Economics of Banking and Finance Markets
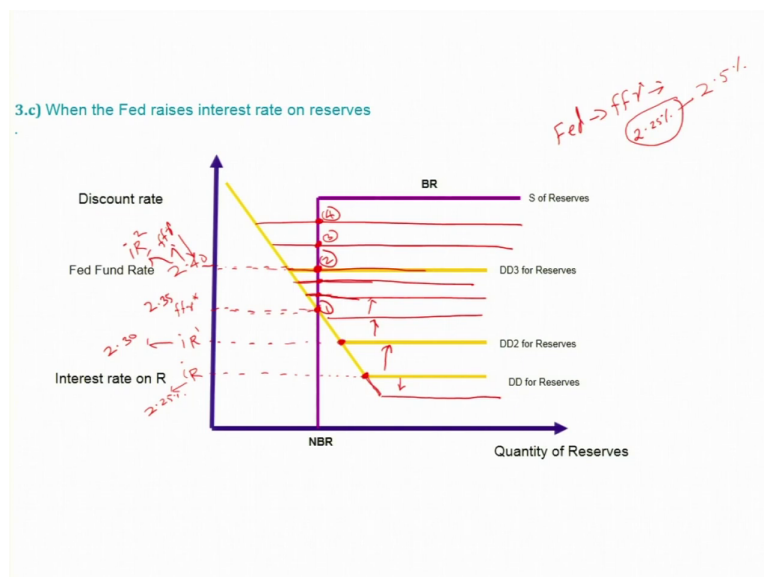**Prof. Sukumar Vellakkal**
Department of Economic Sciences
Indian Institute of Technology, Kanpur

Lecture - 47
Fed fund rate and Taylor's rule - I

Hi everyone. Welcome to this session. In the previous session we have discussed the three main tools of monetary policy, that is the open market operation, discount window and the reserve requirement.

(Refer Slide Time: 00:37)

In that discussion, we also saw that the effects also depend on the position at which the supply curve intersect with the demand curve. In this session, we will continue the discussion little bit on using these tools. And, subsequently, we also see that what are the criteria the Fed use in determining the fed fund rate.

So, let us continue this discussion. We have seen that when the Fed announcing the FFR, they use the lower, they announce a target rate that is the lower limit. For example, 2.25 percentage is the lower limit, and the upper limit is 2.5 percentage, right.

So, in this case, we know that the lower limit that is the 2.25 percentage, that by using the interest rate on reserve the Fed can ensure that Fed fund rate will never go below this lower

limit; that means, 2.25 percentage. So, accordingly the Fed will be determining the interest rate on reserves.

So, here, initially assume that this is the interest rate on reserves, that is the interest rate on reserves. The initial one and we can say that this is the initial interest rate; this is the FFR equilibrium interest rate, where demand for reserve is equal to supply of reserve, right. This is the equilibrium point.

Now, we are going to discuss, what if the Fed reserve system is going to increase the interest rate on reserves. Suppose this one initially, assume that this one is 2.25 percentage. Suppose they increase the interest rate on reserve, then the impact is going to be like this.

We can see that they increase the i interest rate on reserve from iR to this point, there is increase in the interest rate on reserve is going to be iR1, then you can see that the new interest rate on reserve is going to be this, let us give a numerical values for this. For example, make it 2.30.

So, what are the likely impact? You can see here is that the intersection of the demand curve and supply curve happen here, right. Still, that means, if they increase the reserve only this much is not going to change the effective the equilibrium Fed fund rate. Because the interaction that the demand curve is this, yellow one here, and supply curve is the NBR component, this is the intersection point.

What if again, they are going to further keep on increasing the interest rate on reserve, then we can see that, suppose if they attain at this point, increase suppose this one is for example, 2.4. This is the new interest rate on reserves let us call it iR2 this one so; that means, 2.40.

So, you know that now, the supply curve supply curve is this purple colour intersect at this yellow curve here. This is the initial interest rate. Then now, the new Fed fund rate is going to happen at this point. Now, we can see that the Fed fund rate also increases. Initially the Fed fund rate is somewhere for example, 2.35. now, the new Fed fund rate is equal to the interest rate on interest rate on reserve. The new Fed fund rate this is equal to 2.40 as per our example.

So, what we have seen here is that the increase or the changes in Fed fund rate due to the changes in the interest rate on reserves, it depends again on the position of the supply curve
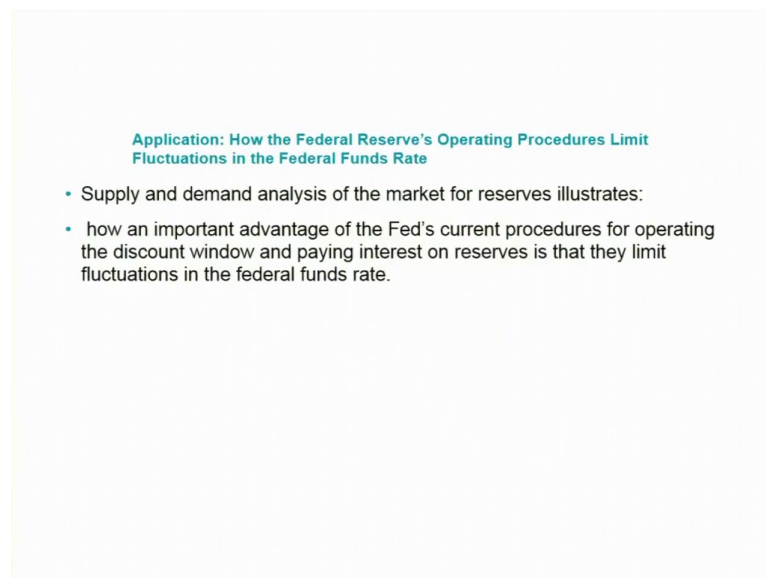
and as well as the demand curve, the intersection point. So, here in this point we saw that here, we saw that there is no impact of increasing the interest rate on reserve to this point, that is to iR1 that is 2.3 from 2.25. If they increase further, but once it makes here is going to make an impact on ffr.

If the Fed increase the interest rate on reserve, you can say that Fed fund rate is increasing again, you can see that if they keep on increasing interest rate on reserve then the Fed fund rate is going to increase.

It means, when the Fed is increasing the interest rate on reserve, the horizontal portion of the demand curve shift upwards. And, obviously, you know that if they reduce the reserve, then the horizontal portion of the demand curve will be shifting downwards. So, what we have seen in this in this discussion and from previous session; that means, the 3 tools of monetary policy can be used by the Fed to change the Fed fund rate.

We have seen that the open market operation, discount rate and changes in reserve requirement, as well as changes in the interest rate on reserve, these tools can be used to change the Fed fund rate.

(Refer Slide Time: 07:19)

Then the question here is that, how the Fed federal reserve's operating procedure limit fluctuations in the federal fund rate.

We have seen that supply and demand analysis of the market for reserves illustrate that an important advantage of Fed's current procedure for operating the discount window and paying on interest reserve is that they influence the fluctuations in the demand federal funds rate.

(Refer Slide Time: 07:47)

So, in the among the all the 3 tools, what we normally see in the newspaper; that means, the outcome of the Federal Open Market Committee's meetings 8 times in a year, that means, mainly the Open market committee are the main influencer in the determination of the Fed fund rate.

However, they also use the other tools; that means, the discount rate and reserve requirement. So, Open market operations are the dominant policy tool of the Fed, since has it has complete control over the volume of transactions. These operations are flexible and precise, and easily reversed and can be quickly implemented.

So, we have seen that of the 2 component NBR and BR, between this we have seen that Fed is having more control over the NBR; because, using NBR suppose if they want to increase the reserve suppose, for example, 10 million.

This increase in reserve can be easily attained by depending upon NBR, because they will be placing order to the delays and accordingly, they will be making the purchase of that the

government securities from the banking market and accordingly the reserve for example, they can increase the reserve by 10 million.

But we have seen that, the BR has certain limitations, they can reduce the discount rate but, there is no guarantee that the precise targets will be achieved. Suppose if they want to increase reserve by 10 million, it is not possible to achieve that because even if Fed is reducing the discount rate the borrowing by the member bank depends upon their willingness to borrow.

Because their willingness to borrow also depends upon their investment opportunities. Suppose they are borrowing it for giving loans. If they do not find productive loan opportunities with a low default risk, then they would not be borrowing from Fed

So, that means, in that perspective, we can say that Fed is having less control over the BR to achieve the target changes in reserve. And, it has more control over the NBR. This is the dominant policy. So, discount rate is less used since it is no longer binding.

If the Fed wants to increase the Fed fund rate through the discount window by increasing the discount rate, then it has some adverse impact on liquidity of the banking system. If the Fed keeps on increasing the discount rate for this purpose, this will reduce the liquidity and increase uncertainty for banks; that means, mainly because the one of the main sources of funds for the banking system is the Fed.

So, if they increase the discount rate, is going to affect the banks' borrowing power. So, the discount window remains a tremendous value given its ability to allow Fed to act as a lender of last resort. So, the discount window, in addition to it acting as a monetary policy tool, the discount window is mainly to act as a lender of the last resort when the banking system is facing a liquidity constraint, then at that time reducing the discount rate and the bank is going to lend to the needy bank.

So, about changing the reserve requirement, that means, increasing the reserve what we have seen that, in the curve, when they this is the initial demand curve when they increase the reserve, we can say that the curve is shifting rightwards, this is what we have seen that curve shifting rightwards. But the concern here is that, when the Fed is increasing the reserve; that means, initially 10 percentage.

When the Fed is going to increase to 15 percentage, then you can see that is going to affect the profitability of the banks, right; that means, 10 percentage to 15 percentage, now they have to keep more reserve with the banking system, then the money left over with the banking system is less for making loans and making investment in government securities, that funds will come down.

So, that means, suppose their objective of the Fed is to influence the Fed fund rate; however, this also has another adverse in consequence; that means, the banks profitability will decline if they increase the reserve requirement; that means, less fund is left with the banking system for lending and buying government securities.

(Refer Slide Time: 13:45)
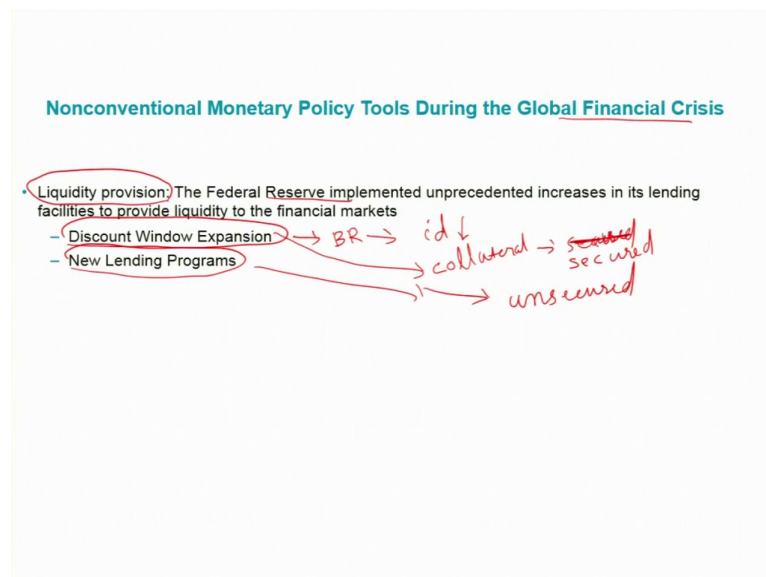
So, these are the relative pros and cons. So, during global financial crisis time, this kind of policy tools, the conventional monitory tools that the Open market operation, discount window and reserve requirement would not work; because mainly during financial crisis time, you can see that there is an impact on the liquidity aspects.

The liquidity of the banking system is at a very low-level bottom level during financial crisis. So, at that time, using Open market operations, discount window and reserve requirements would not be making any desired impact. At that time mainly, the discount window will be expanded by reducing the discount rate considerably.

Introducing new lending programs on top of the discount window also will be carried out. Because, in the discount window, we have seen that to lend to the banking system they need collateral. This is a secured loan; these are secured loan. But, during financial crisis you know that the collateral the net worth of the banking system also declines.

So, they do not have much collateral or net worth to submit with the central bank. So, at that time they must give some unsecured loans and it mainly come as a as part of the bailout package and that means, a new lending programs will be introduced; it will become some non-conventional monetary policy during financial crisis time.

(Refer Slide Time: 15:35)

Overall, we can say that conventional monetary policy tools fail during financial panic. Because, when the economy experiences a full-scale financial crisis, the conventional monetary policy tool cannot do the job. For mainly for 2 reasons; one is financial system seizes up to such an extent that it becomes unable to allocate capital to productive uses and so, investment spending and the economy collapses. And, during financial crisis the negative shock to the economy can lead to zero-lower-bound problem.

So, at that time zero-lower-bound problem means, the lower limit of the Fed fund rate is going to be 0. For example, 0 is the lower bound and upper bound is for example, 0.25 percentage. So that means, the target Fed fund rate should be almost near to 0. For example, 0.10 percent 0.10 percentage; that means, literally 0, it means one bank can borrow from another bank without paying any interest.

So, that means, during the negative shock time, there is limited investment and the banking operation also decline, shrink and as a result they also do not want to borrow, and banks would not be having reserve to lend as well. And, at this time, sometimes the Fed fund rate, this kind of policy tools would not work. The FFR would not work; at that time the Fed need to rely on the bailout package and new lending programs.

What we have done here is that we have completed our discussion on the Fed fund rate determination and how different conventional policy tools can affect Fed fund rate determination. And, subsequently we also discussed, during financial crisis time, the conventional policy tools would not work often.

(Refer Slide Time: 17:36)

Now, let us continue our discussion using how the Fed fund rate, what are the motivating factor in determining the Fed fund rate? For example, Fed is saying that the target Fed fund rate is for example, 2.25 percentage to 2.5 percentage, this was the Fed fund rate announced in July 2022.

So, before that, for example, in year 2020, the FFR was almost near to 0, the lower bound was 0; upper bound was 0.25 percentage. So, prior to that in 2018, Fed fund rate was a little bit lesser low figure, but above the 0. So, at a different period, we can see that Fed is changing the Fed fund rate; the target Fed fund rate has been kept on changing.

The Fed is not doing randomly; there are some reasons for that. Maybe when the economy is in boom, the economic activities at the boom stage; that means, high-level of economic activity, at that time they want to increase the rate of interest, because at that time they also see sometime inflation is very high, they increase the Fed fund rate.

But when the economy is at a recessionary stage, then they will reduce the interest rate. The in general, this is the general observation, during recession or if the Fed anticipate a recession, then they will reduce the Fed fund rate. So, as a result, we can see that the interest rate in the economy will get reduced and as a result there will be a rejuvenation of investment, that is investment in productive, that investment by firms to produce more goods and services. And, as a result, the economy will be bouncing back to its natural track.

So, in this way, let us see, as a part of economics in action, in determining the Fed fund rate, there are some suggestive tools as well. One of the tools is Taylor's rule. John Taylor, he proposed a tool based on which the Fed can decide the target fed fund rate.

For example, based on the current level of output and inflation, they can suggest that this is going to be the Fed fund rate. So, we are going to discuss this Taylor's rule in detail in this session and in subsequent session.

(Refer Slide Time: 20:43)

There are two things we need to discuss; one is the target; target means the target Fed fund rate. And another is the Fed fund rate determined by market.

We have seen in the earlier sessions that interest rate in an economy is determined by the market. We have used the demand for bonds and supply of bonds as the framework to determine interest rate in the market

A common mistake is to imagine that the changes in the way Federal Reserve operates alter the way the money market works. So, because we have seen interest rates are in fact determined by the demand and supply of money, that is true as well. The interest rate is determined by the market forces.

But what we have seen here is that Central Bank can influence the interest rate by changing the money supply or the reserve. Changing the money supply or changing the reserve with the banking system through which the Central Bank can influence the interest rate. So, you will sometimes hear people say that the interest rate no longer reflects the supply and demand for money because the Fed sets the interest rate target.

The fact is that the money market works the same way as always. Interest rate is determined by the supply and demand for money. The only difference is that, now the Fed adjust the supply of money to influence the Fed fund rate. It is determined by the demand and supply.

They increase the supply of money through reserve, or they reduce the supply of money to achieve its target interest rate. So, it is important not to confuse a change in the Feds operating procedures with a change in the way the economy works.

(Refer Slide Time: 23:29)

So here, what should be the desired Fed fund rate? How is this target rate determined? Here, well known economist John Taylor proposed a rule to set the target fed fund rate.

So, John Taylor suggested a tool as an activist rule; that means, the target Fed fund rate should be determined based on a formula. The Taylor's rule tells the monetary authority to set interest rate in response to economic activity. So, this is his formula that is i_t, means the short-term nominal interest rate, that is nothing but the Fed fund rate. Then, r star is the real natural long run rate of interest.

This one is the real natural long run rate of interest corresponding to natural unemployment. So, the concept of natural unemployment means, it is corresponding to the natural GDP (natural output); that means, given the resources; that means, land, labor capital and all the resources technology including all the resources of the economy at a given point of time, how much the economy can produce? What is the natural GDP? So that means, the natural GDP.

The corresponding employment level is called natural employment level or suppose in a we normally say that natural employment means 100 percentage employment, but not really. For example, 5 percentage of the population, for example, 5 percentage of the population they cannot be employed due to structural reason and some frictional fact is, it is not necessary that full employment means 100 percentage of the labour force is working.

We accept that for example, 5 percentage of the population labor force cannot work due to some structural reason and voluntary unemployment etcetera. This one is called natural unemployment. That we are willing to accept, for example, 5 percentage to 6 percentage, that is well developed countries normally accept that full employment means natural unemployment at a 5 percentage or 6 percentage.

When economy at a normal; that means, economy is at this natural economic growth, natural GDP, the corresponding interest rate is called natural long-run interest rate.

And this one is the rate of inflation, which is measured by the GDP deflator and pi star is going to be the target inflation rate.

This one is the inflation gap. And yt is the actual real GDP and yt star is the potential GDP. Potential GDP means that given all its resources how much GDP it can produce? That is the

potential GDP. Normally we see that, normally the economy should be at this natural growth producing the potential GDP.

But, due to some friction in the economy, it falls below that, then the recession happens. And, if it is above the potential GDP, then the economy is at the boom stage. Otherwise, in the normal time economy will be producing what it can produce given its resources that the potential GDP.

What is actual GDP? And what is its potential? That is called the output gap. Suppose the potential GDP is greater than the actual GDP, then you can say that there is a negative gap. Because suppose the economy can produce for example, 100 billion that is the potential, but its actual GDP is only 90 billion then you can say that there is a gap of minus 10, that is, economy at recession. We can say this output gap is negative, it means, economy is currently producing below it can produce.

So, this is the output gap. So, what Taylor suggests that, when a constant 2 approximates the long-run average real interest rate, the inflation rate is 2 percentage and with the Taylor's approximation of alpha pi and a beta y is going to be 0.5. So, that means, i_t is going to be 2, this is the constant 2 used in the formula. And Taylor suggests that the alpha coefficient is going to be 0.5 and the beta coefficient is also going to be 0.5 accordingly.

He suggests this one and based on the empirical research he said that this r, the real natural long run interest rate, should be 2 and the alpha, the weightage for inflation gap, is going to be 0.5 and weightage for output gap is going to be 0.5. And then accordingly, and keeping this one, and then what is the inflation gap in the economy? What is the output gap in the economy? Accordingly, the Fed fund rate should be determined.

Suppose if current inflation is 5 percentage, with a 2-percentage inflation target while GDP is 1 percentage above the potential GDP, then Fed would set the Fed fund rate at i_t is equal to 9. So, this is the way. Suppose given that, current inflation is 5 percentage with a 2-percentage inflation target and while GDP is 1 percentage above the potential GDP; that means, potential GDP is that the output gap is greater than the normal. Economy is producing 1 percentage above is natural GDP or potential GDP.

Then Fed is setting the Fed fund rate at 9. So that means, plugging this one, plugging this value in the Taylor rule formula, we are going to see that the Fed fund rate should be 9. So,

based on this rule, this activist rule, given these factors these are the output gap, the inflation gap and accordingly they will be fixing the Fed fund rate as 9 percentage.

In the next session we will continue this discussion.

Thank you for watching this video.