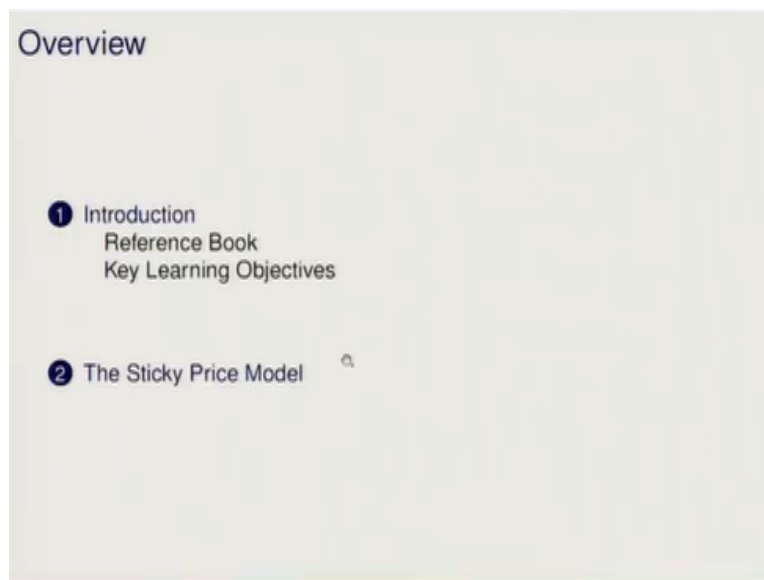


Micro Foundations of Macroeconomics
Prof. Wasim Ahmad
Department of Economic Sciences
Indian Institute of Technology, Kanpur

Lecture - 27
New Keynesian Sticky Prices I

Welcome back so let us start. We are going to start a new topic now. Now we will be talking about the Keynesian new Keynesian salt water. Saltwater school of economic thought became quite a popular history a school of economic thought and it still exists and you have a lot of developments taking place so saltwater school of economic thought believes that you have a role of the governments and the government intervention becomes important. So, it is attached with the new Keynesian school of economics.

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So, here we are going to talk about the sticky price model. So, sticky prices which means that when you have a rigid. So, far what we have discussed is whether it is real business cycle or the Keynesian coordination failure model. In both cases we did not focus more on the rigidity part or a sticky part so the prices and wages were flexible. So, we were just superimposing the condition that when you have the rate of interest higher how the labour market is going to react.

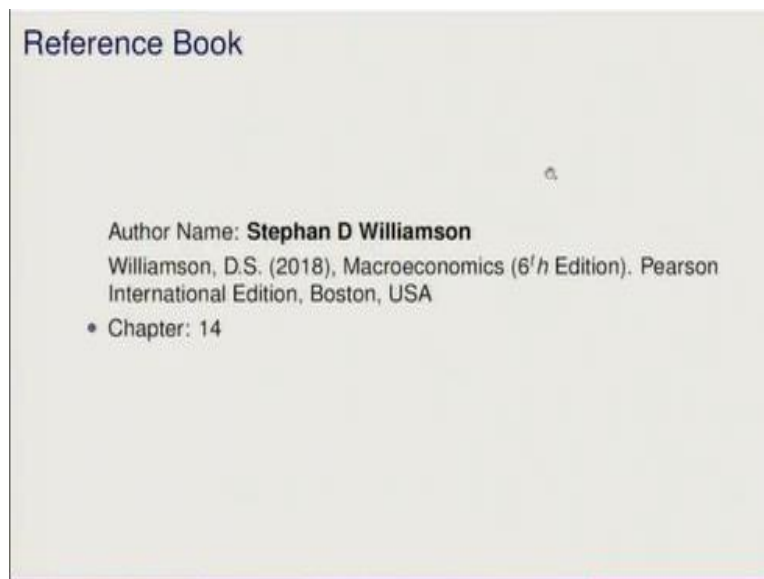
So, that is what we had the output supply curve and then we also had the output demand curve. And then we also superimpose the condition that if you have an increase in rate of interest then

whether the labour will go for current or future so what will be the substitution effect scenario. Here we will be trying to look at the stickiness that we talk about in macroeconomic context. When we have a context when we have the scenarios wherein, we are so in real life when we say about flexible wages and prices.

It may not be easily acceptable because in most of the situations what we see that the short run adjustment is difficult in long run adjustment is easier. So, maybe in the; long run when you think that when you are going to old then you will have a different lifestyle but in the very short run period may be less than a year or so it will be difficult to change your behaviour in a big way. In the same way when you look at the macroeconomic variable then it becomes really difficult to understand.

That how things are changing at a much larger scale. So, we are trying to understand the sticky prices in that direction.

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So, the reference book remains same we are talking about the Stephen Williamson.

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Key Learning Objectives

- Construct the New Keynesian model with sticky prices.
- Demonstrate that money is not neutral in the New Keynesian model.
- Show how government policy—both monetary and fiscal policy—works in the New Keynesian sticky price model.

And we are trying to understand the new Keynesian model with sticky prices. How in the Keynesian coordination failure model we understood that money is not neutral but we will be also saying that in more formal way we are introducing the Keynesian idea of stickiness in the short run and then we will see that how new Keynesian idea will try to further substantiate that argument that we had in the previous session.

Show how government policy both monetary and fiscal policy works in the new Keynesian sticky price model. So, there it becomes really crucial that how new Keynesian model helps understand the stickiness and how we can think about the interaction of monetary and fiscal policy under the sticky price model

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Key Learning Objectives

- Show the implications of the New Keynesian model for what we should see in the data, assuming optimal monetary policy.
- Construct a liquidity trap equilibrium in the New Keynesian model and show how negative interest rate policy works.
- Explain the criticisms of New Keynesian models.

Show the implications of new Keynesian model for what we should see in the data and the optimal monetary policy. So, maybe here we will be looking at the Taylor rule and further the dynamics that are useful in understanding the monetary policy making. So, the art of monetary policy making what it involves will be talking about that. Construct a liquidity trap in the new Keynesian model.

So, in which also if you remember monetary inter temporal model, we talked about the zero lower bound where we had the when we say that the money supply and the bond that you have if both are equal. Then we have the liquidity trap situations will be talking about and how negative interest rate policy works in which all directions and then we will be at last highlighting the limitations of the new Keynesian model. So, this is what we are trying to understand.

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The Sticky Price Model

- Firms sell as much output as is demanded in the short run at a fixed price.
- Model monetary policy as a fixed target for the interest rate r , supported by setting the money supply appropriately.
- Employment determined as the quantity of labor required to produce the quantity of output demanded at the fixed price of goods.

Now let us first understand, what do we mean by the sticky price model? When I am saying about the sticky price model that then it involves two things. First thing is that how individuals perceive about future that if I am standing today here how I am thinking about after one week 10 days or 15 days or 20 days. Now the second aspect is that when I am talking about the expectation then I will also think about that what will be the cost of that expectation.

So, if I am the shopkeeper and if I am selling some goods, I know that price of this good is going to be higher in future so this is my expectation. But the cost would be that if I am going to increase this price then if all others are not increasing the price, then I may be the loser that the customer that who are coming to buy goods from me they may go to those sellers who are not increasing their price.

So, if you are expecting certain thing in future, it also has some amount of cost involved and those cost involved are having the main attention of new Keynesian school of economic thought. That how when you have a price change in the pricing happening in the economy in the short run it does not lead to immediate change in everything. So, this is what they try to make their. If for example if you see that inflation is going to be higher then you will not find that everyone is increasing the price immediately.

Maybe the price of raw material has gone up but the final product output may not be going that higher. You can see the best example is that most of the car companies are facing the problem of semiconductor shortage. And as a result, what has happened that? In some or the other way and since the; metal prices are also going up post Covid-19. So, the companies are trying to cope up with the existing prices they are not increasing the price immediately.

Some firms have gone for margin increase they are trying to pass the cost in a gradual manner they are not passing those cost immediately to everyone. So, that becomes an important scenario to understand. The typical example the very conventional example that the Keynesian school of economic thought always cites is about the menu cost. So, what is the menu cost? So, many cost is that when you are if you are owning a restaurant and if you are running in a very downtown street then there it may happen that if the cost of input is going up.

Then whatever the ingredients you are using to have to serve to the customer or to prepare good food to serve to the customers. If the input prices are going up you wait for some point you wait for some time. You do not pass that increase price immediately to customers. Because it is assumed that if you are going to change the price of the menu quickly then you also incur some extra cost. What are those extra cost? Extra cost is that you will have to go for printing. You will have to go for thinking about how much I have to increase.

So, if you are going to increase the if you are going to see the increase in printing cost so if you are having extra cost attached if the printing of your menu, then this will also create a extra burden. So, if the prices are changing quite frequently in the short run it will not lead to change in price of most of the items, it will have some kind of stickiness rigidity in prices. In the same way when we talk about wages so classical argued that the wages and prices are flexible.

And the real business cycle model and even the Keynesian perspective they added with the help of I would say neoclassical what was the idea was that how we can understand the business cycle dynamics with flexible wages and prices with the role of expectation. Here in this situation, it happens that if there is a role of expectation, if you have a individuals or if you have a forms

looking for some amount of I would say the or if you have individuals talking about or I would say some firms in the economy talking about the price rise.

Then you will find that they will not be following the price rise trend immediately. They will wait for some time because there are not just the menu costs printing cost but there are also other concerns that if all are not increasing the prices. Then you will always have the risk of losing your business. So, in the very short term you will find that the prices do not change. And in the same way that I mentioned about the wages so I was highlighting the wages.

The way we are describing the prices of goods and services we it is also directly applicable so in case of classical what we saw that prices and wages were flexible. In case of Keynesian the wages are also sticky in the same in the sense that the contract, the kind of formal agreement happens between the employer and employee at some time in the short run it may not be as flexible as emphasized by the classical. It may take some time.

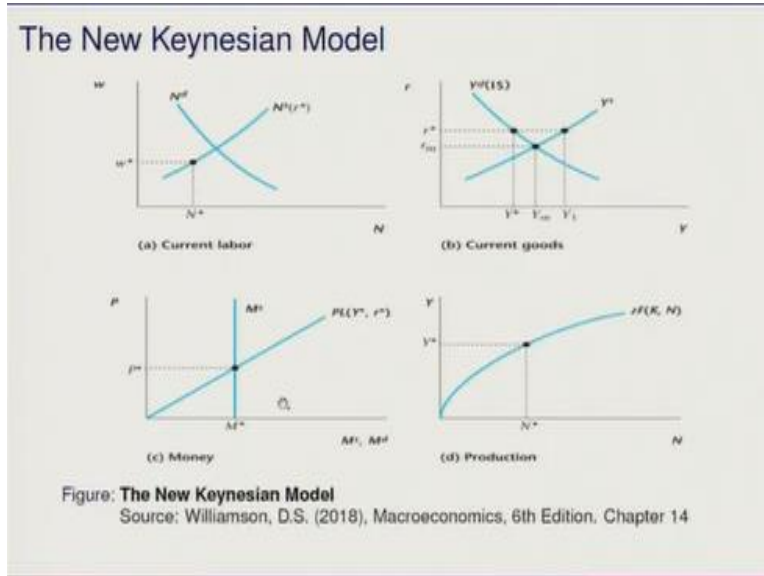
So, those kinds of those angles are added to the new Keynesian school of economic thought. The second argument that the or second proposition that the new classical have is the monetary policy as a fixed target for the interest rate supported by setting the money supply appropriately, which means that when you have money supply increase as they argue that money is not neutral in the case of new Keynesian school of economic thought.

So, when money supply is increasing then this is having positive impact on rest of the macroeconomic variables. And there will be certain role expectation role of certain macroeconomic variable certain agents in deciding about the role of monetary policy in the economy. So, there you have a; and here they also decide about the threshold that if you have the optimal level of supply in the economy.

If you have no output gap if you do not see any kind of deviation from natural rate of interest then everything will go as usual. But they bring one intervention here about the wage rigidity. So, once you have the wage rigidity playing very important role then the understanding of money supply becomes interesting in the sticky price model. Here you have a employment determined as the

quantity labour required to produce the quantity of output demanded at the fixed price of the goods. So, this is very common that we find in most of the cases.

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Now the new Keynesian model here in this case it becomes really important. Let us look at the chart b which is crucial. Now here in most of the cases we are seeing that this is the output production function. This is the output Y^* is the output, N^* is the labour here you have the money supply. Here you have the PL (Y^*, r^*), so this is how you have. At this price here you have the P^* and this is the money supply and this is the demand for money.

And r^* is the same that we have the fisherian demand for money that we derived. Now here demand supply but at this wage rate here you have the labour supply this much, now b is crucial here we are seeing that r_m and Y_m is the equilibrium level of rate of interest and the output. So, this is the equilibrium level of rate of interest and output here you have to make sure that, what we are seeing is that r^* is linked with Y^* and linked with Y_1 also.

So, if r^* is the equilibrium let us first deal with r^* and Y_1 . Firms would like to supply suppose Y_1 output it is willing to supply and it is desired to supply Y_1 output but it is supplying only Y^* so this gap that you have $Y^* - Y_m$ or I would say. So, this is the scenario that you have that this is the equilibrium output and equilibrium rate of interest and this is also called as the natural rate of interest at which you have the equilibrium output.

The actual supply actual output supply the firm wants to supply this much. But because of this wage rigidity that you have because labour supply form with the given rate of interest it is supplying only this Y^* which means that $Y_m - Y^*$ becomes some kind of output gap scenario or I would say $Y_m - Y_1$ becomes the output gap scenario so these two are the important aspect to look at.

So, here what it means that the deviation from Y_m either to Y_1 or Y^* it creates some kind of scenarios under which we are not at equilibrium. So, if any deviation from equilibrium this creates the output gap kind of scenario. So, in case of new Keynesian model this is what it implies that given the output demand which is nothing but the IS curve that you have already dealt in most of your basic macroeconomic test book.

This IS square which is the demand it shows that here you have the output of r^* and Y^* . This is the willingness to supply which means that it is talking about capacity. This is the actual but you are supplying only Y^* and this is primarily attributed due to this Y^* and N^* . So, in the short run this is how the Keynesian function looks like and Keynesian model looks like because in Keynesian model if you have this output gap created and this creates the problem.

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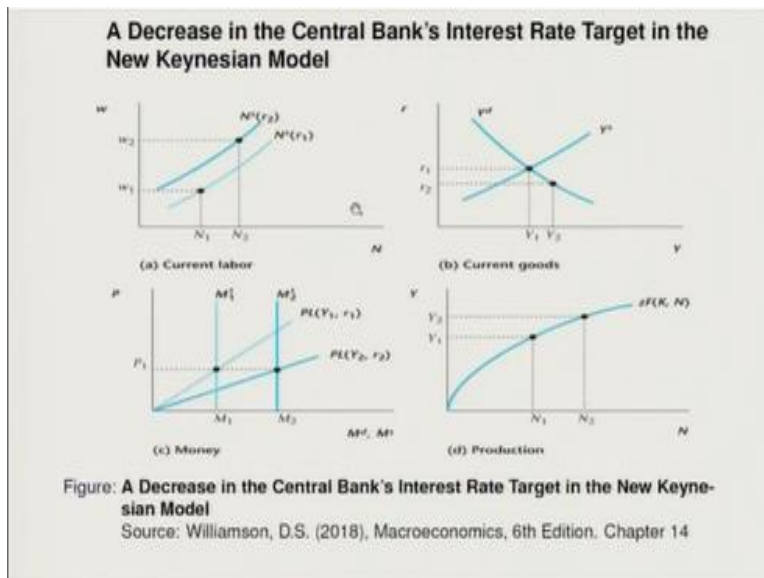
Two Key Concepts

- The output gap is the difference between equilibrium output (if prices were flexible) and actual output.
- The natural rate of interest is the equilibrium rate of interest if prices were flexible.

So, output gap that you have it is the difference between equilibrium output if prices were flexible then actual output so actual output is this is equilibrium output so $Y_m - Y^*$ is nothing but the output gap and this is where we have the role of lot of policy that what we can do. So, that we can reach at Y_m at least if not Y_1 we can at least come to this point, we can come down and we can reach to $r_m - Y_m$. So, this is how it looks likes.

The natural rate of interest that we have it is r_m it is equilibrium rate of interest if prices were flexible. But since prices are not flexible so this is how we are seeing and this price is not flexible it is also linked with the W star and N star. So, this is how it implies, rest of the things are very simple to understand not much to deal with.

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Let us understand that what happens when we have the money supply degree. So, when we have a when we talk about the Keynesian idea. So, Keynesian idea is always talking about some kind of process through which we try to understand the behaviour of most of the macro variables that how the macro variables are reacting in the context of mostly the short run. And here what we are trying to understand is that if you have more number of variables.

So, whatever we have understood in the last session about consumption about investment about real wage about the employment whether those variables are also pro cyclical in this case. So, in case of new Keynesian this is where we are talking about a decrease in the central banks interest

rate target in the new Keynesian model. So, here what we have is that here we have the labour supply once we have the labour supply, so this is the initial condition.

So, here we have W_1 and here we have N_1 . What we are saying is that this is the equilibrium point r_1 and this is the $r_1 Y_1$ this is the scenario. So, this is P_1 so in order to make sure some money supply increases the role of the central bank is to maintain the price stability. So, it tries to maintain so whatever adjustment it makes. So, it is P fixed so prices are sticky not changing, though there is a change in the money demand.

But this is not this is whatever you have increase money supply this is also adjusted with the money demand. So, it is almost same so, price does not change. Here we have $N_1 Y_1$ so here what we are saying that when we have increase in money supply. This might be a scenario in which the gum these central bank wants to maintain and the inflationary scenario in the country or maybe the better outlook.

With the increase in money supply this we have so this I explained with both the scenario but let us deal with the superimposition scenario when M_1^s and M_2^s if M_1^s is shifting to M_2^s this is leading to increase in money supply which means that the rate of interest is going to be lower. So, this rate of interest is going to be lower. Once we have the rate of interest going to be lower what typically happen that investment is going to shoot up.

When investment is going to shoot up then you have a more of output increasing so this Y_2 so output shift to Y_2 and here it attaches to this point. Here we have an earlier it was Y_1 but because of the rate of interest decrease here you have Y_2 . Now this Y_2 corresponds to the point at which here we are seeing that there is an increase in output and increase in employment here we have N_1 and N_2 .

N_1 denotes the labour let us not get confused M_1 is the money supply $Y_1 Y_2$ are the outputs and $r_1 r_2$ are the rate of interest. So, now this particular chart is very crucial. With this rate of interest getting lower the individuals will be tempted to work for more and as a result what we see is that

here you have the supply of labour increasing. And what typically it happens that in this situation when you have the r_2 rate of interest lower.

Here individuals are so the wage rate is going up and when we have the wage rate going up, we see increase in employment. So, which means that this when I am linking r_2 with Y_t due to increase in money supply this is leading to increase in output and this increase in output is augmented with investment. So, investment is getting higher, if investment is getting higher then it is obvious that firm would like to hire more labour.

And labour when they are seeing that rate of interest is going to be lower, then it is better that they will be focusing more on the employment side and here we have a both having interaction. So, this is where we are seeing that here we have N_s . Now when I am having the rate of interest scenarios linked with the labour supply so the wage rate is going up the employment increasing. So, from the business cycle perspective what it what typically happens is that price stickiness that we have it remains same.

The increase in money supply leads to lower rate of interest increases output, increases employment and this also increases the wage rate. So, if you have a so if you have the interest target of the central bank moving more in this favour then this automatically short out the issue of employment it also short out the issue of investment, it also short out the issue of output gap. So, output gap that we normally call calculate.

So, let us spend some time on the output gap that what we how we are dealing with so if you are having suppose you have the GDP series. So, here you have the GDP series, in GDP series you have two components one it is called the trend so you will have the suppose India GDP is 1,40,000 crores. So, if India GDP 1,40,000 crores, then here you have this much output. If this output, if I have to calculate the output gap how will I am calculating any data series will have two components trend and cycle.

Now if you are if you want to calculate the output gap then you can simply subtract the from the actual GDP you can simply subtract the trend whatever value that you are going to get. That

cyclical value that we have that we call it in practical sense that while we use it for output gap, we substitute for output gap. In most of the situations what we have is that when you have the output gap playing very important role then when we have the negative.

It means that your trend component which was supposed to increase it is lower than the then the or it is higher than the actual so here the trend is higher than actual then it is negative. When you have a positive which means the actual output is higher than the trend. So, there you have the positive output gap. If you plot this then you will see the cyclical trend that where the output was fluctuating.

So, in macroeconomics, if you want to do any kind of project or any kind of assignment then these variables are very useful to calculate. So, you can see the impact of the output gap on interest rate on exchange rate and how the exchange rate reacts with the output gap. So, this basically shows the demand supply and demand scenario that how much you have and it also it is linked with the capacity in the economy.

So, supply also reflects that how much you can produce and how much it is actually demanded so that is what you have so, your actual output how much you can produce and the equilibrium output. So, this is how it is dealing here. So, I hope this particular understanding has made us understand the model in a much better way. So, a decrease in central bank interest rate.

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The Non-neutrality of Money in the New Keynesian Model

- A reduction in the central bank's interest rate target, supported by an increase in the money supply, acts to increase aggregate output and employment.
- The demand for output rises at the fixed price of goods, and firms accommodate the increase in demand by hiring more workers.
- Consumption, investment, and real wage, increase.

Now what it says the non-neutrality of money that we are talking about. So, non-neutrality of money in the new setup what it says. It says about a reduction in the central bank's interest rate target supported by an increase in money supply, acts to increase aggregate output employment. This is what aggregate output is increasing aggregate output, increasing employment, increasing employment, increasing wage rate is going up, so this is what I try to mention here.

The demand for output rises at a fixed price of goods and firms accommodate increase in demand by hiring more labour, this is what we have. So, here if you have a demand for output so once we have the demand for output how it will be coming when the rate of interest is lower it becomes more attractive to buy more goods and services. So, there we have consumption investment real wage all increase.

So, if you have a such type of scenario your investment is going to be higher and consumption will also be higher.

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Principles of New Keynesian Stabilization Policy

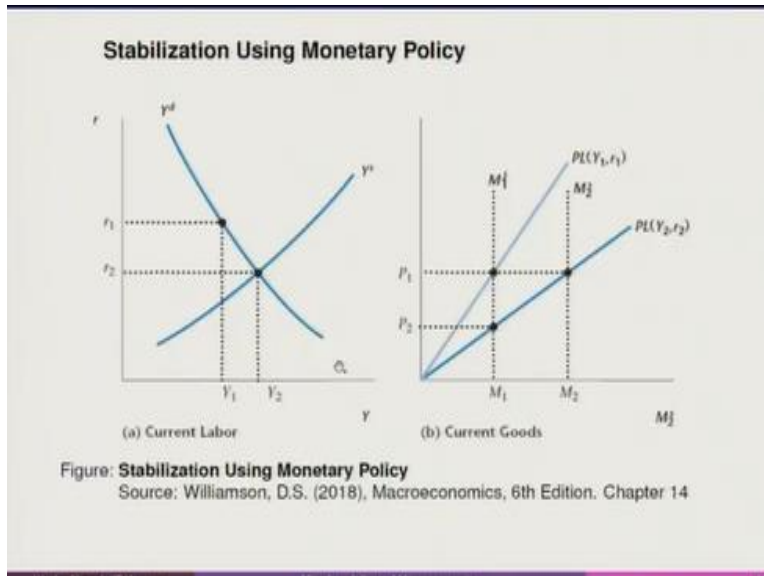
- Private markets cannot work efficiently on their own. Prices (and/or wages) do not move quickly enough to clear all markets in short run.
- Fiscal and/or monetary policy decisions can be made quickly enough, and policy actions work quickly enough that the government can improve economic efficiency by smoothing out business cycles.

So, this is where we talking about. Private markets cannot work efficiently on their own. Prices do not move quickly enough to clear our market so this is the short run scenario. Fiscal and monetary policy decisions can be made quickly enough. Policy actions work quickly which means that it can be thinking about. So, if you want to understand the efficiency part you can bring in.

So, this is what we have tried to understand this also mentions about the efficiency part what happens when we have the rate of interest decrease which means that money supply is increasing. So, this brings efficiency to the system because most of the macro variables are increasing and if most of the macro variables are increasing then this is going to have positive impact on some of the positive impact on the aggregate economic output.

And once you have aggregate economic output increasing so, your overall economy will go up so that is the underlying idea we have here. So, here we trying to say.

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I will be covering the next part from here and then we can we will have discussion on non-neutrality of money further and we can think about how we can make this particular the new Keynesian understanding better. I hope with this particular background you are at least aware about what is the meaning of stickiness how is stickiness plays a very important role. And later sections we will have the more formal introduction of stickiness with certain monetary policy rules, stabilization rules of fiscal policy and even the taxation rules.

Those rules are important to understand especially from the macroeconomic dimension perspective. I am stopping it here and thank you, thank you so much you.