Microfoundations of Macroeconomics
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Lecture – 05
One Period Model V

So, hi everyone, we are going to start the next session.

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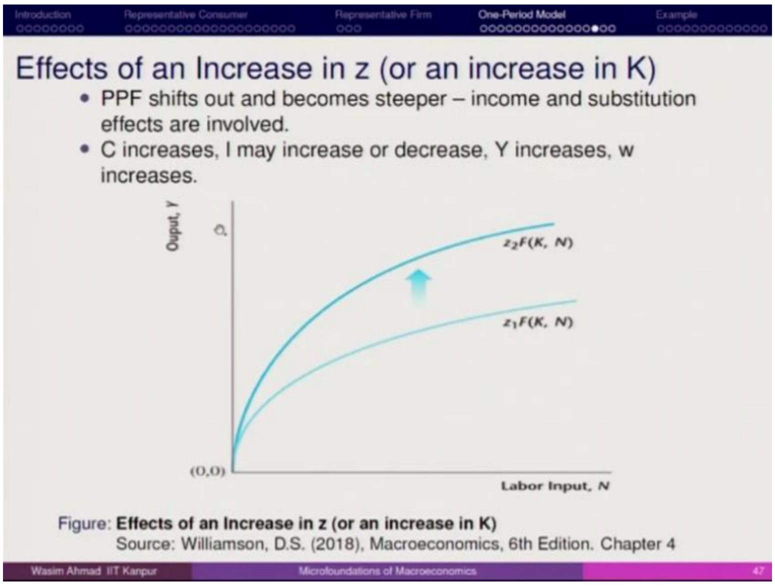

Now, the second case. what is the second case? Second case is that effect of increase in z. So, when we are talking about effects of increase in z, so, here we are talking about productivity. How productivity increases or decreases? When we go for increasing the z it means that the factor productivity is increasing like better technology, may be a good weather, better working conditions. These things are part of the productivity factor. So, in this situation, what will be the immediate output?

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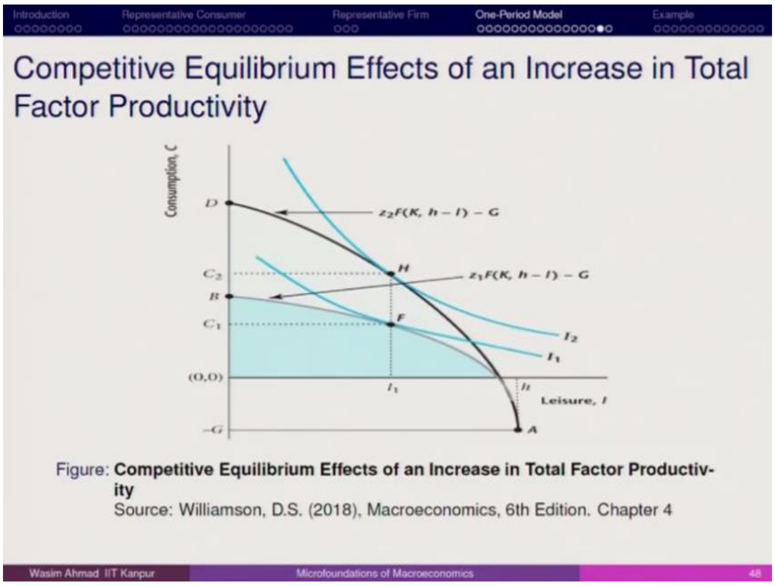

So, the immediate output would be that the representative consumer was earlier here at F point. But, now, the representative consumer is moving because of this productivity shock, the positive productivity shock. This consumer is moving to I_2. Now, he is at point h. Now, at h point, you can see that from the consumption side the consumer is playing a very important role. So, here, we have C_1 and C_2.

But, here, when I say C_1 and C_2, so, here, you have to understand that we are talking about the increase in consumption of the representative consumers. So, the representative consumer is going to have a good time. But leisure remains the same which means that from when we have an increase in productivity it is sure that the labour is going to have a good time. It will have better consumption possibilities. This is what it is looking like.

But, from the leisure side, it is unclear whether leisure will increase or decrease. This is one of the important understandings. This is $z_2F(K, h - l) - G$ represents the PPF that we are mentioning. So, unlike the government expenditure increase, here it is more or less clear that we are talking about an increase in productivity.

This increase in productivity is translating into increase in consumption. It is up to the representative agent to decide. It may happen that because of this increased income which means that now the individuals are going to be asking for more. So, here, the condition more or less remains the same in this situation C is increasing, l may increase or decrease, Y increases and w increases. Why w increases?

Because then, once you have the better conditions which means that the marginal product of labour is going to be higher than of course the, there will be some kind of demand from the labor side also. So, this will lead to an increase in wage rate and to better consumption possibilities for the representative consumers.

But, it depends upon the reactions of the representative consumers. It may happen that representative consumers may like to work for the same number of hours they used to work. They may be supplying a limited number of the hour. It all depends upon the representative consumers' decision that how representative consumers are going to be deciding about. So, this is one aspect that you have.

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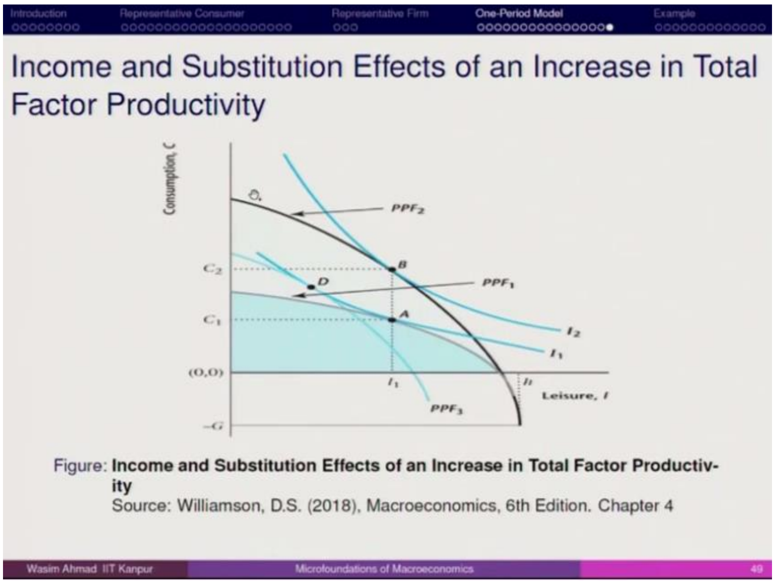

In the case of income and substitution effect, if you just try to understand how it works. Here, you have the B point. So, here, we draw a parallel line to PPF_2 just to derive the income and substitution effect. So, here, we draw the parallel line. And, here also, a parallel line to this because the representative agent has moved from A to B.

So, just to derive the substitution effect which is from A to D and D to B is the income effect. What we are trying to see is the new production possibility that we have which are the same slope as this one. It is again going in favour of the consumption. So, from a consumption point of view, when substitution effect, it is clear that compared to original C_1.

This representative consumer is going to have this much consumption. But, leisure is decreasing which means that now, this particular representative agent will have to work. He would like to work for a greater number of hours. So, that is quite a possibility. But, if you just take into account D to B which is the income effect, if you just take into account the income effect, then this representative agent is not going to increase the number of hours.

He would like to go for the same. So, the income effect is having a clear-cut idea that it is having a positive effect on consumption. Leisure, it is having a no effect. But, the substitution effect is having effect on both. If the representative agent wants to work for more number of hours and he would like to get more income, that is quite a possibility. But, the income effect side is not very clear what to do.

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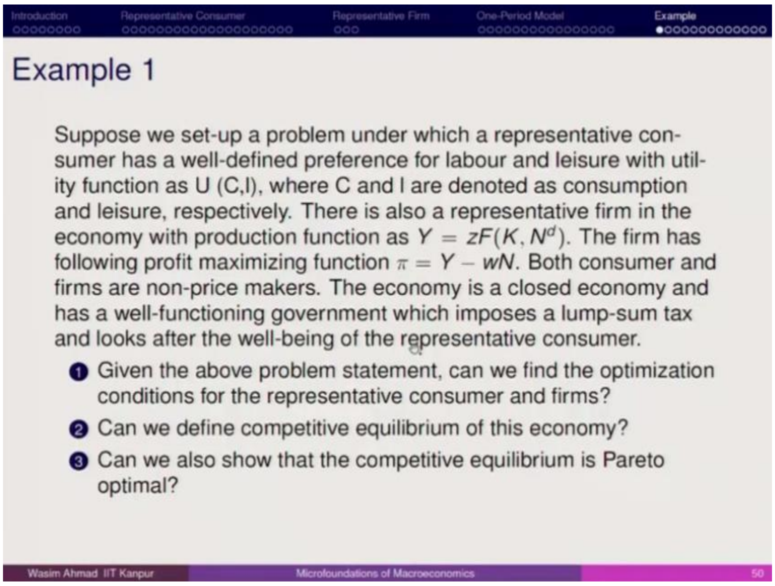

So, whatever we have derived so far, we can think about how we can understand with the help of certain examples. Some examples I have given. So, let us examine them one by one. Suppose we have a representative consumer which has a well-defined preference for labour and leisure with a utility function of $U(C, l)$ where C and l denoted as consumption and leisure respectively.

There is also a representative firm which is having the production function $Y = zF(K, N^d)$. The firm has the profit maximization function which is $\pi = Y - wN$.

Both and consumers and firms are the non-price makers which means that they are price takers. The economy is a close economy and has a well-functioning government which charges the lump-sum tax from the representative consumer and looks after the well-being of the representative consumer. Now, given this statement, we have defined the utility function.

We have the firms which are having the production function which is having the profit maximization function also. So, given this statement, can we find the optimization condition for the representative consumer and firms? If we can do that so, can we write it there?

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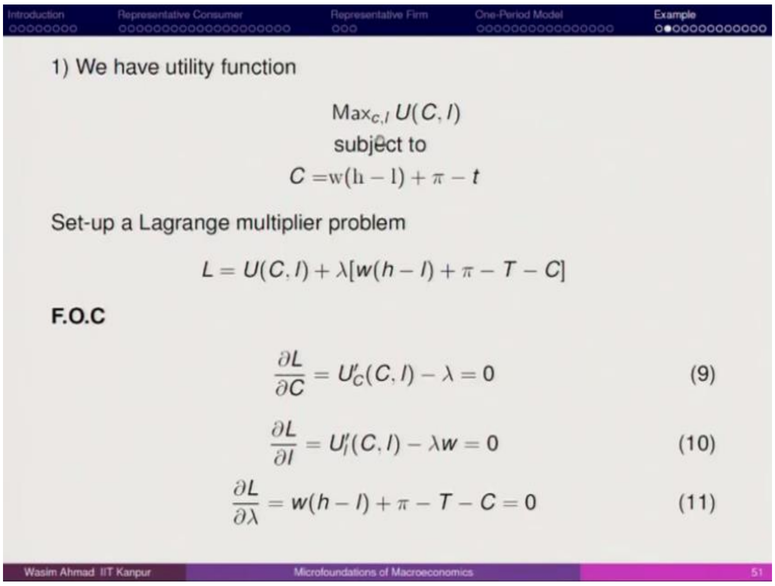

So, here we have

$$\underset{c,l}{\text{Max}}\, U(C,l)$$

$$\text{subject to}$$

$$C = \mathrm{w}(\mathrm{h}-\mathrm{l}) + \pi - t$$

So, this is what we have defined the budget constraint of the representative agent. So, budget constraint is what this particular guy is getting as wage rate w. So, here, we have mentioned about that for labour and leisure. So, this consumption and leisure framework we have. So, this wN that we have is coming for the labour.

And then, here, you have the π which is the profit. But, it is also being distributed to the representative agent. So, here we have $h = l + N$. So, here, N can be written as $h - l$. So, $\pi - t$, this is net dividend income of this representative consumer. Then, here, we have the Lagrange multiplier problem. So, we set up a Lagrange multiplier which is nothing but

$$L = U(C, l) + \lambda[w(h - l) + \pi - T - C]$$

If you want, you can also use the method of substitution. But, if you are going to use the Lagrange multiplier which is the dynamic optimization problem you just go for first order condition with respect to C and l. So, here, we have

$$\frac{\partial L}{\partial C} = U_C'(C, l) - \lambda = 0$$

$$\frac{\partial L}{\partial l} = U_l'(C, l) - \lambda w = 0$$

$$\frac{\partial L}{\partial \lambda} = w(h - l) + \pi - T - C = 0$$

So, this is what we get it.

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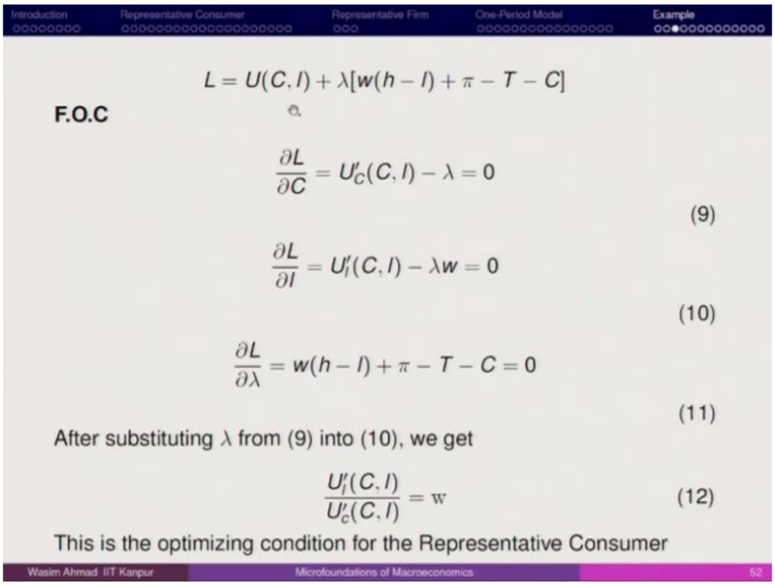

So, if you just solve for lambda and then if you just try to substitute, then you are having at this particular solutions which is

$$\frac{U_l'(C, l)}{U_C'(C, l)} = w$$

which is also the condition for the marginal rate of substitution. So, marginal rate of substitution is nothing but the same that we got that it is with regard to the wage rate. Now, we will be, so, from this particular analysis, we are able to derive the marginal rate of substitution.

MRS is equal to w, so, which is the slope which means that the slope of the indifference curve is just equal to w at equilibrium.

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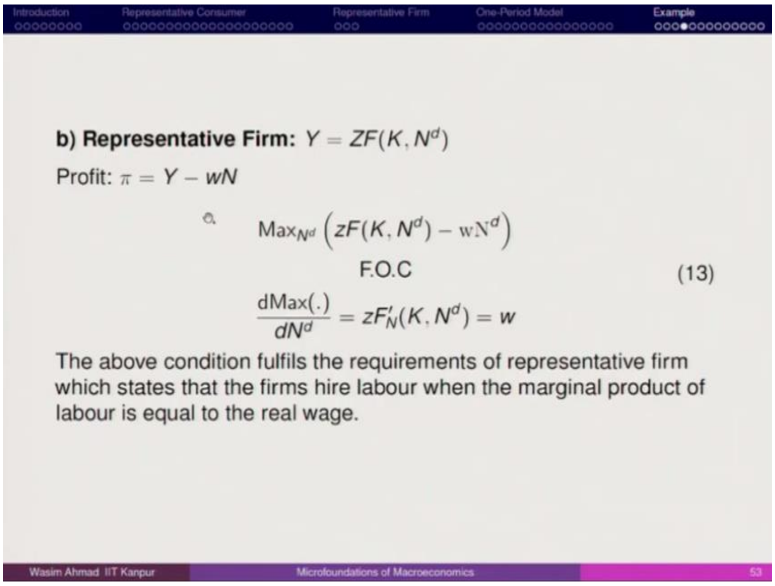

Now, we are going to talk about the representative firm. So,

$$Y = zF(K, Nd)$$

profit is equal to

$$\pi = Y - wN$$

So, here, it is

$$\underset{Nd}{\text{Max}}(zF(K, Nd) - \text{w}Nd)$$

The first order condition is

$$\frac{dMax(.)}{dNd} = zF'_N(K, Nd) = w$$

So, we know that it becomes once we want to derive the marginal productivity. So, we are differentiating with respect to Nd. $zF'_N(K, Nd)$ become the marginal product of labour. So, this will also be equal to w here. So, this is what we get which means that here it says that the marginal productivity of labour is equal to w. So, this also also satisfied and fulfills the conditions of firm.

And, which also says that here it is talking about the firm that this equilibrium will decide about how much labour has to be supplied and how much demand will be coming from the firm. Both will be interacting with only one variable as any important variable equilibrium which is the wage rate. So, here also the wage rate is playing important role and here also we are finding that it is playing important role.

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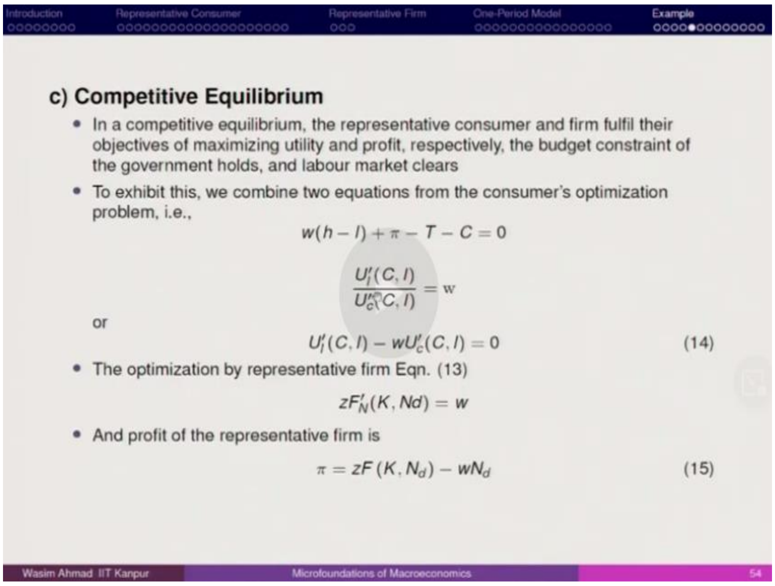

Now, we are going to see the competitive equilibrium part. So, in competitive equilibrium, the representative consumer and firm fulfill their objectives of maximizing utility and profit. The budget constraint of the government holds and labour market clears. So, here, what we try to do is that we combine 2 equations from the consumer optimization problem. So, here, it is $w(h-l)+\pi-T-C$. So, here, what is the $h - l$? And then, here, we are also superimposing the optimization condition of the firm which is the marginal product of labor is equal to wage rate, $\frac{U_l'(C,l)}{U_c'(C,l)} = \text{w}$.

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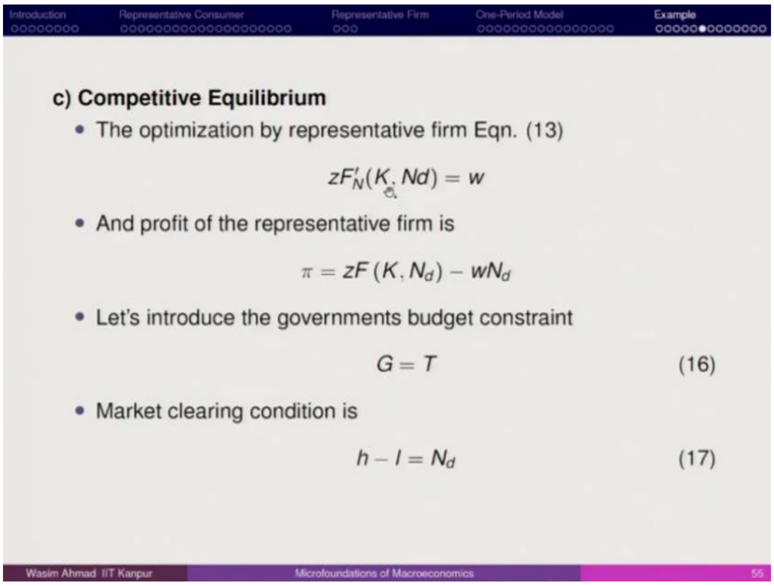

So, here, the optimization representative pi and the profit function are these.

$$zF_N'(K,N_d) = w$$

$$\pi = zF(K, N_d) - wN$$

Now, what will be the government budget constraint? Budget constraint will be government expenditure is equal to the tax rate, $G = T$. And, the market clearing condition will be what?

Market clearing conditions will be $\text{h} - \text{l} = N_d$. So, it means that how much labour supply is equal to labour demand.

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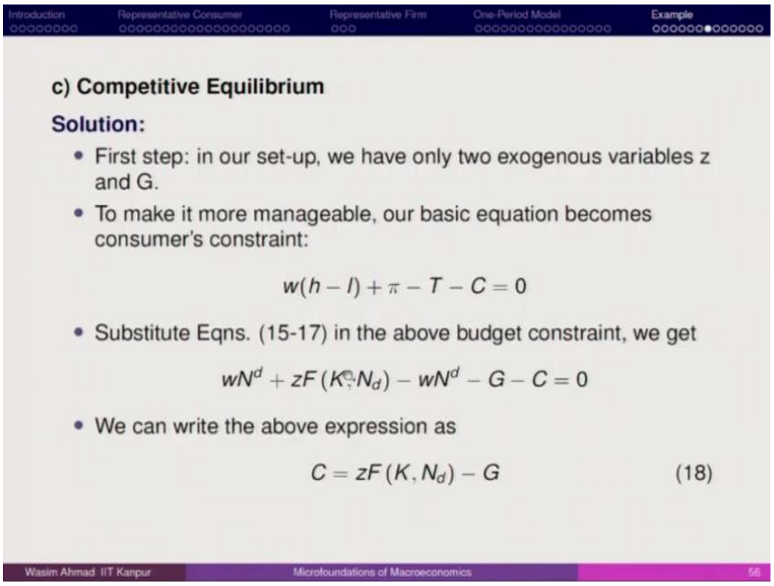

Once we are trying to solve for the competitive equilibrium, there the role of the representative agents becomes really important. Here, it is $w(h - l) + \pi - T - C$. And then, here, we substitute π and T. So, here, once we go for substitution. So,

$$wNd + zF(K, N_d) - wNd - G - C$$

We can write the expression of this as this because this gets cancelled. So, what we are having is nothing but

$$C = zF(K, N_d) - G$$

And, if you just try to work it out, it is equal to

$$Y = C + G$$

$$C = Y - G$$

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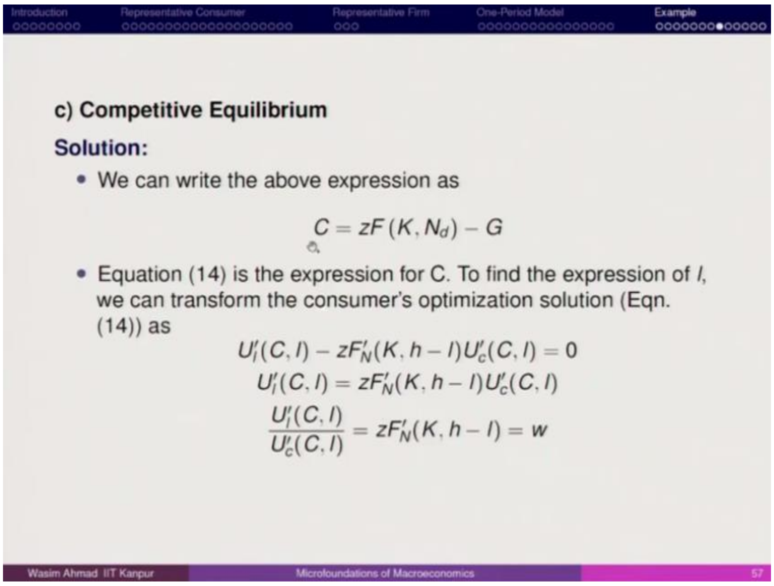

So, we can write this particular expression. Now, from here, we can again go for since equation 14 is the expression for C, so, to find the expression of l because we are transforming that. we are now looking for the, we are changing the consumer optimization. So, here, equation 14, it becomes like this particular expression that we have. So, here, we are trying to showcase it here.

$$C = zF(K, N_d) - G$$

So, here, what we are seeing in case of 14. Here, the first derivatives are

$$U_l'(C, l) - zF_N'(K, h - l\,)U_c'(C, l) = 0$$

$$U_l'(C, l) = zF_N'(K, h - l\,)U_c'(C, l)$$

$$\frac{U_l'(C,l)}{U_c'(C,l)} = zF_N'(K, h - l\,) = w$$

And then, here, we are trying to get the same expression that we had is equal to w.

So, here, it becomes important. In 14, this is what we try to understand. So, if we bring this this side. So, here, it becomes the marginal rate of substitution. So, here, we try to achieve by the same objective. So, finally, what we are getting is that the marginal rate of substitution which is represented by the ratio of marginal utility of leisure upon marginal utility of consumption. And here, we have w. So, here, we are talking about the competitive equilibrium.

So, in competitive equilibrium, what is assumption that we have? That in competitive equilibrium the representative consumer and firm fulfills their objectives. The consumer objective is that this particular representative consumer would like to maximize his consumption with the number of hours supplied to the market.

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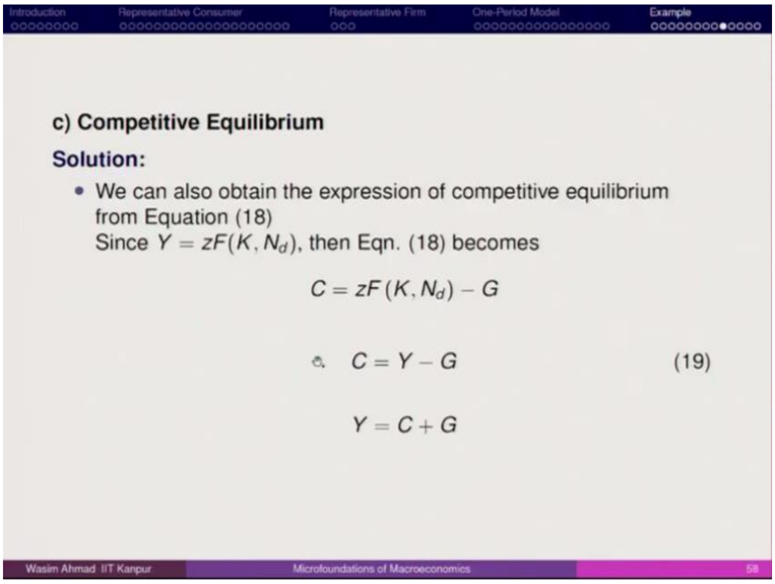

In case of competitive equilibrium, this is what we have the competitive equilibrium where we are talking about

$$C = zF(K, N_d) - G$$

$$C = Y - G$$

$$Y = C + G$$

So, finally, we are arriving at the condition that we had earlier. So, instead of if you are going by the marginal condition, the competitive equilibrium it can be by this. Or, it can be by this that we have done earlier.

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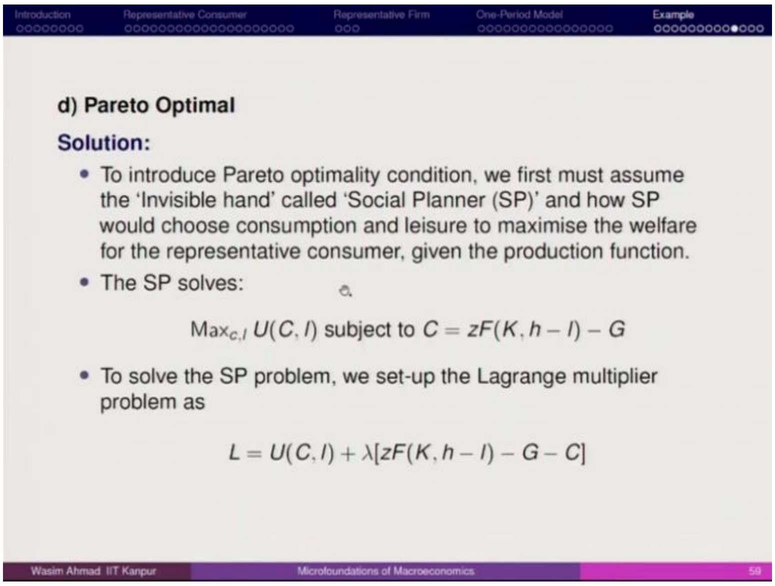

Now, let us talk about the Pareto optimal condition. So, Pareto optimality condition as we have assumed for the Pareto optimality conditions. So, here, we have to see that whatever competitive equilibrium that we have achieved whether it is socially optimal or not. So, we will now stop here. And, we will try to see in the next session the whether the competitive equilibrium that we have defined is Pareto optimal or not.

Or, it is economically efficient or not. So, for that reason, we will have to superimpose certain conditions. And then, we have to see that whether we get the same marginal rate of substitution is equal marginal rate of transformation is equal to wage rate. So, that condition we have to fulfill it again. But, as of now, let me summarize what we have done.

So, we first defined the competitive equilibrium. We worked with the comparative statics. We were more confident about government consumption, government expenditure leading to increase in consumption. But, it did not work. It led to decrease in consumption. Wage rate also fall. So, these 2 variables act counter cyclical. But, in case of productivity, you have consumption increasing because there you have the direct role of the income effect.

And that shows a lot of dynamics involved and substitution effect is also having the reinforcing effect on the consumptions. So, it was clear. Then, we worked with the optimization condition. And, we tried to satisfy the marginal conditions of the competitive equilibrium and we did that. Now, in the next exercise, we will be doing about the Pareto optimality condition, thank you so much.