Microfoundations of Macroeconomics
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Lecture – 20
Rational Expectations and Economic Policy 1

Hi everyone. In the last session we discuss about different schools of economic thought in macroeconomic and we had almost introduced ourselves with the classicals, Keynesian, new Keynesian, new classical then we also had the idea about the saltwater and freshwater schools of economic thought.

How they think about, how they perceive about different types of policies whether it should be market-oriented or it should be government-oriented, and what will be the scope of intervention in the market or in the functioning of the market. We have already examined these things from the perspective of different thinkers and how they have contributed. In this class, we will be talking about the perspective of neo-classical.

And then we will be trying to see how we are trying to understand the behavior of policymakers, how far policymakers try to integrate the behavioral changes or human behavior in the policy-making, and when they formulate the policy whether those dimensions are also looked at. Rational expectations have a lot of role in the area of macroeconomics because it allows you to understand the deviations from the normality that we have if we are introducing any random shock to the macroeconomic system.

How far it is feasible to achieve or to reach equilibrium if you are reaching equilibrium even after this disturbance or the learning that happens. Whether it is appropriate how far we can accommodate this. For macroeconomist, it has been a major challenge since the beginning and people have gone through different types of models so whether it is if you talk about econometrics or whether it is a simultaneous equation model.

Simultaneous equation-based macroeconomic models or I would say reduced form models where we have different types of reduced form equations even incorporating structural changes with certain coefficients, I would say restrictions on certain coefficients. We try to understand the macroeconomic behavior in that environment. Here we are looking at a very micro level.

And we are trying to understand that if you have some expectations working in the market with simple demand and supply scenario, are we able to understand the behavioral changes that we are observing in the economy. If we can think about understanding those dimensions then it will be easier to understand the policy stance of the government and the policy stance of the central bank.

There is a role of expectations so once we are analyzing the role of expectations in the model then it becomes really important that we should be at least trying to understand how individuals go about forming such expectations. If they are simply going about based on the previous information or based on collating the whole lot of information whatever they have or based on some expertise if they can analyze that kind of information.

Then that gives us the broad framework to introduce certain kinds of policy variables and analyze whether those policy variables are also impacting. Expectations have a lot of roles in macroeconomic policies. In this session, we will be devoting more time to setting the framework and understanding with simple macroeconomic models how rational expectations theories have been analyzed in macroeconomics.

And towards the end, I will be giving you some hints about how the new Keynesian took it over. From saltwater and freshwater, you can think that we are trying to understand from the model is starting from the freshwater then it goes into the salt water where the saltwater economist tested this or toast this idea of the rational expectation or also the Lucas Critique that it will come later.

That whether the policymakers are able to understand or read the pulse of the different agents in the economy, if they are not able to read pulse of different agents in the economy then whatever policy activation they are taking or whatever measures they are planning to take will have no effect that the new Keynesian with the framework of rigid ways they try to incorporate into model.

Stanley Fischer is considered one of the major contributors in that area. We will have those dimensions also to look at.

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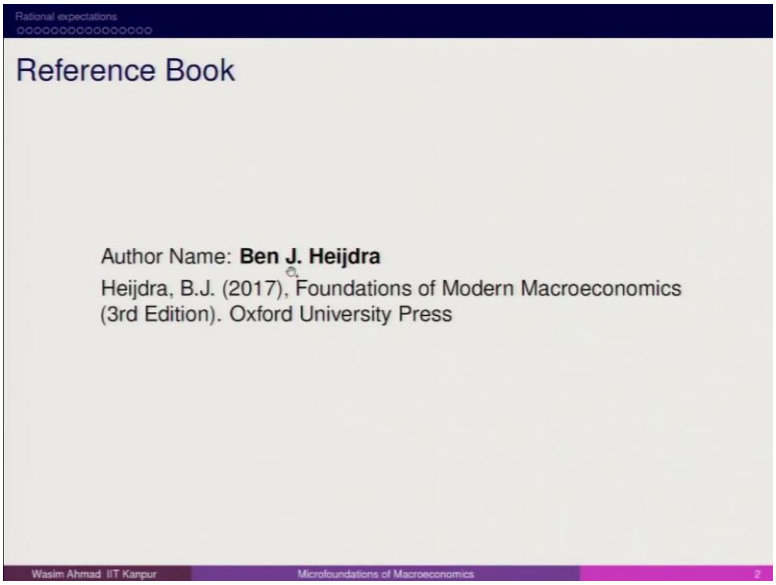

Let us start. The reference for this particular session is Ben. J. Heidra I am referring foundations of modern macroeconomics. We have already covered this part.

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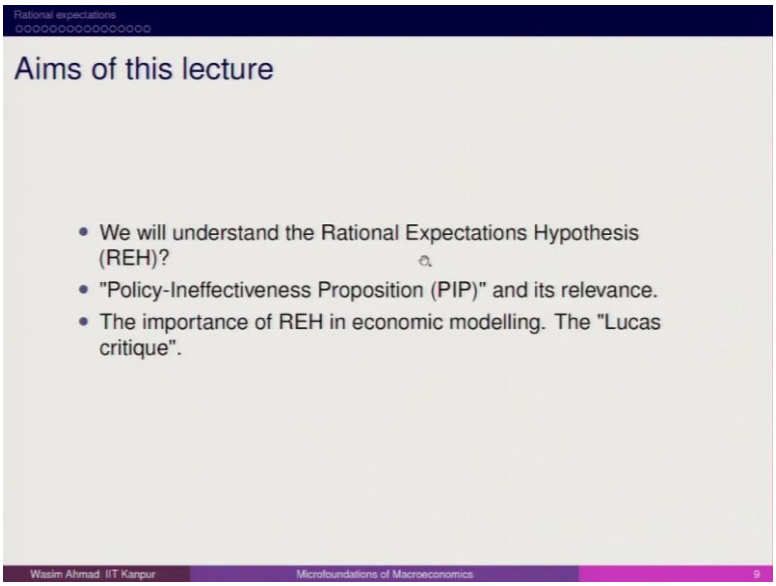

Let us spend some time understanding the rational expectation hypothesis. What do you mean by the rational expectation hypothesis? When I use the term policy ineffectiveness proposition then what is the meaning of policy ineffectiveness proposition then we have something called Lucas Critique where it is applicable. We will be formulating some theories to understand this.

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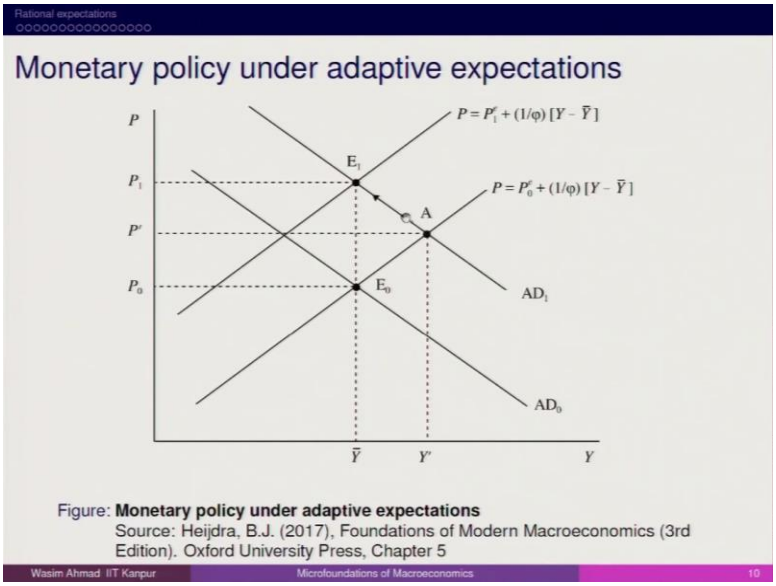

Let us understand with the simple model with adaptive expectations where you are just thinking about more relying on the immediate past. If you have that kind of framework so suppose E_0 is the equilibrium at this point you have a $\bar{y}$ and then here you have the P_0 this is the price. If I am trying to understand the role of expectation in the monetary policy framework when we have an increase in the money supply.

Now if you have the increase in money supply then the economy moves to point A which means that at this point we are disturbing the equilibrium. Now we are at Y' and P'. Now in order to make sure that you arrive at the same level of output there is learning happening here and this is moving further towards so you have AD moving upward so here it is AD_1.

Now you reset point A where you find that this is the equilibrium output and we are not at the same output. Here we are moving upward and we reach at point E_1 and at E_1 we are operating at the same, but the price level has gone up. Now this particular understanding of learning and further the shifting of certain I would say policy indicators in the economy has I would say a lot of bearing on the policy implications in the formulation.

For example, in this case, if this is the same case of monetary policy then we see that whenever we have an increase in the money supply from the simple Friedman idea that we have the rise in price level at the given output, but the movement from E to A and A to E_1 it involves a certain amount of learning and that we say that this is happening because agents are not reacting immediately.

They are forming the expectation and based on those expectations they are working with actual numbers and then they are trying to learn. This learning process has a lot of applications in macroeconomics.

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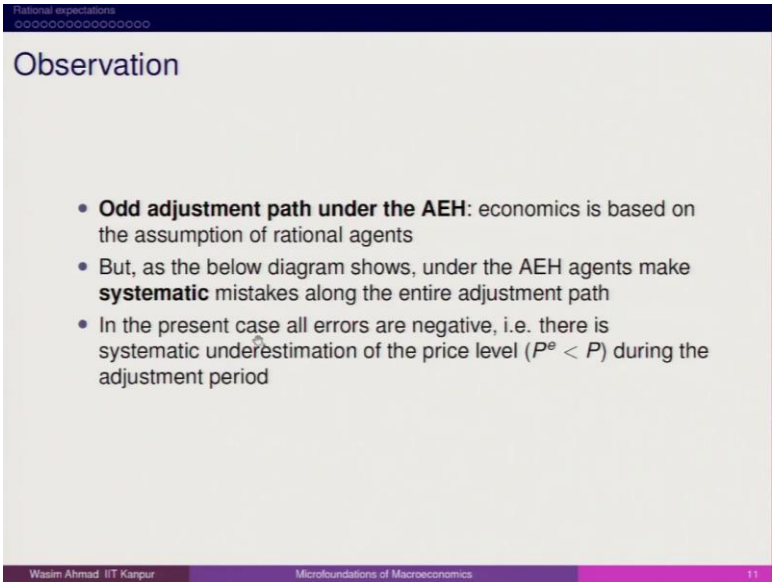

So here is what we try to understand.

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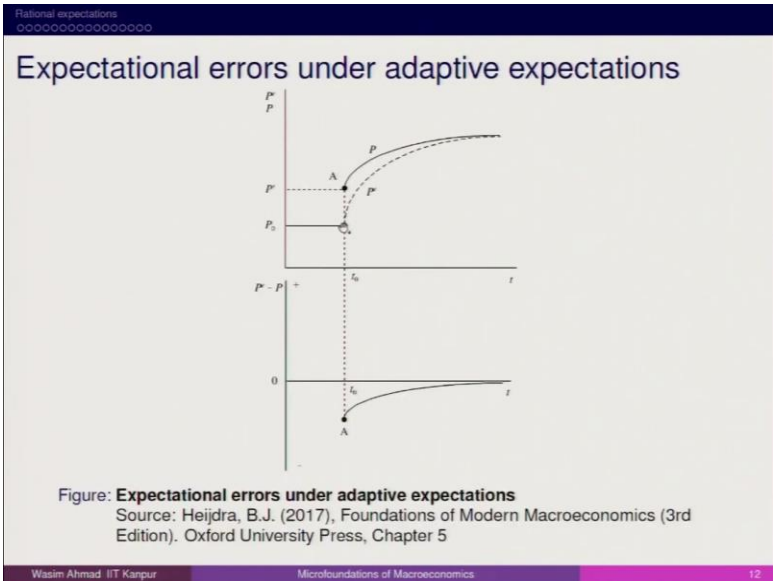

Suppose the individuals have some expectations based on the previous period price if they are expecting the future price if the future price is higher if they expect a higher price in the future than the actual higher price which means that if you have expected that in next period inflation is going to be 5%, but inflation is happens to be only 4%.

Now here the expectation about 5% will be supplying some amount of extra labour because you expect that price is going to be higher then you tend to supply a higher amount of labour and this will have further bearing on the consumption pattern and also the amount of output produced. As a result you feel that the output is going to produce more because you have more supply of labour if it is backed by an equal amount of supply of input and technology.

You can see that in the beginning, we have a wide difference between P_0 and P', but after some point in time, it is merging. The gap is narrowing. If you are starting with T_0 if the individual is having the information you can see that as we move we have further differences between P_e the expected price minus the actual price the difference is narrowing and this is what we call the ideal case scenario where we have the perfect foresight hypothesis which means that you are so exact about the future expectation that even if there is a deviation you are able to understand that and based on that you formulate your expectation.

Such types of ideal scenarios are not available every time so in some cases it may be, but if you have deviations from such an ideal situation then how you can think about the role of expectation, so, that is the idea behind it. Expectation error that we have we try to understand by introducing some randomness to the model. Whenever we are trying to specify a model we try to introduce the stochastic term and we say that if this term disappears then you have the deterministic rule.

So, which means you are almost matching with the perfect foresight. As long as we have this stochastic term attached to the model then it will create some kind of deviations because this is the random shock it has such properties. As long as it is satisfying that it may not matter, but on average we say that the expectation has no role because the mean value is 0, but if it is higher then it is going to impact the model.

The deviations that we may see here could be because of the randomness in the model. Rational expectation started from the adaptive expectation idea, but later it worked with more variables incorporating the changes in the model. This we try to understand here.

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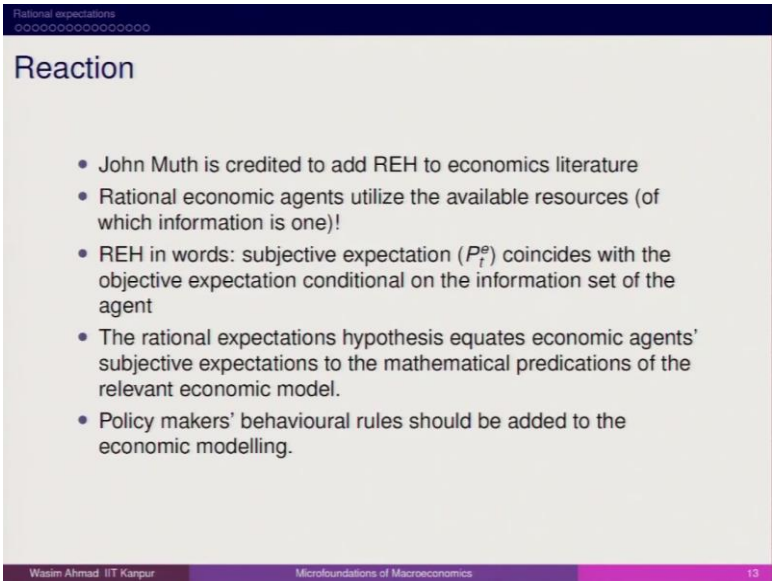

Now if you try to understand from the perspective of the rational expectation hypothesis then John Muth is having the name attached to it and he is also considered the major contributor to the rational expectation hypothesis. Now the idea is simple, the simple idea is that whosoever is thinking about the future then they have some amount of information and no one likes to waste that information they would like to utilize.

Maybe if you are living in a country where the education system or I would say the tertiary education or the secondary education is not that great. The majority is still illiterate if a large number of the population is illiterate then of course it will not create some kind of rational expectation kind of scenario. For rational expectation, you need to have a better idea.

This we try to understand here. Now if I am going to think about the rational economic agent so here it works in this way. Here you have the rational expectation hypothesis. Here we say that the subjective expectation that an individual is forming based on the previous period of information coincides with the objective expectation. Whatever is going to be the actual based on previous period expectation if we are able to arrive at.

The period is nothing, but the subjective that we call it. rational expectation hypothesis equates economic agent subjective expectation to the mathematical prediction. This is how they try. Mathematical prediction of how it works, we will be examining.

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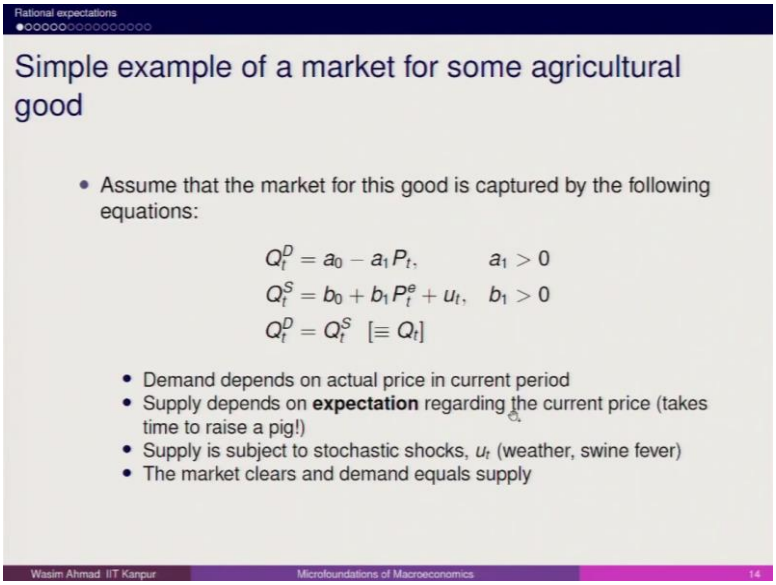

Now let us understand with the simple model. Here the simple model is this where we have

$$Q_t^D = a_0 - a_1 P_t$$

Now a_1 is greater than 0 because of this magnitude, but the relationship is negative with the Q_t^D, so this is the demand. This is the supply wherein supply we are having

$$Q_t^S = b_0 - b_1 P_t^e + u_t$$

Here also we have b_1 greater than 0 and then here we have

$$Q_t^D = Q_t^S$$

So, this is demand is equal to supply. This is the demand, this is the supply and in supply, we always say that here you have the role of expectations which means that here you are forming the expectation based on the previous. Whether I have added this particular part or not so here it works that in most cases I will be coming to that part very soon.

Here you have to understand that demand depends upon the actual price, supply depends upon the expectations regarding the current price which means that in the previous period you might have or based on some information you have expected some output and this is the market-clearing mechanism. Now u_t is the random shock that is the most important characteristic of the rational expectation model and this has lot of bearing on the policy formulations. So, understanding of this is crucial.

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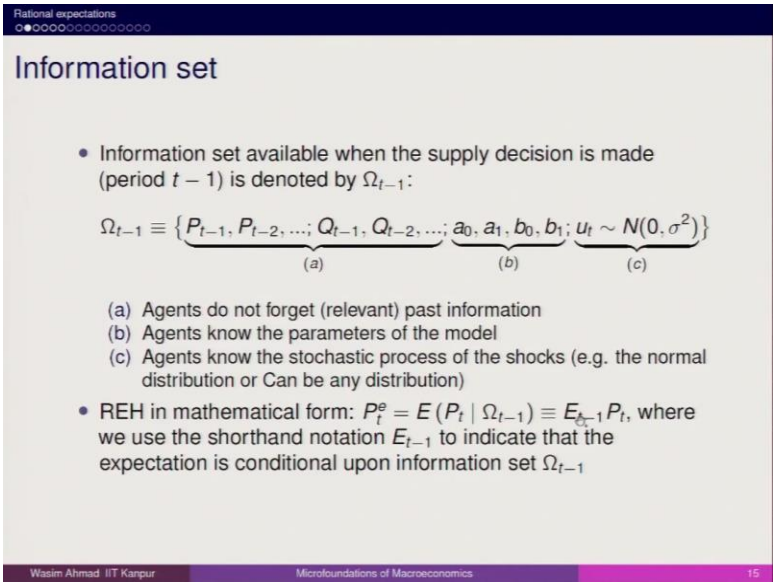

Now if I am going to think about the P_e^t this is what we have expectations about the price. P_e^t it is nothing, but expectation the of P_e^t conditional upon all the information that you have in the previous period which means that if I am going to replace this particular term. It becomes $E_{t-1}P_t$. If you are forming the expectation in the previous period about the current price.

This is what we try to achieve in this. Now, let us see this part. If I am saying that this particular gamma is having these variables incorporated it means that it incorporates the price in period t – 1 and t – 2. It also incorporates the quantity prices in the previous periods also then here you have the coefficients. So, coefficients are what $a_0, a_1, b_0 and b_1$ and then you have the error term.

Now this stochastic error term has certain properties that $E(u_t) = 0$ the variance is constant, the correlation with own lag is 0 which means that no autocorrelation, covariance of u_t and some P_t or Q_t variable it is 0. All these properties are just for the sake of basic econometrics if you are aware of those assumptions we are formulating them here.

But the ideal point is to note is that this information that you have a past you are incorporating all in your E_{t-1} to predict about the current price level information so this is what we say. $E_{t-1}(p_t)$ is important to derive or to have some idea about the current prices. This is how we always try to mention that in the rational expectation process you try to incorporate all your information whatever you have.

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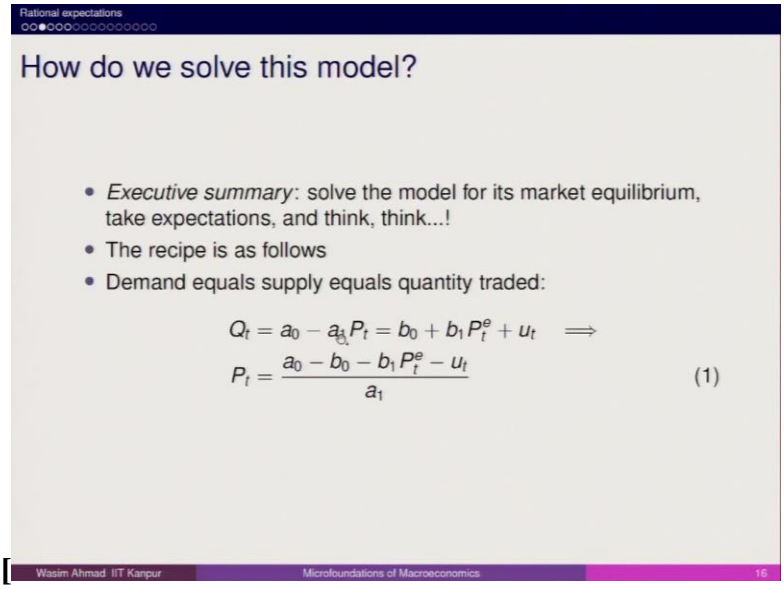

Now if you just think about solving it, how we can solve? Since you have the residual term or the random term, so it is simple demand supply scenario. If I am going for $Q_t^D = Q_t^S$ then it becomes like this. So,

$$Q_t = a_0 - a_1 P_1 = b_0 + b_1 P_t^e + u_t$$

And if I solve for P_t here I get

$$P_t = \frac{a_0 - b_0 - b_1 P_t^e - u_t}{a_1}$$

This is how we are driving. One of the important things to note is that here we are having the residual term the random term and this will play important role later.

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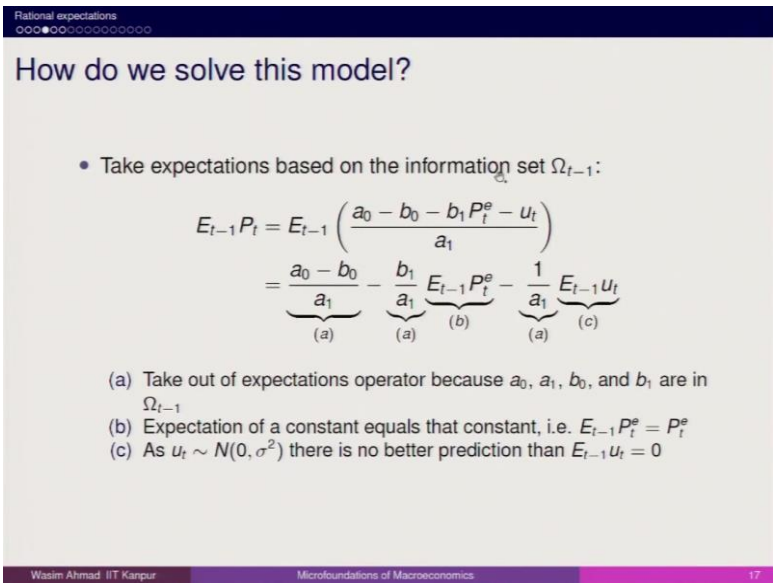

Now as I said that here you have the expectations playing a role because you have the information at t – 1. This we are taking into account so we are introducing expectation to this particular expression. Here we have

$$E_{t-1}(P_t) = E_{t-1}\left(\frac{a_0 - b_0 - b_1 P_t^e - u_t}{a_1}\right)$$

We know that $E_{t-1}(u_t)$ is 0. Here you have $E_{t-1}(P_e^t) = P_e^t$.

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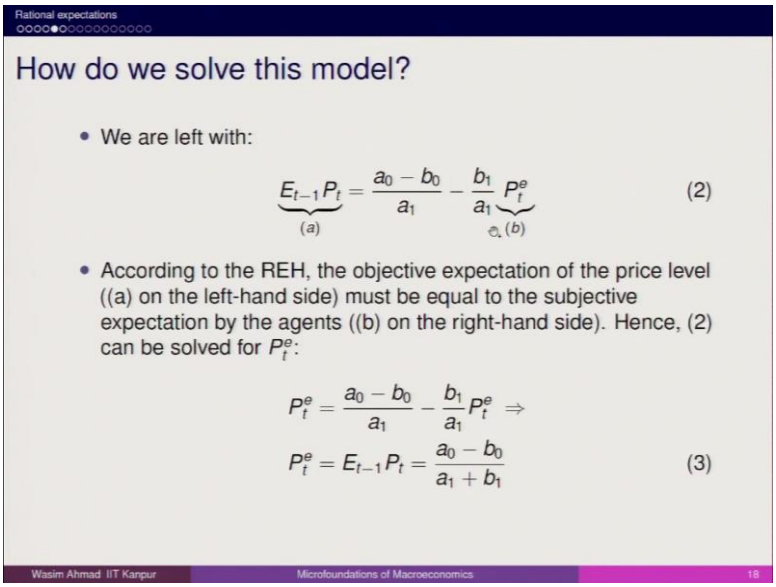

Now we want to again see that how much I can get about. here you have a so here we have the objective expectation and b here you have the subjective expectation. So here based on this we have the subjective expectation. If I am going to write about this particular part that how it works then we can simply say that we are getting

$$E_{t-1}(P_t) = \frac{a_0 - b_0}{a_1} - \frac{b_1 P_t^e}{a_1}$$

$$P_t^e = \frac{a_0 - b_0}{a_1} - \frac{b_1 P_t^e}{a_1}$$

$$P_t^e = E_{t-1}(P_t) = \frac{a_0 - b_0}{a_1 + b_1}$$

So here we are having the same value. According to rational expectation hypothesis the objective expectation must be equal to subjective. Now here we can solve for the subjective expectation. If you are solving for subjective expectations you get the above expression, which means that rational expectation hypothesis assumes that your objective expectation is equal to

subjective expectation. Here we have fulfilled that criteria and after solving this is what we get.

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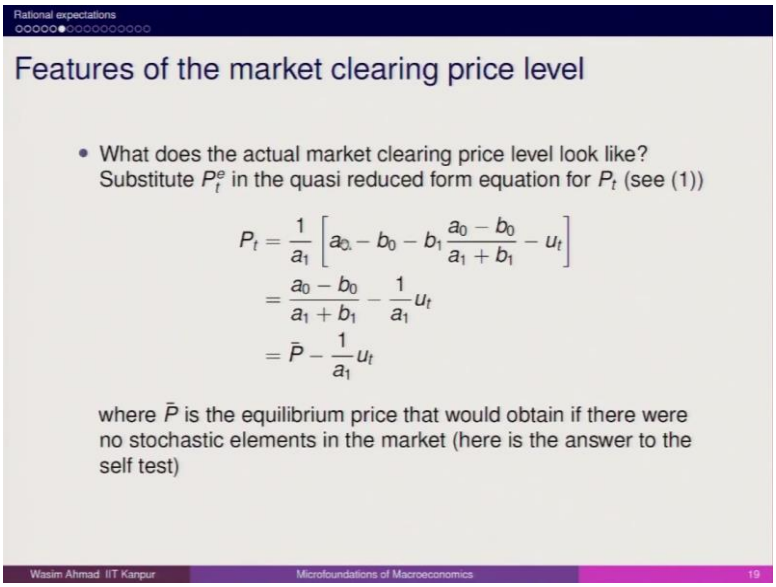

Now what is the actual market clearing price look like. if I am going to substitute this P_t^e here in 1 then we can get the $P_t$value so how much I am going to get the $P_t$value I am substituting this here. I have

$$P_t = \frac{a_0 - b_0}{a_1 + b_1} - \frac{1}{a_1}u_t$$

$$P_t = \bar{P} - \frac{1}{a_1}u_t$$

Here your P_t is nothing, but if this is the equilibrium price then equilibrium price will be equivalent to above expression.

As long as this $u_t$is not appearing then your system is deterministic you do not have to worry about, but in real life that is not the case the deviations happens through this. This $u_t$will be factor into the $\bar{P}$ because this will be subtracted here and this will depend upon the magnitude of a_1 which is coming from demand. If I am saying about the magnitude of a_1.

This is coming from here that we have. This is the coefficient of demand equation. What we are mentioning that as long as this is 0 we do not have to worry about. We reach towards the equilibrium price, but if it is not 0 and this could be because of the not good monsoon, not good rainfall or the sudden demand rise or if you have imbalance, suddenly you have some kind of natural hazard so that has created extra pressure.

Those things are added here. The idea behind rational expectation is that if you are giving shock to a system as long as that shock is active you may not be achieving or you may not be having the perfect foresight kind of scenario, but as long as you have the random term equivalent to 0 or if it is disappearing then you have the deterministic system operating.

And then you may achieve the perfect foresight scenario. This is how it deals with. Now here so far the major learning of this is that in order to understand the demand supply scenario or price and quantity you need to understand the behavior or the importance of objective expectation and subjective expectations both have major role here and this was the simple price quantity relationship. We will be say the macroeconomic part.

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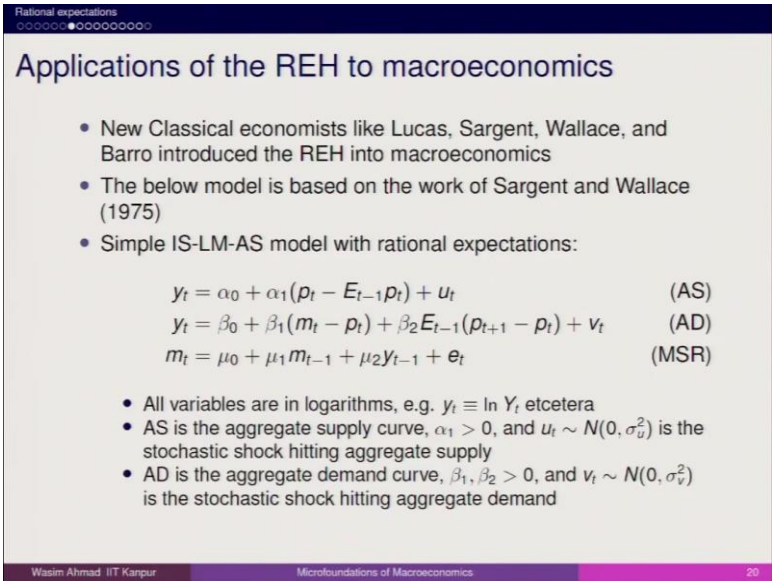

Sargent and Wallace are known to challenge the notion of the government intervention by the policy maker and they introduced this idea with the certain expectation that this idea will not be holding for certain types of macroeconomic policy design. Lucas, Sargent, Wallace and Barro they are credited to introduce the rational expectation hypothesis is in macroeconomic.

Sargent and Wallace work of 1975 is credited to challenge the new Keynesian idea of rigidity into the model and they provided the explanation for that and Lucas later became he advocated about the role of inclusion of behavioral aspects which means that micro foundations must be there into the model then only you will understand the behavior in a much better way.

So at that time people were more relying on the macro econometric model, lengthy models and try to estimate the policy design and they used to design the policies using those equations. For the first time they receive the shock by having such type of analysis.

Before I move to deal with further, I would say explanation of these models and further operations and solving for the rational expectation hypothesis I would like to conclude this session that in this particular session we introduced ourselves with the rational expectation idea.

And we started looking at the difference between objective expectation and the subjective expectation how these two play very important role. How the individuals incorporate the new information, how do you go about the expectations. You can go on the RBI website and you will have the RBI inflation expectation survey. There also they incorporate such things.

And some of the researchers those who have worked or those who have examined the data they always come up with such type of recommendation that whether the inflation expectation is adoptive or the rational. Such type of understanding helps the policy makers to design or to introduce the policy variables in such manner that it really impacts all other macroeconomic variables and including the price level in the economy.

When I introduce the random shock to the model and as long as it is available it is very difficult to find out, but one of the good things that we are learning is that we are working out with a reduced form equations and there it becomes easier to understand. I am stopping it here and we will continue again in the next session. Thank you so much.