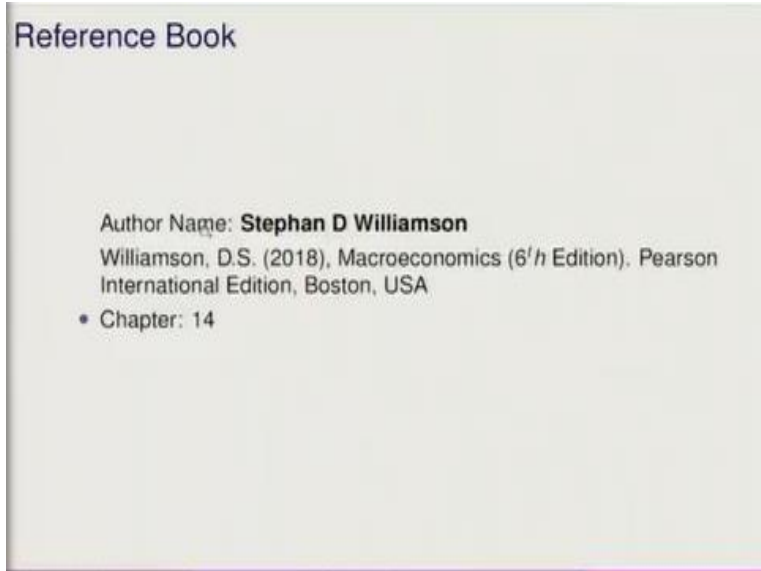
Welcome back. So, let us start. We are discussing the new Keynesian economics with sticky prices set up and in this new Keynesian economics we are trying to understand that how we can understand the role of monetary and fiscal policies when we are assuming that we have the price rigidity or sticky prices. In the last session we understood about the scenario in which we are assuming that the central bank decreases the interest rate target.

So, once we have the decreasing of interest at target then this creates a very awkward or is a very favourable moment. When we see increase in consumption investment and then real wage and output. But the opposite of this will be that what happens if the rate of interest target is much higher. So, in case of India we have gone by inflation targeting so as per the inflation targeting rule it is 4 plus minus 2, the inflation target.

So, if the central bank decides about the interest at targeting sorry, here we have the inflation target 4 plus minus 2 not the interested target. So, in the interested target we are deciding about whether the inflation is beyond 6% or it is less than 2%. So, 4 plus minus 2 mean is or the middle I would say value is four which means that average inflation should be 4% in the economy. But in some situations when you have the interested target higher because you are not able to control on the inflation.

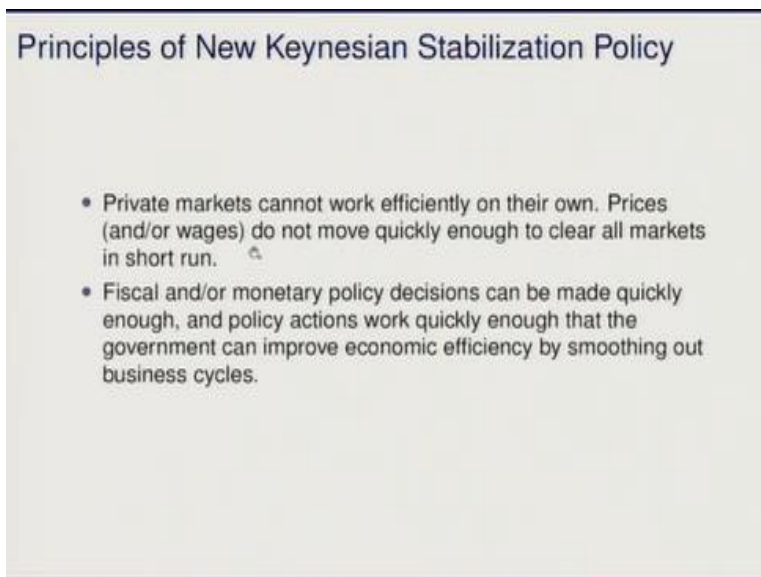
Then in those situations things may go against the economies of your consumption and all other variables may not be going as expected as we saw in case of decrease in the interest rate targets. Once you have decrease in the interest target then it makes sense.

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So, here we have. So, the session will same will be the same Stephen D Williamson.

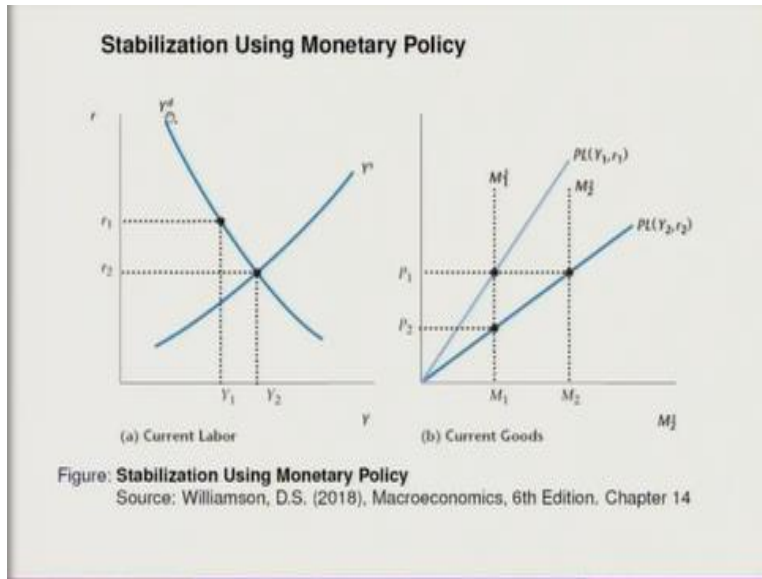
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And we are trying to understand the stabilization framework. So, what we understood that how the monetary and fiscal policy decisions can be taken to understand the policy actions and how we can improve upon the economic efficiencies. So, improve economic efficiency in the sense that the agents in the economy should interact and there should not be any kind of or economic loss to any agent.

So, whether the labour or whether the firm everyone should be satisfied and as a result this will further facilitate the smoothening of the business cycle. So, this is the underlying idea.

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Let us start with the first situation. Here, you have the stabilization using monetary policy. Now in this setup what we have is that this is the demand supply scenario. So, maybe you can understand that this r_2 is the equilibrium but the central bank keeps the interest rate at r_1 . So, here you have the r_1 and this one corresponds to Y_1 . So, the ideal situation should be this. But let us assume that economy is operating at this level.

So, here you have r_1 and here you have Y_1 which means that aggregate demand and aggregate supply are not the same. It is having the aggregate demand is lesser than the aggregate supply which means that corresponding to this, this is the price so at this price so price is P_1 and here you have the demand for money which is $PL(Y_1, r_1)$ and here you have this supply of money. So, here the supply of money at M_1 here you have the price P_1 .

And at this price P_1 the money demand and money supply scenarios and money market clears you can say. This is the money supply and this is the price that you have. So, you can think about a situation that the I would say the corresponding to this the firm is willing to supply the output which is or in the economy the demand for output is lower than the supply which means that the high chance that even if the central bank does not take any measure.

It is highly likely that this mismatch of demand and supply that you have after some point of time without doing anything will bring about equilibrium here at r_2 . But and then because of this mismatch in demand supply scenario because of this r_1 there will be a some kind of adjustment with the price and price will also fall at P_2 . So, this is the natural situation without doing anything this will be the natural case that the economy walks at r_1 and here you have Y_1 .

Suppose we assume that we have a exogeneous shock and this shock is arising in the same way that we have seen during 2007 at global financial crisis. Then in that situation what will happen? So, if we are assuming a shock into the system then we can understand that the economy was operating at this point. And without doing anything as I mentioned since the economy is already having such type of scenarios.

Then it may reach towards equilibrium here at P_2 with the lower prices and the money supply and this will take time. So, this is not just the short run it will take some time. But if you are having to understand the stabilization scheme of the Keynesians then it becomes easier that the central bank will immediately reduce the rate of interest. And in order to when you were saying that increasing the reducing the rate of interest then it means that it is about increasing the money supply.

So, once you have the nominal interest rate getting lower you increase the money supply and this money supply increase since we have the price level fixed. So, this is a rightward shift in the money demand scenario. So, here we have PL (Y_2, r_2) and then here corresponding to this the money supply is M_2 . So, instead of coming here which was the automatic process if I am going by the Keynesian intervention that central bank has reduced the interest rate target.

And now as a result you have the augmentation in the money supply. So, money supply is higher and we can see that the price has shoot up. So, price is now going back here at P_1 so we are assuming that price we are not touching because in the Keynesian setup let us keep the price as sticky. What typically happens is? That earlier so the gap that we had between Y_2 and Y_1 . This gap is being reduced here and now the economy is operating at r_2 and corresponding output is Y_2 .

The money supply increase it is also having the similar kind of movement that with the price fixed. The demand because when you have the moneys when you have interested lower you know that we have analysed in previous case that your real interest rate will be lower and this will further create scenarios for boosting of the economy. So, the previous analysis will make it more applicable here.

But the only thing you have to understand is that we are making the stabilization scheme possible only when we are targeting the monetary instruments and this brings about equilibrium in the economy. So, this is the stabilization policy that you have. But this interest rate decrease it could be in the form of what we have in the Indian monetary policy setup we have the Repo rate decrease and then here you have the broad money increase.

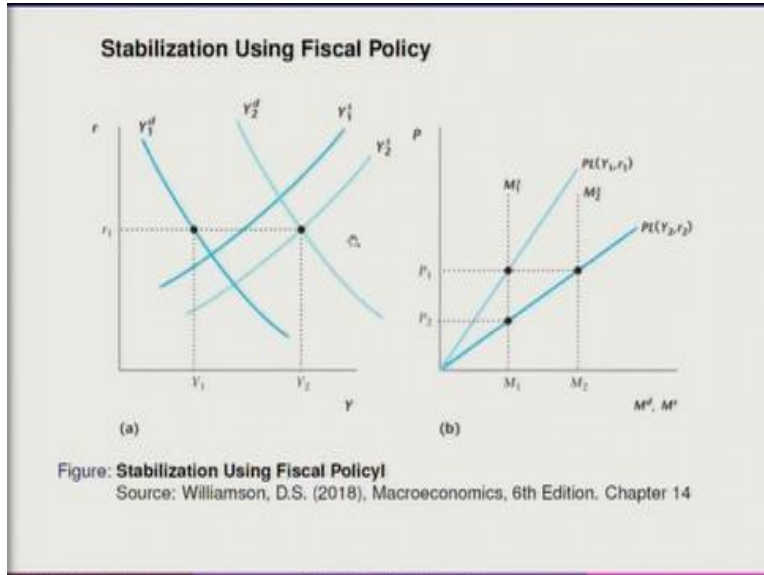
So, if you are increasing the broad money then how this particular variable is playing important role. So, this is how it works. So, overall, what comes out that you are able to achieve the equilibrium of demand and supply of output with r_2 lower interest rate and this is also creating a money market equilibrium with the prices fixed. So, this is how unlike we had the automatic one where we are not doing anything.

This demand supply mismatch is creating a scenario where price is getting lower. But at this point what we are finding that the prices are fixed money supply has increased. So, this will create further scenarios for the employment and growth, rate of interest lower. So, this will again reduce the output gap. So, overall, the economy stability starts with this and these price that you have fixing will always incentivize the producers to produce more, the rate of interest is lower.

So, this will create better investment scenarios. From the consumer side also, the consumer is also getting higher or I would say in inter temporal context you can think about that consumer will be having some kind of preference that since the rate of end is going to be lower. So, whatever they have they will be using it for consumption. So, this is how it looks like. So, here you have the current labour and current goods.

So, this is how when you have the output almost clearing here, no output gap. So, you have the interest rate decrease creating a scenario and this shock that I introduce this shock impact will be minimized and this is how you have the goods market you have.

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Now this is the monetary policy side. So, we can just keep an eye on this output gap you have and how much you have the minimization of the output gap and how much you have the money supply increase and with this money supply increase how much you have the reduction in interest rate. You have the stabilization using fiscal policy. So, once I talk about the stabilization using fiscal policy then this is how it works.

That if you have the demand scenarios are Y_1^d this is the rate of interest this is the corresponding Y_1 and here you have the scenarios like for example P_1 . So, it is the same like last time what we had that if we are going to have the Y_1^d if we are not doing anything then if at this level again you have the supply which is here. So, actually it should be the actual equilibrium should be here. But economy is again having the similar kind of scenario that we have introduced here.

So, if I am going to introduce here the aggregate demand at this level here Y_1 but since you have the demand supply scenario is not same as it is. So, here again this will have some kind of if the demand is going to boost up. So, suppose if the monetary policy or suppose in case of fiscal policy

let us think about the government consumption increase. If government consumption is going to increase it means that governments expenditure increasing.

Now this government in expenditure increasing it will lead to further boosting of the demand and supply scenario. So, this is how it works. But if we are thinking about the price stickiness then this is how it looks like but here if you are going about the scenario so if I am going to minimize the risk that we have 2007 at global financial crisis. If I have to minimize the risk of the spread of the shock so if I am having the Y_1 so this is the scenario at which we have the $r Y_1^d$ and Y_1 .

So, if this is the scenario then we are saying that you have the rightward shift in demand. And once you have the rightward shift in demand because of the government expenditure increase or if suppose we have the rate of interest keeping same. So, if this rate of interest is same then how we can decide about? So, we are not bringing any change in the interstate we are keeping it as same. Without any intervention of the government, what it looks like that?

If the rate of interest remains same central bank is not taking any decision so this rate remains flat. The only thing is that the demand will shift rightward because of this scenario which we are keeping interest fixed. But with respect to prices, it will not be same the price will fall because here you have the demand which is at $r_1 Y_1$ and here it is shifting right. But at the same time the supply is not shifting by that much.

So, supply it is not so here you can see big jump moving from Y_1^d to Y_2^d . But you can see supply is not having that much response which means that supply is not getting that much increase so here you have. So, you can see that Y_1 and Y_2 as compared to monetary policy here $Y_1 Y_2$ is much larger because of the government intervention and you can also think about the interested scenario. So, earlier we were having let us think about once again.

So, here I am having this scenario here is the perfect scenario where demand and supply equal. So, this should be the ideal situation. But we are starting at r_1 here corresponding to this you have Y_1 here. But if you have if you have this kind of situation then it may happen that that if you are

I am introducing the government expenditure then it may also be the case that the demand will be shifting rightward, the supply is already here.

So, with this particular supply and demand we are able to arrive at this point and keeping since when we are not introducing the monetary policy, we are just introducing the government. So, maybe with regard to the tax cut or anything you can assume. So, this is how it looks like r_1 remains same. We are seeing the strong shift in demand but supply is not shifting that much and this creates a trouble and this has to be compensated by increasing the money supply.

Because you have the; if your money supply increasing then you have the right ward shift in the money demand scenario and this money demand scenario will create a further impact on this output, we have in equilibrium here. So, as compared to here when we have the rate of interest this particular scenario looks better at Y_2 . We are having at r_1 Y_2 amount output which means that output has increased with the same rate of interest.

And with the combination of both the government expenditure and also the supplemented money supply. It is creating a favourable scenario with both interest rate and the price level. But price level or even the interest rate will have some kind of not very smooth adjustment that we have seen here. Because in most of the; cases in fiscal policy until unless it is combined with monetary policy then only it makes sense otherwise it will create trouble.

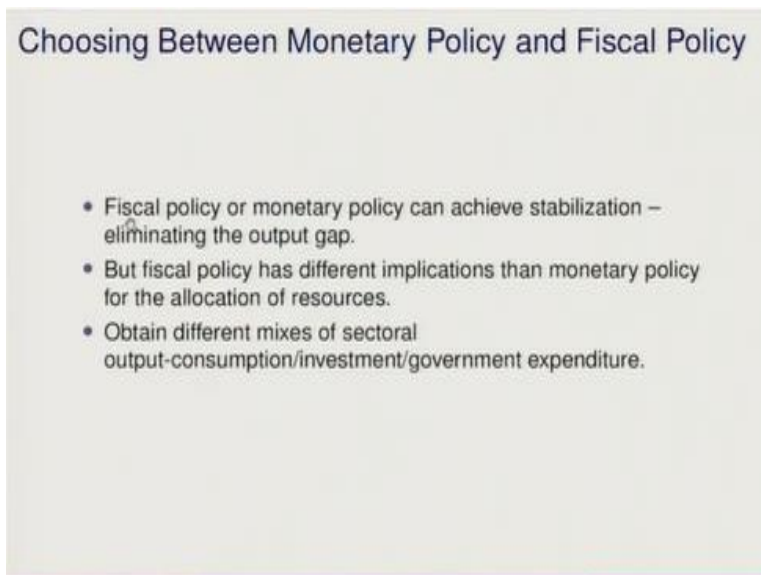
What will be the trouble? Trouble will be in the form of crowding out effect which means that if you are going for expansion in the economy with the government expenditure then it may happen that your private expenditure or the private investment will be wiped which means that the government is going to borrow more amount of money through different sources by purchasing or if government purchases involves in huge amount of purchasing then it also plays very important role.

That it will trigger some kind of imbalance in the bond market and this bond market imbalance will further have bearing on the private investment. So, unlike very smooth analysis that we had in case of monetary policy, fiscal policy will not have that smooth. Because this is accompanied

by the money supply increase. Otherwise, it will shoot up the interest rate and further create a trouble. So, this has to be so you can think about the rate of interest going higher.

If I am shifting the demand with the earlier supply the first speed supply so here you have. So, output gap will be much higher output gap sorry rate of interest will be higher and this will further reduce the output but ultimate is that when you combine it with the money supply. So, this is how the stabilization scheme works in the case of fiscal and monetary policy.

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The slide is titled "Choosing Between Monetary Policy and Fiscal Policy". It contains three bullet points:

- Fiscal policy or monetary policy can achieve stabilization – eliminating the output gap.
- But fiscal policy has different implications than monetary policy for the allocation of resources.
- Obtain different mixes of sectoral output-consumption/investment/government expenditure.

So, fiscal policy so choosing between monetary and fiscal policy. Fiscal policy or monetary policy can achieve stabilization eliminating the output gap. So, this is the output gap we are trying to understand at different equilibriums we have. But fiscal policy has different implication than monetary policy for the allocation of resources because here you have the output change much higher.

Obtain difference mixes of sectoral output consumption, investment government measures so those things you can understand. So, this is the underlying idea that with the stabilization policies you have to always keep in mind that the impact will be bigger on output. But this will further have certain limitations with regard to the interest rate. So, this has to be combined with the monetary policy scenarios this is how we are doing it.

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Does the Keynesian Model Replicate the Data?

- Important in the New Keynesian model to recognize that monetary policy is endogenous.
- Since money is not neutral, the behavior of the central bank matters for what we will see in the data.
- Suppose that there are total factor productivity shocks, and central bank acts to close the output gap.

We are trying to see with the similar kind of setup that we have already assumed about the real business cycle model. In real business cycle we had introduced the persistent rise in the productivity total factor productivity. That if production system is going to be better if the production system has a better scenarios, then how we can generate. I would say if we have the same kind of scenario then how we can create some kind of viable policy decisions with regard to the business cycle.

So, in real business cycle it was easier because we focus more on the inter temporal consumption process that if your productivity shock. So, you can derive this idea from one period consumption model where we had introduced that if you have productivity shock. If this productivity shock is creating a favourable scenario so, in that setup the wage rate is going to be higher because if productivity is increasing then firms may not mind hiring more worker.

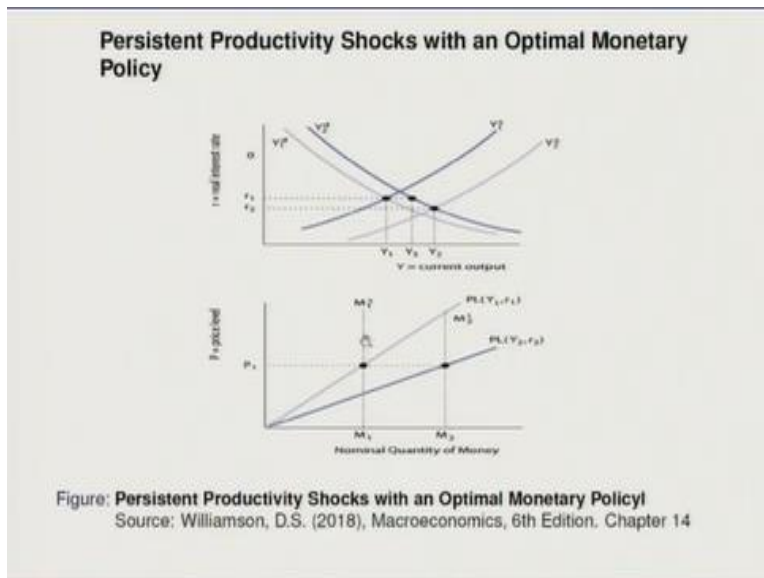
And worker will also have good living condition. So, the consumption will have better scenario. So, for example if wage is going to increase then this representative consumer would like to either go for more number of working hours or it can go for some leisure. So, that we are thinking so in terms of consumption we can think in that direction. So, in case of real business cycle we try to adjust with flexible wages and prices by introducing inter temporal consumption pattern.

But here in case of new Keynesian it becomes important to understand that whether the nuances that we have derived whether we are able to get the same. Second aspect, that we discussed that in

case of real business cycle we introduced the concept of monetary neutrality. So, money neutrality here in case of new Keynesian we are saying that money is not neutral it is endogenous variable so this is how we are trying to see.

So, suppose that there are total factor productivity shocks and central bank acts to close the output gap which means that employment and natural rate of employment gaps are much lower than how we can industry understand.

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So, here we have persistent productivity shocks with an optimal monetary policy. So, if you have persistent productivity shock then this is how it works that here you have the initial level of your output demand and supply is here. Now because of this demand and supply so suppose if you have the productivity shock. So, at this level here you have the r_1 and here you have the Y_1 . But because of the productivity shock supply or output has increased.

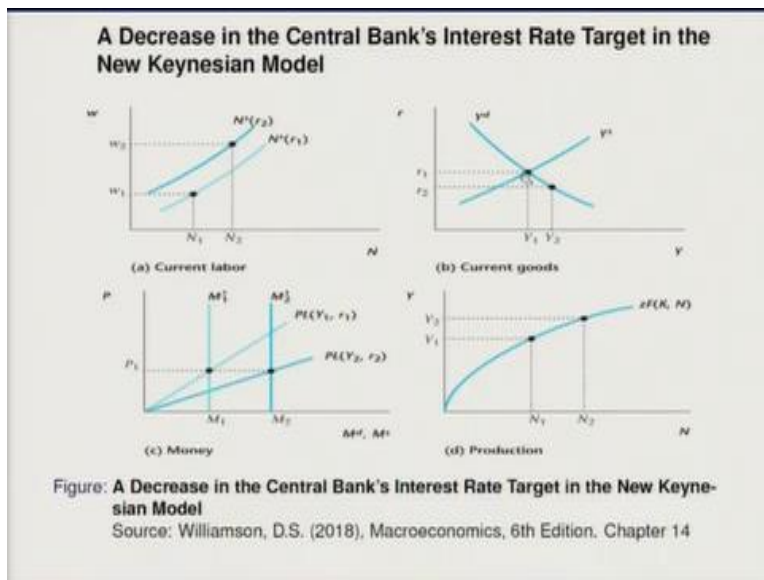
So, if I am saying about the supply of this increase then everything also about the demand. So, here we are saying that if supply of the output has increased because of better productivity. So, here you have the rate of interest lower. So, if you have the rate of interest lower so this can be also linked with the monetary policy scenarios that monetary scenarios are much in favour. So, here you can think about r_1 and r_2 , at r_1 you are producing Y_1 , at r_2 you are producing Y_2 .

But here the gap is between Y_1 and Y_2 as the output gap and how we can minimize this. So, minimization can be done by introducing or by fixing the monetary policy same. The only thing you have to do is that you have to increase the money supply and bring the same kind of setup that you have. So, that you will be arriving at so you should have gone by Y_3 here but again, you can say that you can increase the output. So, here at r_1 the demand in supplies and r_2 is this Y_1 .

When I am saying that you have increase in my supply which means the rate of interest is lower so here you have so productivity shock as such. It is going to create a favourable scenario as long as the monetary policy is supportive. So, this is how we are thinking about the real rate of interest. So, here you have the real rate of interest at r_2 and here you have Y_2 . The price level which we are fixing it as same so here we have the P_1, P_2 .

The nominal so here you have the normal quantity money and this is what we have the rightward shift in the demand for money and this rightward shift in demand for money is having M_1 and M_2 and this rightward shift in demand for money $M_1 M_2$ is much stronger and this can be linked with this r_2 .

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So, similar to what we have done in the case of the decrease in the central bank. So, this is how it looks like this is the scenario that we have and this is what we are looking at. It is bound to have a similar kind of a structure that we are, we have got here. So, finally we will be trying to minimize

this output, the output gap that we have. By introducing the monetary policy and this is how we understand the deep the implications of the monetary policy that one can have.

So, at Y_1^d and Y_1^s output Y_1 is produced with the increase in or with the decrease in rate of interest or I would say increase in money supply. Keeping prices fixed we are able to arrive at Y_2 which means that you have the better output scenario and this brings to an equilibrium in the same way that we have for the real business cycle that more or less with the same level of understanding that we had for the real business cycle or new Keynesian.

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Hard to Distinguish Between New Keynesian and Real Business Cycle Models

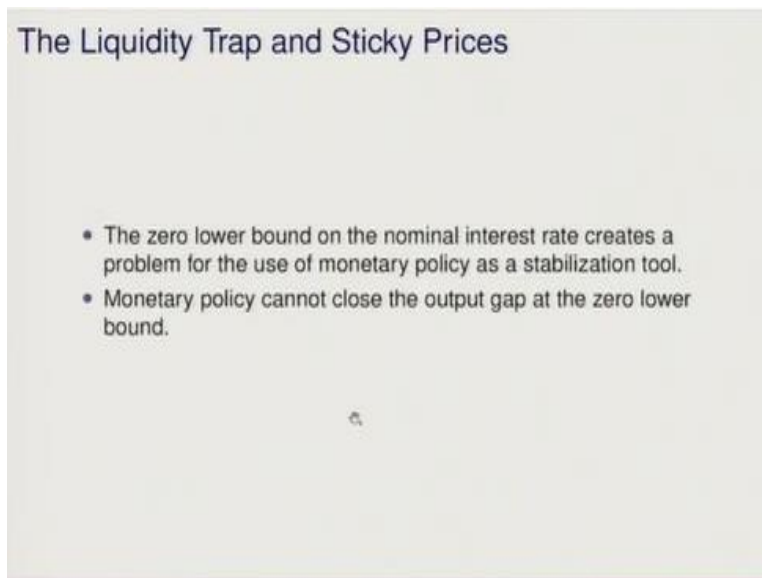
- New Keynesian Model: Suppose the central bank always closes the output gap.
- Real Business Cycle Model: Suppose the central bank stabilizes the price level.
 - Cases 1 and 2 produce exactly the same data under persistent total productivity shocks.
 - In both cases prices are observed to be "sticky," and real variables behave in the same way.

Here also we are able to get the same which means that the central bank always comes out with the scenarios which fulfill the output gap. So, this is what we are achieving it here that we are trying to see that how we can fulfil the output gap and how it moves. So, demand supply scenario both should be there, here the idea is that if you have. Suppose this is the equilibrium point Y_1^d and Y_1^s here you have the productivity shock.

So, productivity shock will increase the output and this will be more linked with the demand supply. So, here suppose if you have the demand is this much which is Y_3 . So, $Y_1 - Y_3$ may be the output gap. But here if your central bank is reducing the interest target which is further complemented with the money supply increase then this you are arriving at new equilibrium and this Y_2 is much bigger.

So, this is what we try to understand that central bank will always close the output gap. More or less, it is this having the same implications with regard to price stability. Because in the new Keynesian setup price fixes makes, I would say price fix makes the analysis interesting. And in both cases prices are observed as sticky and real variables behave in the same way.

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One of the important aspects about the new Keynesian model is that it tries to help you understand the real business cycle context in a much simpler way. But one of the stringent assumptions that this particular new Keynesian economic thought makes is about the price rigidity and one of the criticisms of the new Keynesian is the non-realistic picture of the price rigidity because if you are thinking about for example the menu cost.

So, maybe the restaurant will not change the price as I mentioned in the beginning. But if the restaurant is going to keep the same menu, then it will also impact the business. So, they always update the menu after regular intervals. So, that the; customers will have a different experience. So, the assumptions of many cost that if you have a short run, price variations or immediate price variation.

Then this will not impact output with the efficient technology with the development of new technology it has happened that such type of short-term models may not be applicable if you are

taking out a such type of stringent assumption. So, these are the issues we will be taking up this further in the next session and will be trying to understand. So, maybe certain dimensions of productivity shock that we discussed.

Some more I will be adding the dimension and will be seeing that how we can and maybe with one or two examples that how we can understand the productivity shock in the optimal monetary setup and how we can link it with the real business cycle in a better way. I am stopping it here thank you, thank you so much.