**Microfoundations of Macroeconomics**
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**Module No # 07**
**Lecture No # 34**
**Monetary Policy IV**

Welcome back so let us start the new session and in this session, we are having a background of new Keynesian. So, we discussed in the last session this role of the central banking that how the central bank credibility can be enhanced further. When you have the nominal anchor and you have the inflation targeting mechanism, the personality good personality of the central banker.

Who is against the rise in inflation or averse to high inflation and the third is that how the central bank can be independent will be focusing on the new Keynesian school of economic thought now.

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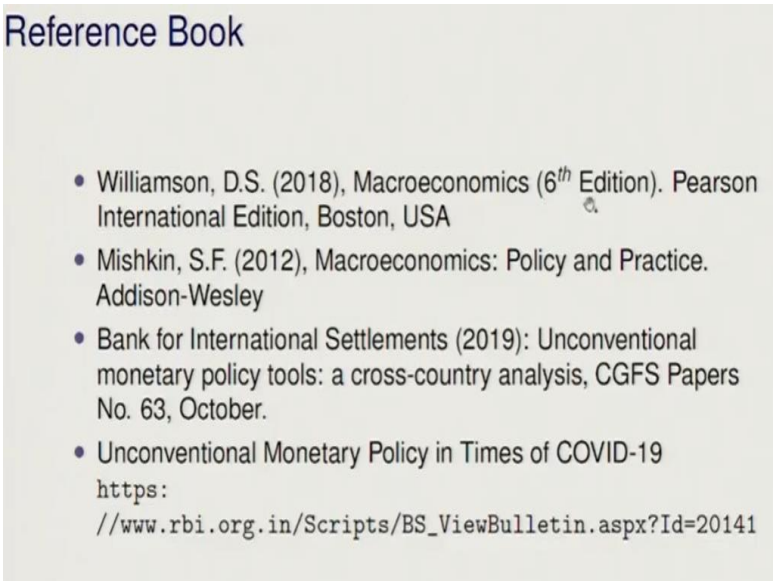


And for this particular lecture the major reference will be the Williamson, the macroeconomic sixth edition, Pearson and these 2 documents the BIS and the unconventional monetary policy.

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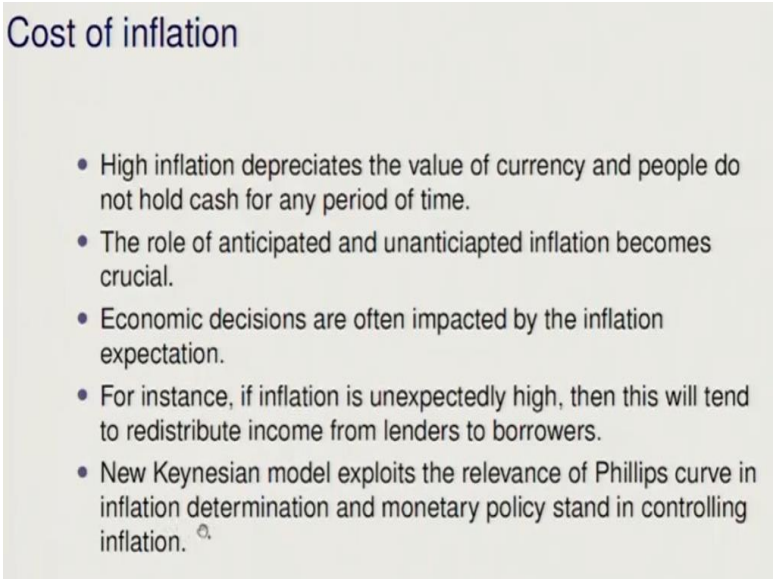


So we were talking about the inflation, so as I mentioned that, in inflation is unexpectedly high, then this will tend to redistribute income from lenders to borrowers. So if you have if you are lending some money and at some rate suppose 10% rate of interest and the inflation comes out to be 12% then your real gain from the borrower is negative which means that the borrower is having advantage**.**

So when you have the inflation higher than risk distribution of income plays very important role. Then new Keynesian model exploits the relevance of the Phillips curve in the inflation determination, and what we see is that it is about the monetary policy stand and how will be controlling the inflation? So, this is how we understand so first we will try to understand the role of Phillips curve with regard to the inflation expectation. And then we will move to certain scenarios through which we will be trying and understand.

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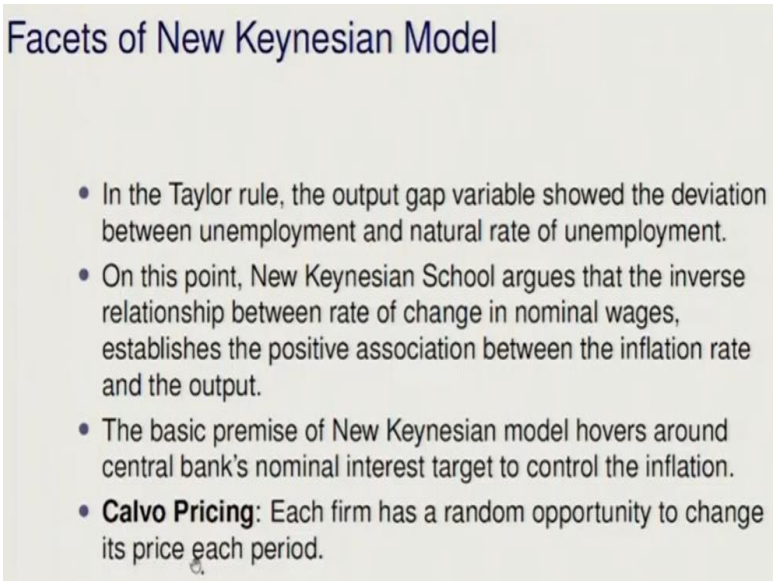


So in the new Keynesian model what we have is that they focus because it comes under the activist school of economic thought. So there we had non-activist and activists so this is about the activist under which we try to put certain conditions to the central bank with certain interventions. That using the Taylor rule, the output gap variable it simply shows the deviations between unemployment and natural rate of employment.

So we see that, the target of the central bank is also to maintain this that the actual unemployment must be near to this if it is this then we are removing the variable called output gap, so output gap will be 0. On this point new Keynesian school of thought argues that there is inverse relationship between rate of change in nominal wages, and the rate of nominal wages and the unemployment and establishes the positive association between inflation rate and the output.

Which means that if you have the inverse relationship which means that it shows about negative relationship, here the unemployment is missing which means that during nineteen fifties and sixties during nineteen fifties itself aw Phillips had given this idea. That there is an inverse relationship between the nominal wages and on unemployment if you have the nominal wages higher which means that if you have more and more people looking for job.

Then which means the percentage increase in the nominal wages will lead to reduction in unemployment if you have a less of nominal wages then your unemployment will also increase. But this change that you have in unemployment it is we are counting with the deviations from the natural rate of unemployment. If this deviation that we are talking about then what comes out that it simply shows the relationship between your inflation rate and the output.

Which means that if you have if your actual output is greater than this, then you have less of a unemployment. But at the same time, we see that this actual output increase beyond the natural level of output, or the output beyond I would say natural level of unemployment. What we see that there will be excess demand and this demand will be further pursued by higher level of inflation rate which means that the positive output gap is compensated with the rise in inflation.

So 2 dimensions are added by the new Keynesian school of economic thought, one is the inverse relationship between nominal wages and the unemployment, and then second is about the positive. Because if the unemployment is lower which means that your output gap is more moving in the positive sense you have more of excess demand coming and this excess demand may also create the infrastructure scenario so this is how it is linking.

However, the basic premise of new Keynesian model hovers around the central banks and nominal interest at target to control the inflation. So this is what, how it evolves so they use the criteria what comes out is the Calvo pricing so to be before I discuss the Calvo pricing, let us spend one minute time on understanding the role of Phillips curve. So, Phillips curves when aw Phillips when he worked with data on the wages and the unemployment then what he came out with surprising the inverse relationship.

But this data set that he had used to establish in case of UK it did not work on most of the countries so people started forgetting this model. But new Keynesian school of economic thought they brought back the Philips curve idea again. To prove their price registry dynamics and the introduction of Phillips curve helped the new Keynesian school to understand better about the price dynamics the role of expected inflation.

So they added the rational expectation framework with the Philips curve and they try to explain this. So what is the Calvo pricing? Each firm has a random opportunity to change it is price each period. Which means that if you have a for example a staggered price that we term we use, or menu cost that we use, that if you have the price rise some of the agents in the economy will react immediately.

Some of the agents will wait for some time and in future they expect that in future they will be revising, they will not be revising immediately. And this is very strict assumption and stringent assumptions of the new Keynesian school, but Calvo pricing at least tries to add the dimension and helps understand that how this staggered or the menu cost idea looks like.

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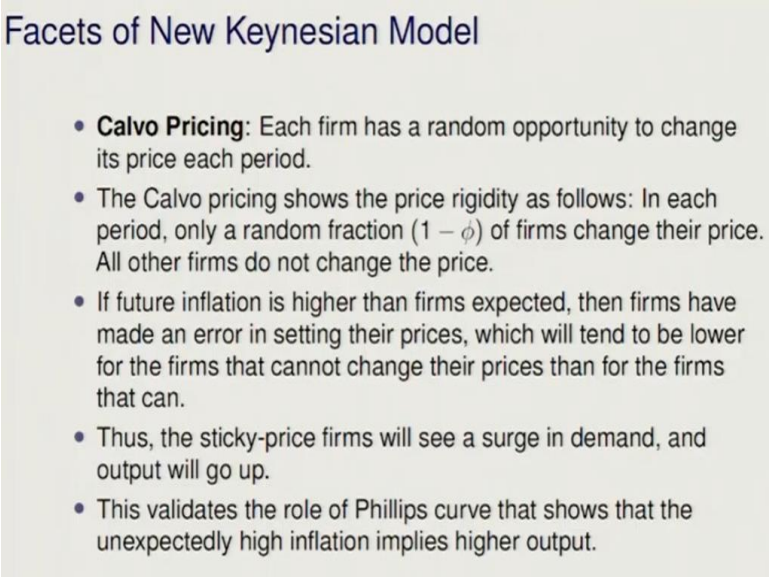


So each firm has a random opportunity to change it is price each period right. The Calvo pricing shows the price rigidity that in each period; only a random fraction 1 - $\phi$ of firms changes their price. All other firms do not change the price which means that you have the certain proportion of firms reacting to price change immediately and some firms may not react, so those dimensions are important to understand.

Here it is if future inflation is higher than firms expected, then firms have made an error in setting so if firms think that they are in future the inflation rate is higher. Which means that they will be also adjusting with their prices if it appears that whatever they had made adjustment with prices the actual inflation, or the future period inflation much higher. Which means that those firms which have not; revised the price their demand of the goods will go up right.

Which will tend to be lower for the firms that cannot change their price then which means that if it is high if it is having an opportunity that some firms are reacting commensurating with the price change. Some firms are not allowed or they are not reacting then those firms which are not reacting may utilize the better opportunity. Which means; that the sticky price firm will see a surge in demand because they have not been able to change and output will go up.

Now this stringent condition though it may not be easy to digest, but here it gives a perspective and this will be analysing in the further I would say we will add this dimension to further topics. Now if you are thinking about this then this validates the role of the Phillips curve also, which shows the way which we showed that if you have under if you have operating under sticky price firms then it is highly likely that.

If you have higher expected inflation then this will increase your output which means that less focus on the sticky price. Some firms are changing the prices, some firms are not changing. The firms which are changing the prices if, they are not able to meet the inflation target still, they will be selling at higher price. The firms which are not able to change the price, they will their product will be competitive more demand.

Which means that the unexpectedly high inflation for firms which are reacting, for those funds which are not reacting adhering to the new classical idea or sorry new Keynesian idea, then they will experience higher output. Because the sticky price firm as it is mentioned will see a surge in demand and output will go up. So this is the underlying idea that we are trying to understand in this particular framework.

From here 2 possibilities are, one is that when you have unexpectedly high inflation then how central bank is going to meet the target of the price stability and the employment right. So if, the central bank is going to have such type of price rigidity scenarios and under this particular central bank has to meet the target. Then how they will be achieving the higher output? That is also a major concern.

So these 2 dimensions will be adding and indirectly these things are linked with what we have discussed credibility and the nominal anchor. So, credibility and nominal anchor concepts are also important in this direction.

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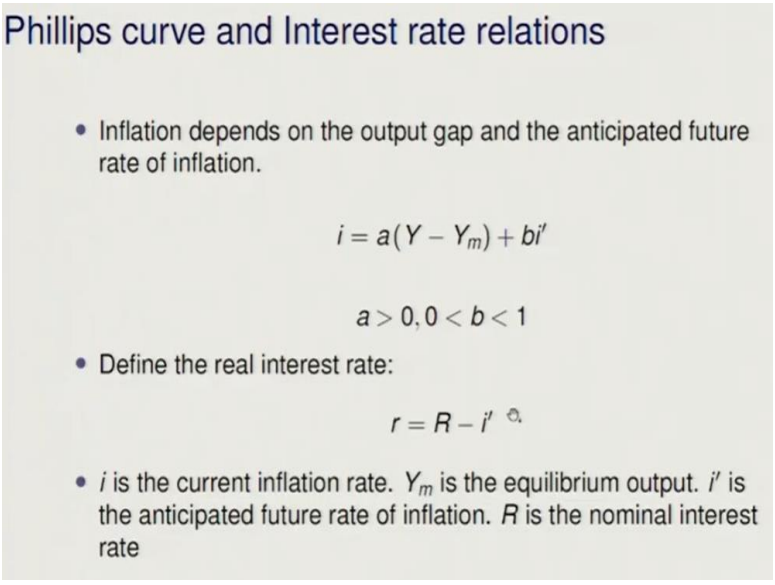

Let us understand that whatever we have derived the Phillips curve because the price rigidity helps the firms to become more competitive. And then they also so unexpectedly if the inflation is high, the output level is also going to shoot up. If some firms are following the market norms, they are having higher expectation about inflation, and some firms are not following they are following the price rigidity.

Here what happens? Inflation depends on the output gap and the anticipated future rate of inflation. So if I am saying inflation which is dependent upon the output gap and anticipated. So here we are having the output gap which is directly linked with the rate of inflation, so i is the current inflation rate b is the behavioural coefficient related with the future inflation. So, $i'$ that we have it talks about future inflation $Y - Y_m$ is the output gap.

This is the coefficient condition, so b is varying between 0 to 1 which means that it may not be having one to one scenario, it may be lower. But a, is showing a direct association which means that a, is unbounded is just the greater than 0, so it can pick any value. So what it means that if rate of inflation is going to go high your output gap will also increase so this will have the direct relation. Here this b the limit of b lowers and upper it will have some kind of implications.

That whether, the 1% increases in future inflation it is leading to how much change in the current inflation. So how; much change is happening so about the expectation formulation that we are trying to see. Then we have the Fischerian idea so Fischer equation that we always mentioned, which is that real rate of interest which is r = R – i' which is the expected inflation. So this we have already discussed when we discussing about inter temporal monitoring inter temporal model so this comes from there so I' right.

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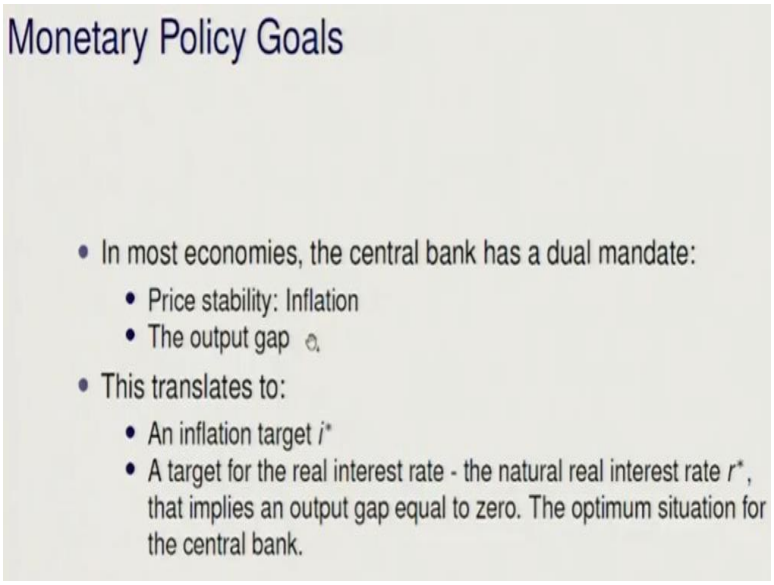


Now in most economies, what happens that central bank has a dual mandate? So what are those dual mandate, one is that they have to bring stability in the in the economy so price stability is one. Second is about the maintaining a as a sound employment level which means that unemployment has to be lower, which also means that the output gap should be y is equal to $y_m$ and the real rate of interest or the nominally interested targets.

Let us focus on the nominal interest rate target must be equal so which means that the ideal target rate it must be with the actual, so those are the condition. So here what is the underlying idea? That for the central bank targeting inflation becomes easier, so they may specify for example in India. We have a specified 4% plus minus 2 so 6% and 2% four is the mean.

So here we are having the mid-level 4% but output gap becomes difficult target for the central bank. So maybe when they are targeting at 4% whatever is the output gap that will be very difficult to achieve. So these 2 lakes that we have for the dual mandate so in case of federal reserve these are the dual mandate, in case of u.s central bank in case of most of the economy these are the normal targets.

If you are following the Taylor rule that we have followed so price stability is the inflation then here we have the output gap. So one of the leg will be very difficult to fix and it is also very difficult to fix both the legs. So maybe you are fixing the inflation your output gap is not fixed, when you are trying to fix output gap your inflation is deviating. So these 2 I would say these 2 conditions and scenarios are very common.

And these 2 scenarios are also further linked with what we have discussed the credibility and the nominal anchor problem. So these 2 conditions also translate to what we have the inflation target $i^*$. A target for the real interest rate minus the natural interest rate $r^*$, it implies that at this level when we have the real interest rate minus the natural real interest at $r^*$.

Both equal then at this level your output gap will be 0 then you are able to meet both the objectives dual mandates, if you are meeting only one then you have to look for another that what will be the ideal situations. These concepts are important to understand.

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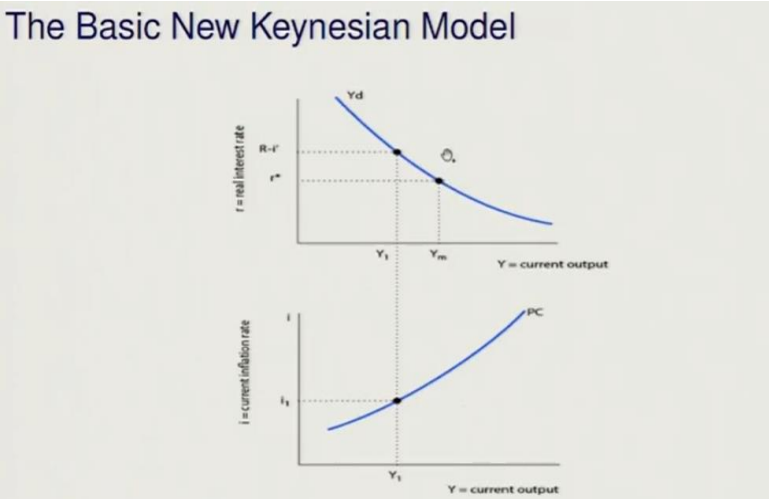


Figure: **The Basic New Keynesian Model**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

So from that perspective it becomes easier, that if this is the real interest rate right this is the natural real interest rate. So here it is $r^*$ at this level here you have the $Y_m$ the output. But given the real interest rate that we have which is the nominal interest rate minus the expected inflation you are producing output $Y_1$ and then here you have the inflation rate of $i_1$ which means that here you have the output gap created.

And in this particular case the central bank will not be able to achieve both targets. Here what we are seeing is that current inflation rate is $i_1$ that is**,** but here we have the output gap created and this output gap created will create trouble. So as long as you are here you are having positive output gap. So from output gap side central bank is not able to meet the target though from price ability side it may.

But if we are superimposing the condition that what happens in what all situations we can bring this point to this $Y_m$, so that this gap that we have it disappears. Now for that angle we are will be trying to add further dimensions to this.

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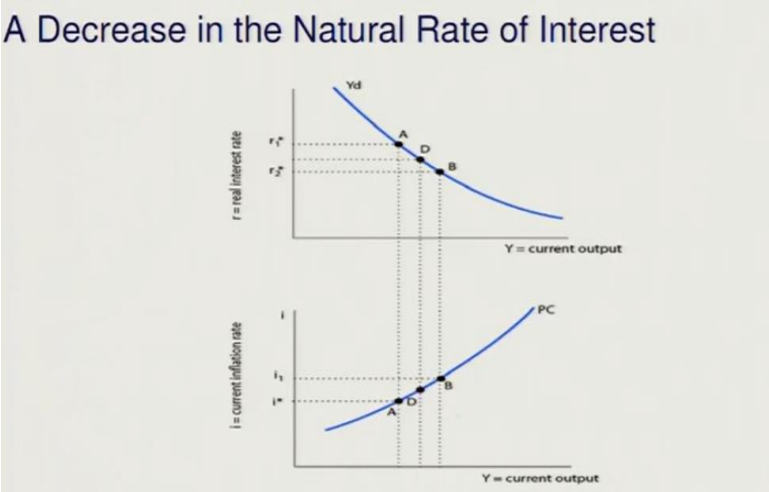


Figure: **A Decrease in the Natural Rate of Interest**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

What are those dimensions? So the first condition is that a decrease in the natural rate of interest. If you have the decrease in the natural rate of interest then suppose if you have $r_1^*$ at point A corresponding to this here you have the inflation rate $i^*$ at A. Now what we are seeing is that$r_1^*$ and $i^*$ here you have the natural, if you have the natural rate of inter suppose it comes down, then what happens here we are having $r_2^*$ at point B so A is the natural scenario.

Now at point B here we have $r_2^*$ at point B here and with this the inflation rate has gone up. So nominal rate of real interest or natural rate of real interest if it is coming down it means that in order to meet this the central bank has to make sure that it moves from A to B, and maintain this equilibrium which is this at this $i_1$ but what we are finding that the natural real rate of interest is still higher.

So in order to maintain this, what central bank does is that? They simply think about the some kind of role of expectations you can introduce here. So with this at point B what we are seeing is that? The real rate of interest decrease, now the central bank will have to go about. So here we can think about here we have the output demand right curve, which means that if the central bank is targeting this point then the central bank will have to now go for moving from A.

But if you are having at B you are having higher inflation target, so even if we are reducing the rate of interest you are not going to meet the inflation target. So even if the $r_1^*$ if it is going to be lower supposing it comes at point B here we are having the higher level of inflation though the inflation should have been at point A. Now in this situation what is recommended? Recommended that because these; 2 situations are very difficult to meet.

Let us understand first that here at point A what we have is the $r_1^*$ and here we have $i^*$ this is what is the actual situation? We are trying to superimpose a condition that what happens if you have decrease in natural real rate of interest. If natural real rate of interest is going to decrease, then what we are seeing is that the economy moves at point B here at this level the corresponding inflation comes $i_1$ which is higher than the target $i^*$.

Which means that if the if the economy moves from A to B then the economy is able to remove the output gap**,** but still the inflation gap will be there. So in order to maintain the central bank can decide about a point D where it comes in middle between $r_1^*$ and $r_2^*$, and also having $i^*$ and $i_1$. So in the middle of $i^*$ $i_1$ it can create a scenario, which means that midway, so lower and upper scenarios may create a formidable situation or favourable situation for the central bank to operate.

So D is the point at which though there is a deviation with regard to the inflation so this can be minimized also, from $r_1$ to $r_2$ bar which is the decrease in natural rate of interest this can also be minimized. So with this condition what we are learning is that, for the central bank it is not easier to maintain both the dual mandates. At one point when the central bank is targeting to minimize the output gap here, we are having the output gap of this much.

Instead of minimizing all, the output gap what central bank can do is that it can create a midway through which it can adjust the inflation, and also adjust the real rate of interest the reward that we have. So this is one condition under which we try to operate.

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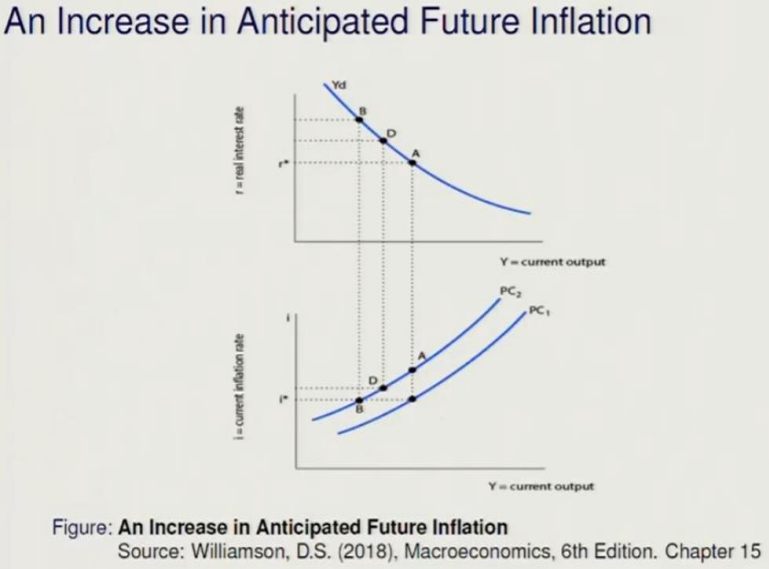


Figure: **An Increase in Anticipated Future Inflation**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 15

Then, we are going to look at situation what happens when we have the increase in anticipated future inflation. As we have already seen that if the credibility of the central bank is very low then in that situation people will not be caring about the rate of interest announcement, or inflation data coming from the central bank. And they will be further expecting higher inflation in future which in turn will further create a very adverse scenario.

We have already looked at demand side and supply side shocks, that in demand side it is very difficult for the central bank to create a credible scenario. Otherwise it will permanently move from a short run to long run imbalance, so that is what we are trying to understand here as well. Here what we are seeing is that $r^*$ is the real interest rate, A is the situation right, and here we have $ibar^*$ so $ibar^*$ is here.

Now if you have the increase in anticipated inflation which means that this could be because of the future inflationary expectation scenarios, some firms are not following the price rigidity and they have they have gone for increasing the price. So if that is the case then you have the shifting of the Phillips curve up, so Phillips curve moves up. Leftward shift and leftward side leads to higher inflation.

What is this situation here? Situation is that if it is moving up then here we are having from A from here we moved here at A, which is also showing the higher inflation. But at point A this is the real interested scenario at which we do not have any output gap. At point B because of the higher inflation scenario though we are having we are meeting the inflation target which is which could be because of the real rate of interest has gone up.

So this is equilibrium the real rate of interest has gone up if it has gone up then you have this much output gap**,** which is also meeting the inflation target but creating again output gap. At point A we are seeing that because of the shift left or shift of the Philips curve we are moving at A, if you are here at this point you are meeting the $i\ in\ i^*$ but not for the rest, so here you have $r^*$.

So in order to come to this ideal situation what central bank can do is that they can go and decide about point D. And point D will create a scenario through which ah central bank will try to manage between A and D. And here there will be role of productivity shock, then there will be role of output supply, which means that labour demand and supply, are clearing the output at which level market clears.

So here we are also adding those dimensions, but if you look purely from the angle of the chart then what comes out that. The underlying idea is that whether, the central bank is meeting the target $r^*$ with inflation rate $i^*$ . If both are having same there will be no output gap the inflation gap will further satisfy the Taylor requirement and economy will have no shocks at all, and no unemployment at all, so dual minded criteria will be easier to meet.

But here in this case what we are finding that because of the one meeting which means that one, criteria the central bank is meeting another criteria it is very difficult to meet. So in those situations central banks have to create the midway and midway it is this point that point D will be beneficial. Though it will have an adjustment with regard to the output gap it also will have adjustment with regard to the inflation so this is what we try to see.

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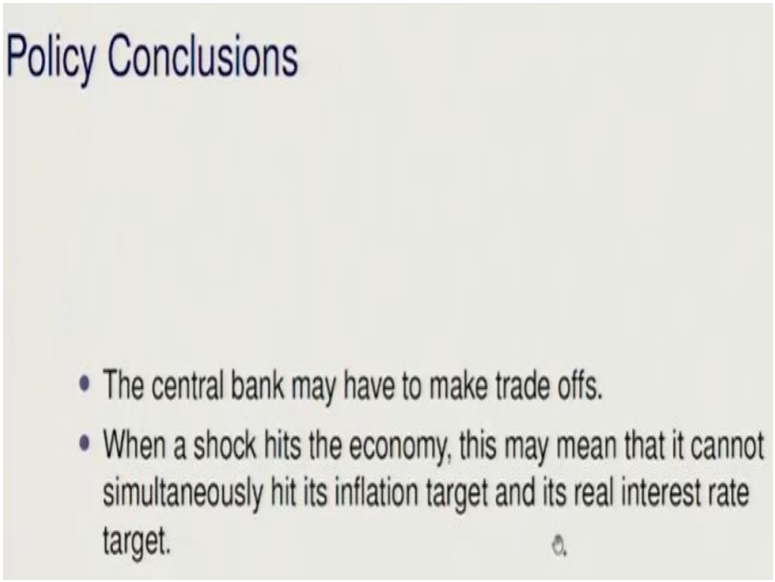


So how they make it so conclusion is that, central banks may have to make tradeoffs that we are mentioning between A to B, tradeoffs between A to B here also D point. And this is the point at which central bank should be coming and meeting here so this is how we are trying to see. When a shock hits the economy, this may mean that it cannot simultaneously it is inflation target and it is real interested target so this is how they try to understand.

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Now in the literature when you talk about new Keynesian what comes out that? People have gone for what we call it the different apprehensions about low real interest rates. In our US where the Bernanke mentions that when you have uncertainty in the scenarios in the economy especially during 2007-8 global financial crisis. Some of the terms which macroeconomic received from different individuals Bernanke mentioned about savings glut.

Which means that if; you have uncertainty in the economy then individuals are not so much bothered about the consumption. They simply look for future consumption so which means that there will be compromising on current consumption saving more, so those scenarios are added with the saving glut. Summers added the dimension of secular stagnation in the sense that if the economy is facing very uncertain scenarios, unprecedented shock individuals and agents are quite thwarted with the macroeconomic destabilization or the macroeconomic instability.

Then what typically happens that even if the government or central bank is creating opportunities it will not create that much investment, because everywhere you have pessimistic scenarios leading. So the coordination failure model that we discussed about which talked about the strategy complementarities it fails here. So that they have given the term, the Lawrence summer has given the term called as the secular stagnation which talks about dearth of investment.

Increase in financial market frictions which means that it talks about the higher default. So in case of US 2007 at global financial crisis, we found that how the central banks were having tough time meeting the, or they had gone for buying the long-term assets also. How the

borrower and lenders when you have a asymmetric information and moral hazards, how these 2 plays very important role for creating the financial market frictions.

We have higher default less loan availability that creates further awkward situation. So, financial crisis so branded problems and new financial regulations, are the important instruments to deal with. So one of the reasons that we often talk about low interest scenarios are these and we can also think about adding some more dimensions to this. So I will be covering rest of the sections in the next session.

And will be having the scenarios through which central bank tries to push the inflation up because if inflation is really a major target. We will be also looking at the forward guidance scenarios where in visual situation the forward guidance scenario works. So I am stopping it here and will be meeting in the next session thank you so much for your attention.