Microfoundations of Macroeconomics
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Module No # 07
Lecture No # 36
Monetary Policy VI

Welcome back.So we are now going to take forward the argument of our guidance that hope our guidance is going to play a really important role in understanding the actions of the central bank, effective communication of the central bank and how central bank is credible about its forward guidance. So, we will be understanding with the zero lower bound case.
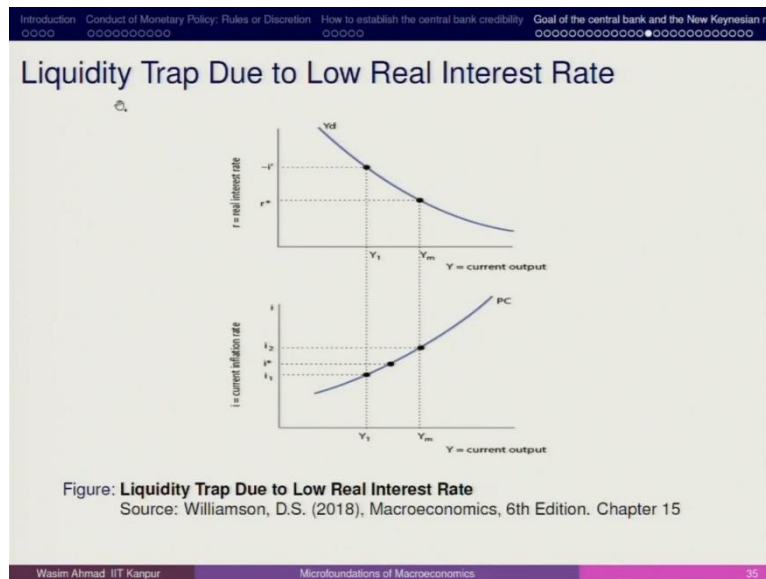
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So, reference remains same, the Williamson book we are referring and we have already covered the Mishkin part. And we have also covered the Bank for International Settlements reference and the unconventional monetary policy. So, we will be now going and seeing that how the credibility of the central bank is decided with the help of the forward guidance. So here it becomes really important to look at. So, here we have the scenarios.

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Liquidity Trap Due to Low Real Interest Rate

Figure: **Liquidity Trap Due to Low Real Interest Rate**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

So, first let us talk about the liquidity trap due to low real interest rate how we are talking about. So, suppose this is the real interest rate, this axis this axis shows the current output, this axis shows the current inflation rate and this also the x axis remains same the y axis is changing for these 2 charts. So, here what we are seeing is that at r^* , which is the equilibrium real rate of interest, if you have the output of Y_m, and it, corresponds to suppose.

For example, the hypothetical scenario is that i^* here right this is the rate of interest, but for the time being, we assume that. So, this is the inflation rate we have i_2 but because of the 0 lower bound, where the nominal interest rate is 0. So here you have $- i^*$ and this can also be 0. Because if you are thinking about the inflation, because in this model, we are not assuming 0.

Because here we are expecting that the central bank has a control on the nominal interest rate. But it does not have control on the inflationary scenarios. So, it has to follow up. So, whether the nominal interest rate will follow the inflationary scenario that we are mentioning. So, that is why here we have the real interest rate negative right. Now, what we are seeing is that corresponding to this the inflation rate is much lower i_1 and it is creating the output gap which is nothing but $Y - Y_1$.

So, you can think about that with this rate of interest, which is almost like a less, which is still that. We are not able to achieve the equilibrium level of output which should ideally be r* and the Y_m. Because of the lower real interest or almost like a 0 lower bound we are having it is having deviation. So, and the interest inflation rate is also lower. Now, what typically should have happened that? Because the nominal interest rate is 0 now, in this case.

The inflation should have picked up but because of the liquidity trap scenario, where your money supply or money or I would say demand for money becomes a perfect substitute for the holding of the bond. So, if you are having the 0 interest rate, then it does not matter that whether you are going for demand for money holding the cash stock or you are going for holding the bonds, if you have that kind of scenario.
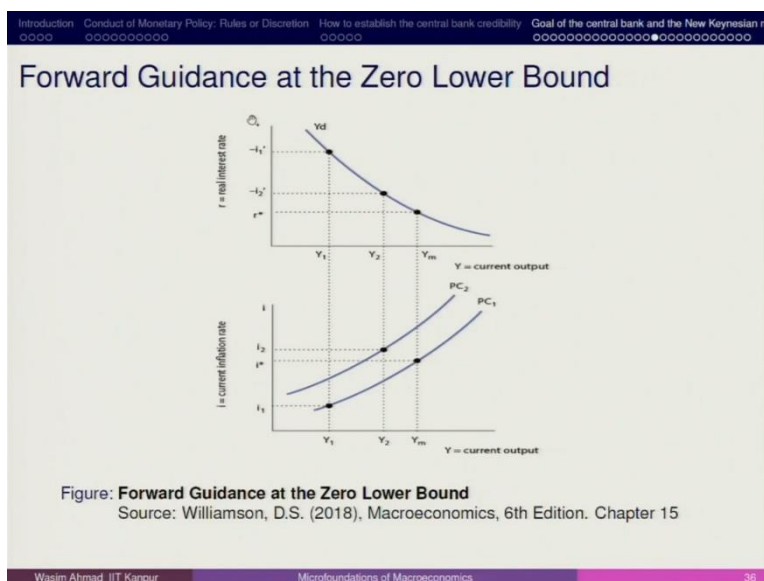
So, what typically happens is that in order to attract so, here what we are seeing that even if the central bank is trying to incorporate certain adjustment with regard to the interest rates. So, interest rate you cannot now change because it has almost already touched the low. So, what we are seeing that there is some kind of permanent deviation happening between the equilibrium levels of inflation which is i_2 and then here we have i_1.

So, in this particular case, what typically will happen? That the; central bank may take some non-conventional major and may try to adjust with this middle point which is i*. So, the liquidity trap situation create a very unfavourable situation that even if we have the interest rates, scenarios, which is the nominal interest rate. Almost zero inflation does not pick up and this is one of the important arguments that new fischerism or I would say new fisherian in school they argue that if you are having low level liquidity trap.

Then or if you have a 0 lower bound if you have the lower real rate of interest, then it typically happens that individuals will not be caring about. The, I would say open market operations and ultimately, your demand for money will also not have that much reaction. So, you may have permanent output gap and permanent deviation. So, in order to bring out the difference is lower.

The central bank has to think about the forward guidance under forward guidance central bank may signal that the rate of interest is going to be higher and if sorry, the inflation is going to be higher. So, as a result the nominal interest rate is going to be higher than in that situation. This inflation interest rate trend may shoot up and reach to either start otherwise it will not. So, this is the precondition of new fishery in argument that they mentioned about fulfilling this that in what all situations we can come to this point, which is r * and Y m.

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Figure: **Forward Guidance at the Zero Lower Bound**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

Now, let us talk about the forward guidance. So, in case of forward guidance, what typically happens that this is the r * and this is the Y_m at this point here you have i* right. Now, if you are thinking about the 0 lower bound, so in case of 0, lower bound, what typically happens that if this is the point here, we have the, i_1' and this is corresponding to i_1 which is the inflation.

So, if you have the equilibrium level of inflation or I would say target is this the target, I would say real rate of interest is this the output is this, what we are seeing is that at i_1 because of the 0 lower bound. The inflation is much lower; we are creating the output gap Y_1 and Y_m right. So, different between these 2 lines it is output gap. Because equilibrium should be Y_m and r* the corresponding should be that i* and Y_m right.

So, at this particular line, we should have this i* corresponding to this we should have i m but what we are finding that. Because of this the 0 lower bound scenario, because of the nominal interest rate being 0. We are creating the output gap which is Y_n so, different between Y_m and Y_1 is the output gap. The corresponding to this the inflation is much lower. Now, this inflation lowers in order to increase this, what central bank is supposed to do?

Central bank is supposed to think about how they can make adjustments with the with regard to the forward guidance. So, the central bank mentioned that the rate of interest is going to be or the inflation scenario is going to be higher than your inflation moves to i_2 , and this will create a scenario for i_2 transpose and Y_2 .

So, your output gap which was initially Y_1, so, $Y_m - Y_1$, now, it is reducing because of this inflationary guidance that you are mentioning that there must be. So, you must be knowing that

in the case of Fed Reserve, we always hear on certain interval that Fed Reserve is going to revise the interest rate. Which; means that it is going to move up from the 0 lower bound which also means that it is if it is 1% then it is going to be 1.25 1.50%.

There will be a lot of discussion around that stand that what is going to happen and then the Fed Reserve decides about that whether they have to go for increasing or decreasing the rate of interest. So, typically, it is not linked with the inflation in the case of most of the advanced economies, it is it has to be deal more it has to deal with more of the financial market disturbance because of the money supply increase that they expect.

But with regard to forward guidance, what economists argue that if you are giving the signalling with regard to the inflation, right and future rate of interest higher. Whether it is inflation or anything you can think about. Then it can create a scenario for reducing the output gap and this will further shift the Phillips Curve leftward. And, this higher inflation scenario will also fulfil to some extent the Y_2 i_m. The Phillips curve as I have already showed inverse relationship between the inflation and the unemployment.

So, if you have higher inflation in the economy then it is bound to be that unemployment will be lower right. So, this particular angle leads leftward shift in the Phillips curve. So, this is what we have the, i_2 transport. So, forward guidance what it leads compared to here in this case, there is a wedge the gap between these 2 and this gap is fulfilled or i will say this gap is filled with the forward guidance scenario. So, this is how they argue with the condition that in which all context they can think about having this scenario.

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So, forward guidance or commitment by the central bank to high future inflation. This is what we mentioned given fixed anticipated future inflation because future inflation we have assumed as exogeneous, this creates a scenario, it acts to lower the real rate of interest. Because you are targeting the nominal interest rate to 0 almost right increase current output and increase current inflation rate.

So, this is what we have that increasing the inflation rate? As a result, your output is still lower than the full employment level of output but it is increasing. Because of this expectation about the future inflation because the; labour participants will also be expecting about it. Central bank commitment important it is also that promise needs to be credible which means that as I mentioned that if you are teaching a course.

And if this course has the content of taking the quiz, regular quiz, and if you are not taking quiz, then in future if we are going to make announcement. Then instruments will not be taking seriously in the same way this the central bank is going to make announcement about or certain kind of signalling about the higher future inflation. Then it means that this has to be accompanied by the higher rate of a higher rate of interest.

And if that is not met, then forward guidance may not be credible enough in future. So, people will not be taking the I would say the directions of the central bank seriously. So, there it becomes really crucial.

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What we have now is the Neo-Fisherism . So, fischer has given the idea where we talked about the real interest rate is equal to nominal interest rate minus inflation. In case of rational

expectation, we think about expected inflation right the Fisher equation mentions about that. Then we are seeing in the case of New Keynesian rational expectations model that how the NKRE model can play very important role.

So, Neo-Fisherism first it is important to understand that what do you mean by Neo-Fisherism. The conventional view on central banking suggests that the nominal interest rate target commensurate with the inflation rates. Which; means that if you have the nominal interest rate higher you have the higher inflation rate then only you will be talking about increasing your nominal interest rate. If the nominal interest rate is lower which imply that the central bank is talking about, the lower inflation.

The high low inflation implies high low nominal interest rate target right this is the conventional setup and new school Neo-Fisheriens Neo F argues that the conventional central bank interest rate operations have been wrong. Because if you are keeping the inflation keeping the nominal interest rate almost 0 levels and your inflation should have the impact on it should grow by more than one percentage basis point or 2% or not just one for one.
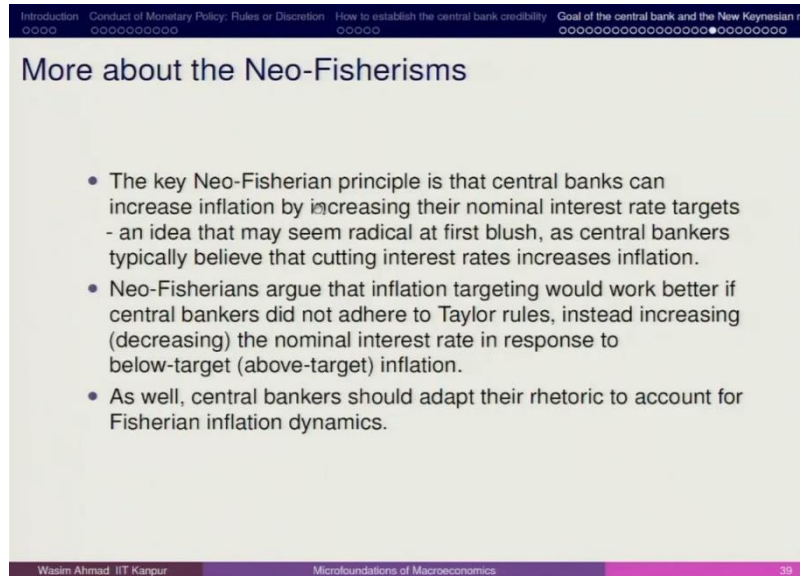
So, if your interest rate is 1%, your inflation should be 2% 3%. So, in the same way as we add with future periods, it should go on. But it is not happening in most of the first world countries and this has become a major challenge which means that inflation control is wrong. According to Neo F a central banker would increase or decrease the nominal interest rate when inflation is below above the central bank's inflation target.

So, this is what we try to always mention about the central banker would increase or decrease the nominal interest rate when inflation is below above the central reserve is just it is recommending to have the policy stand just opposite to the conventional system. That if you have the interest rate, inflation rate lower you go for a higher interest rate if inflation rate is higher, you go for a lower interest rate.

So, counter cyclical you can think about normally we say in case of business cycle counter cyclical and pro cyclical during counter cyclical when economy scenarios are poor. Then you go for invest reducing the interest rate much lower and create a favourable scenario for investment. Here they are recommending that if you are expecting higher inflation, reduce the nominal interest rate.

If you are expecting lower inflation increase the nominal interest rate and this will in, turn will increase the inflationary scenario. So, this is quite controversial and people are still trying to digest this particular idea. So, we will be trying to understand with one or two examples that how it works.

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The key Neo-Fisherian principle is that central banks can increase inflation by increasing their nominal interest rate targets. An idea that may seem radical and then the central bankers typically believe that cutting interest rate increases inflation. Neo- Fisherians argue that inflation targeting would work better if central bank bankers did not are there to Taylor rule.

So, output gap and inflation gap that gap that we mentioned with the target inflation rate that should not be there. And the central bank should focus only on the inflation and the nominal interest rate target. That is it they are not recommending to have any kind of output gap the central bank should adopt their rhetoric to account for the future inflation Neo-Fisherism that we talked about. So, Neo-Fisherism comes from the fisherians an idea, but it is also having some kind of bearing on the NKRE model that we are going to see now.

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Dynamic Output Demand Relationship

$$Y - Y' = -\frac{1}{d}(R - i' - r^*)$$

- Captures intertemporal substitution: more demand for output in current period relative to future the lower the real interest rate. Y' shows the anticipated future demand for goods.
- $\frac{1}{d}$ intertemporal elasticity of substitution, a measure of the representative consumer's willingness to substitute consumption intertemporally, with $d > 0$.
- What we learn from above equation that the difference between demand for goods and the future demand for goods depends on the difference between the real interest rate, $R - i'$.
- The higher real interest rate over natural rate of interest implies that the demand for future goods is higher than for goods in the present.

So, if you think about the dynamic output demand relationship. So, this is the output gap which is inversely related with 1 upon d R – i' which is the expected future inflation minus real rate of interest that we have. So, r bar is the real interest rate that we try to mention about. So, what it captures? It captures that if we are going to see in the framework of intertemporal, then it says that, the more demand for output in current period relative to future lower the real rate of interest.

Because, if you are thinking about more of the current period expenditure it means that you think that in your future the inflation rate is not going to be higher. So, your real interest rate may also not look your, if the inflation values are not going to higher than you think that your real interest rate will be better. Because, if inflation is lower and nominal interest rate remains same then you are going to have the higher real interest rate. Which means that here we think about some kind of better demand scenario in future right.

So, this is what it indicates. Now, if you think about this parameter which is 1 upon d, it shows about the intertemporal elasticity of substitution. Which means that how is the real economic agent whether it is consumer and firm thinking about current and future period consumption. If you think that the real interest rate scenarios are going to be lower in futureyou will be spending more today, if you have real interest rates or your higher in future you will save more today.

So, he talks about that the difference between the demand for goods and the future demand for goods depend upon the difference between the real interest rate. So, this is what are we have R – i', the higher real interest rate over the natural rate of interest. This is what the natural rate of

interest here we have implied the demand for future goods is higher right. So, if you have the then for the goods in the present so, higher if this is going to be higher which is about the expected inflation.

Then people would like to go for more of they will simply postpone the current consumption they will save that amount and maybe using that in future. So, dynamic output demand relationship it mentions about your output gap that we have it depends upon the relative preference of current to future and it depends upon the real interest rate. And how it is deviating with the natural rate of interest now, or I would say not natural real rate of interest. So, this is how we mentioned about.

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If you think about the Phillips Curve, so, this is what we have. So, $i = a (Y - Y_m)$ and this we have already assmed in when we are talking about the new Keneysian school. So, what it says this is also the output gap $Y - Y_m$ and a, is the parameter and it is positive right is greater than 0. When firms set their prices, they do not do so, in forward looking fashion and they always account the anticipated inflation, the anticipated inflation since it is exogeneous.

So, what we have is the expected inflation it depends upon the future output that you are going to have the future input output minus the Y_m, if we just substitute for Y and Y_m here, right. If we just substitute here Y and Y' here, then what we get is this particular part.We just get this part, right, if we are just solving for this future inflation and if we just solve for i' here.

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Rational Expectations Equilibrium

- Solving the model, future inflation depends on current inflation according to:

$$i' = \frac{a(R - r^*)}{a + d\alpha} + \frac{di}{a + d}$$

- Indeterminacy problem: nothing to determine initial inflation rate, so there are many equilibria.

Substitute Y and Y' after solving and then solve for i' here, what we get is this particular expression.

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Rational Expectations

- Assume rational expectations: people in the model have full knowledge of how the economy works, and use information efficiently.
- For simplicity, assume no aggregate shocks to economy.
- So, consumers and firms can predict future inflation and output perfectly.

But from where this is coming, this is coming from the rational expectation where it is the rational expectation? Rational expectation in the sense; that people are utilizing more and more information about forming the expectation. So, where it will be used? It will be used here, when I am talking about the expectation this will depend upon how much is the expected future output.

So, what is the economic outlook how is the economy is going to do whether it will be able to achieve the higher growth scenarios based on that people will be thinking about the inflationary trends. So, that we mentioned about here. So, consumers and form can predict future inflation

on output perfectly. So, this is how we cover solving the model future inflation depends upon the current inflation.

So, this is a how is the future inflation which is dependent upon the real rate here it is the nominal interest rate minus the equilibrium rate of interest this is what we have. Upon a + d and this i is the current inflation, which is also decided by the d is the preference. So, intertemporal substitution right how is the whether the interest scenarios are going to be good in the future.
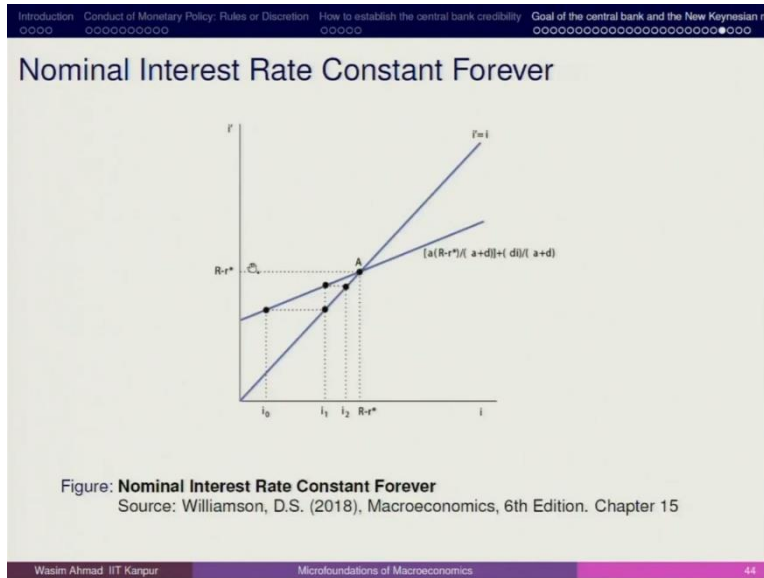
If it is going to be good you save more today spend more in the future. So, here it determines about, but what typically happens is that in case of future inflation for the central bank, let us think about let us stop for a moment. And think about that for the central bank what is in the hand of the central bank? It is the nominal rate of interest, what is not in the hands of the central bank is the inflation? Because it depends upon the output gap, right and an output gap is too much to handle for the central bank.

So, central bank can decide about the interested scenarios and can signal the market about the inflation. So, they may not have exact idea that how this will simply propel in the economy? So, they may recommend that okay we are thinking about this interest rate scenario considering that inflation will be this. But they do not have exact idea that how the inflation scenario will be. Because it depends upon the expectation of the individual's right and individuals may be forming expectations by using the adaptive expectation.

So, some proportion may be having the expectation they will be giving more weight to the immediate previous period then some people will be forming the expectation based on inputting a lot of indicators, then in that scenario. If the central bank is alone taking the decision on r the nominal interest rate how inflation moves up. So, that is the underlying idea that we will be trying to see.

So, indeterminacy problem becomes quite an obvious case here, when we talk about the rational expectation and introduce the rational expectation in the case of dynamic output demand relationship. Especially; when; you have the intertemporal substitution taking place about the current and future period consumption. So, there it becomes really important to look at.

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Figure: **Nominal Interest Rate Constant Forever**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

Now here, what we try to see is that at point A, if the central bank is going to decide about R – r', right and this is the most equilibrium scenario where the future inflation is equal to the current inflation, perfect foresight you can say. This is an example of perfect foresight this is the line that talks about this dynamic demand relationship with the future expected inflation. So, here we achieve right this particular part.

So this is, what we have and this is the current inflation and this is the future inflation. So, y axis is showing about the future inflation and x axis shows the current inflation then you can think about it the central bank is targeting a higher point at which is having the perfect foresight. And the dynamic demand relationship the right crossing at point equilibrium at point A, you will find that inflation will also move from i_0 in the perfect increasing or incremental manner.

It will also move up and it will it will be going towards a scenario where we are going to talk about. That in the period 1 it will move here in period 2, it can touch to this point which is i_1 which is still not the desired the inflation scenario that we have further it moves up and finally, it will be also having increasing trend. So, what is the idea behind the Neo-Fisherian? That if you have the nominal interest rate constant which is if I am the central bank, if I am going to fix the nominal interest rate higher right.

So, here it is A point and A point also is you can think about some kind of steady equilibrium that we always talk about in case of the solo growth model which is about the inflation investment and the depreciation rate, right. So here we have point A now A shows about R – r' and here we have R – r'. So, if this is rate is going to be the constant what we see is that inflation also hovers around and it moves up.

So, it depends upon the central bank, what is the target of the nominal interest rate in the nominal interest rate target is higher and even if it is constant for a longer period. You will see that there will be some kind of upward movement. And this will be primarily derived by the notion that we have about the intertemporal substitution people will be substituting for current and future period consumption making adjustment with this regard and what is more crucial is about the a + d.

So, A is coming from Phillips curve and d is coming from the rate of substitution right about the current and future period conjunction which is directly linked with the inflationary scenario. So, this is how it looks like right.
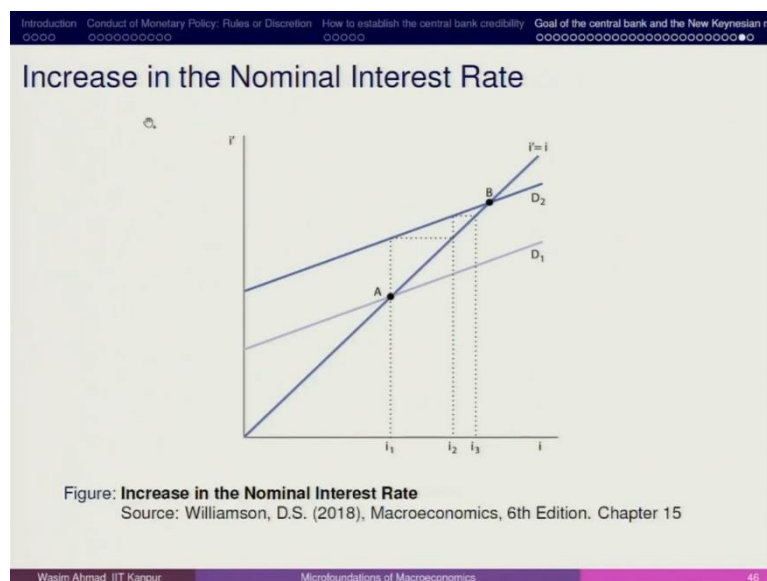
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Now, we talk about the long run fisher relationship in long run fisher relationship, what is the basic premise here we assume that the future expected inflation is equal to the current inflation. So, if future expected inflation is going to be equivalent to the current inflation i'= i. Then in that case the steady state or long run relationship it says that in the long run, what we have seen about the discretion between the beginnings we mentioned about discretion we mentioned about certain rules.

Time inconsistency problem that we, are going to see here in the long run because of the short term decisions, how long run is going to be impacted. So, in the long run, what we assume that we have the expected inflation i' = i. Then in that case your current inflation becomes your r minus the targeted real rate of interest, this is what we have. Now, so, long run inflation is determined by the nominal interest rate.

This is what we have inflation rises one for one in the long run, which are which means that if the current inflation increases by 1%. Same way we can think about the monetary phenomena that if you have the nominal interest rate increasing by 1%, this will also lead to increase in the inflation by 1% only. So, this is how it mentions about. So your inflation, in actuality in the long run is nothing but it is the difference between the nominal interest rate minus the equilibrium real rate of interest.

So, this is what we try to understand here, that if your expectations about the future inflation, it is equivalent to T which having the perfect foresight example, I am talking about long run in the long run. The inflation becomes the spread between the nominal interest rate and the equilibrium real rate of interest if these 2 are having no difference, then your inflation is almost going to be 0. If we have the nominal interest rate higher than the real interest rate then whatever is the difference that will be taking into account the i part. So, this is how we try to link it.

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Figure: **Increase in the Nominal Interest Rate**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

We also see in the short run scenario that how increasing the nominal interest rate will be moving suppose, if you have point A steady state we move to point B. So, from D_1 to D_2, because of the increase in nominal interest rate, we see that inflation also follows i_1, i_2, i_3 it goes up right and he touches right. So, in the same way we see that there is some kind of incentive for the central bank to have the forward guidance scenario and have the higher nominal interest rate target.

So, that inflation will also follow and inflation follows that by taking into account the intertemporal substitution between current and future consumption.

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So, what is the result is that in the long run inflation increases one for one with an increase in the nominal interest rate. If the central bank wants to inflation rate to go up, it needs to increase the nominal interest rate even in the short run and this is the second finding that we have the Neo-Fisherian result. Even in the short run, if the nominal interest rate goes up, inflation goes up. So, this is what they mentioned about if you are moving from A to B, you find that in the non determinacy manner, the inflation will be moving.

But if you ask me that what is the underlying idea behind doing this analysis, is that for the central bank, it is easier to have the to decide about the nominal interest rate based on certain expectations about inflation, but on inflation, they do not have any control. So, the only thing is that they can play with this. So, let us keep the higher interest rate up and then people will be a * and then people will be having some kind of preference about current and future.

So if you are keeping the nominal interest rate higher people will be thinking that let us save today and have more in future. So, this will create a scenario for the long run. And in the long run one major finding that we have that in the long run your inflation is nothing but the difference between the nominal interest rate minus the equilibrium real interest rate. The larger the spread, larger the inflation if the smaller the spread then is smaller than inflation.

So, in the long-term scenario the central bank always react in the same way. So, I hope with this I will become completing this session and I hope it has given you a complete idea about.

So, let me summarize what we have done so far. So, we started with the time inconsistency problem then we had the argument of monetary policy rule, the constant money growth rate we introduced then we also introduced the Taylor rule.

I would say scenario, then we added the dimension of the credibility of the central bank with nominal anchor. We also added some kind of dimension that was should be the objective of the central banks inflation targeting? Then we also add that the dimension of the central bank independence what should be the outlook of the central banker role? Or whether he should be conservative or hawkish on inflation?

So, we talked about that then we move to the new Keynesian school and started thinking about the 0 lower bound scenarios that how we can determine the output gap and how the targeted interest rate can play important? What are the rules or what is the amount of adjustment that central bank make to narrow down the output gap. So, then we introduce the concept of Phillips Curve in detail.

And then we move to the topic when we introduce the forward guidance scenario that in which all scenarios the central bank can push up the inflation and if they are targeting the higher or if you are operating under the 0 lower bound. Then we move to the forward guidance, then we move to the long term equilibrium that how we can decide about what we found that the intertemporal substitution matters a lot.

And then we finally ended up with the Neo-Fisherian idea that there should be inverse relationship between inflation and the nominal interest rate. Even inflation is higher your nominal interest rate should be lower and they try to prove it with the help of the dynamic demand relationship in inter temporal context. So, I hope you have understood the idea refers the book of Mishkin and I would say the Williamson, these 2 books will be helpful to add the dimension further I am stopping it here. Thank you so much for your attention.