Microfoundations of Macroeconomics
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Lecture – 04
One Period Model IV

Hi everyone, we are going to start the next session. And, in this session, we will be talking more about the competitive equilibrium that we were trying to derive in the last session. And the reference books and the topics remain same. So, we will be referring the book mostly of the Williamson and then to some extent Sanjay Chug.

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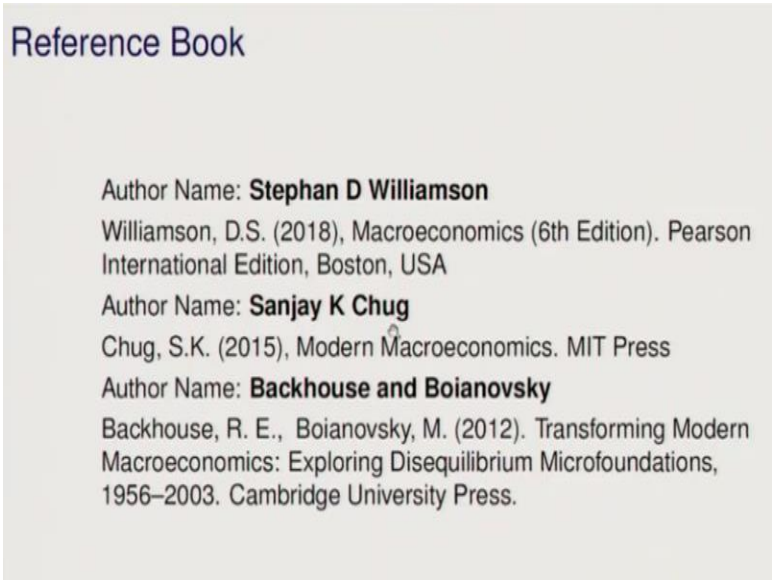

This particular book that I mentioned last, Backhouse, this book will be referred only for understanding why macroeconomic foundations are important. To give you a brief background that what we did in last 2 sessions - we were talking about how we can arrive at equilibrium. How we can define the representative consumer and representative firm. And, with the interaction of representative consumers and representative firm, how we can think about finding the competitive equilibrium.

So, that was the analysis that we were doing. And, to some extent, we had also discussed certain comparative statics.

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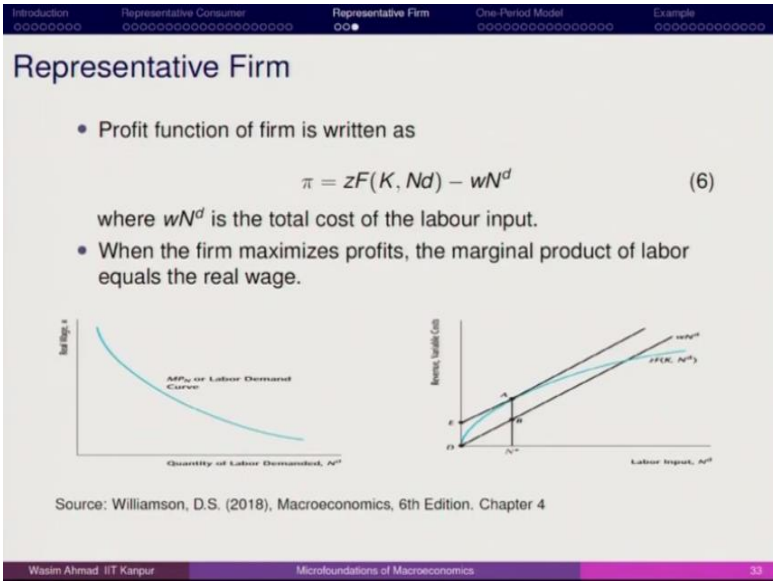

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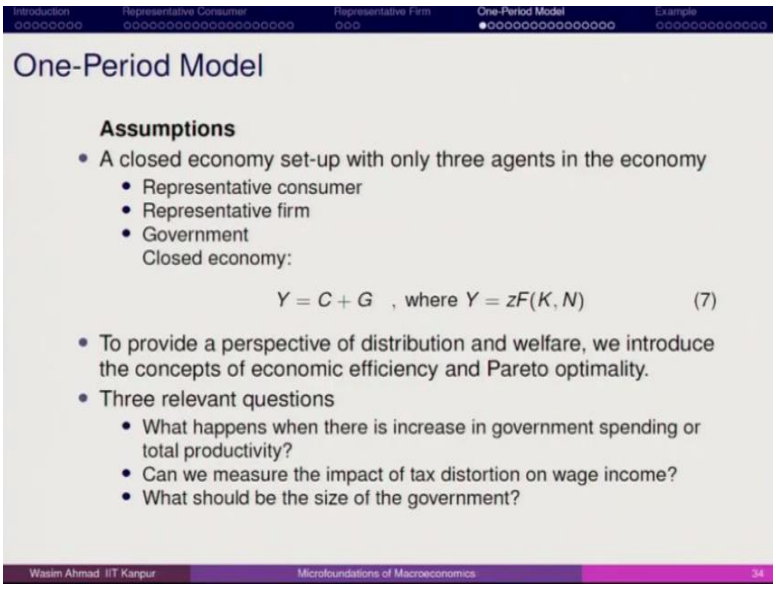

When you have an increase in wages or an increase in dividends or an increase in taxes then how this is going to affect the consumer's choice of consumption and leisure. So, basically, we are trying to understand the one-period framework. There is no future period. There is only 1 period which is the current period. And how individual agents are making decisions about how many hours they have to supply.

And how many hours the firm has to employ a certain amount of labour. So, that kind of examination we are doing. In the last session, we also derived the basic part of the model that is under the close economic setup.

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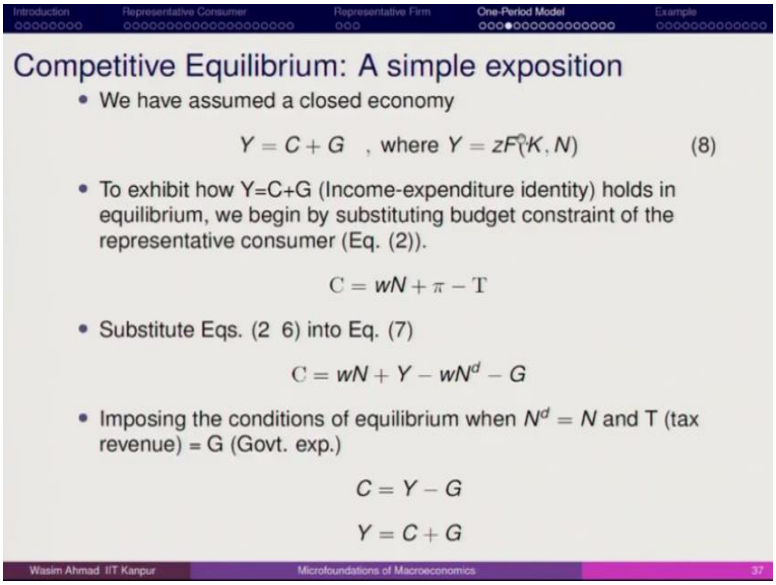

When we are assuming that Y = C + G where Y is also the production function, the output. This is coming from the firm side. Consumption is coming from the consumer side. Y = C + G play a very important role. We try to derive this part. So, here, we have $C = wN + \pi - T$. And then, with the previous exercise that we did, we were able to derive C = Y – G which is consumption is equal to income minus the taxation or the government expenditure and G = T.

So, both are substitutable. Here Y = C + G. We derived close economy model with the basic derivations or assumptions of consumption and about the consumer and the firm. So, these 2 are important aspects. Now, we will be further trying to see from the graphical perspective how this can be represented.

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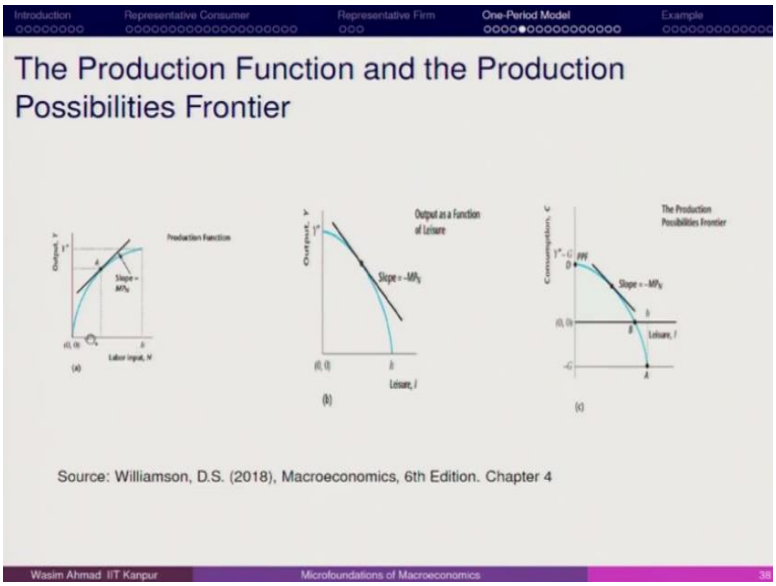

Here what we are trying to see is that if you can see, you have the x-axis and y-axis. On the x-axis, we are measuring the labour input. On the y-axis, we have the output. So, what we are trying to infer from here is that if the consumer is going to work for h number of hours means that he does not take any rest, no leisure at all then, in that case, the maximum output that at the aggregate level can be produced is Y*.

But, given the slope of this production function which is normally the marginal product of labour it is at A. So, at point A, you can think about that this is the amount that if at point A if you can see then this is the output that will be produced with this much amount of labour. So, here, $h - l$ plays an important role. Just the mirror image of this is represented here. And, this is also talking about the possibilities.

So, here, we are talking about the production possibilities. What is the production possibility speaking about? It is speaking about that how we can transform one particular good using technology into another good. So, here, we have only 2 types of goods. Either you consume or you work, or you take leisure. So, the slope of this is MPN and it is downward sloping.

So, here we are just trying to see if you have no leisure at all, so, full of h will produce Y output. MPN will be the slope represented by this. It is downward sloping. So, here you have a minus sign. Now, coming to the third part. It is interesting because here in the third part we are talking about the leisure.

And here, it is the number of hours that the labour supplies. So, the PPF that you are mentioning here, you can see here. This PPF is nothing but it is the production possibility frontier. Here, you have Y – G. And G is here the amount of goods that the consumer is sacrificing as in tax. So, overall, with the combination of these 2, we are able to arrive at the production possibilities of this particular set-up if we are going to utilize full of labour.

And, with that labour, how much output you can produce. So, the production possibilities of the economy is hovering around this. So, this is the zone at in which the economy will operate, and it will try to convert consumption into leisure. So, this is what we try to get from this.

And, with the help of these 3 charts, we will be able to derive the competitive equilibrium that we are talking about.

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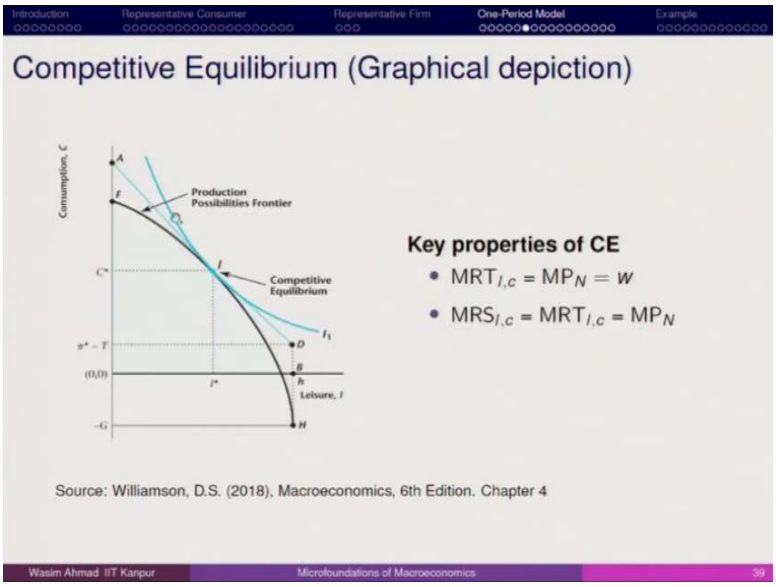

So, here in this chart, we are just replicating the same. Here, we are saying that D to B is the point where the representative consumer is getting the dividend income net of tax that this representative consumer pays. So, particular part, we are not considering. This J is the point where we are finding the slope of this production possibility frontier.

The production possibility frontier is a very common technique used in most production analyses. What it says is that what is the possibility that a particular firm can transform one good into another. And the slope is the marginal rate of transformation. So, here, if we are talking about the slope of this, then it is represented by MRT. If you are talking about the indifference curve which is the representative consumer, so, then it is represented by the marginal rate of substitution.

Now, one thing you have to note is that this is line ABD. So, this is the budget constraint. And, with this, if you try to superimpose the production and consumption, so, what we are saying is that the only thing that decides about the interaction between consumer and firm is the wage rate. So, if I am saying that the marginal rate of transformation of labour to consumption is equal to the marginal product of labour.

And labour will be only working when he gets the wage. So, here the marginal product of labour is equal to the wage. So, this criteria is just the exchange of hands. So, here, it goes by satisfying this criterion. So, $MRS_{l,c} = MRS_{l,c} = MPN = w$. So, if you have MPN greater

than w, you will have more labour demand. If you have MPN less than w, then you have less demand. So, here, it works in this direction.

So, finally, we are able to arrive at the point J where this particular labour $h - l$, will be the amount of labour supplied. And the consumer will be consuming C* which is corresponding to J point. So, in this particular chart, J point is the competitive equilibrium point.

Now, it will have further comparative statics. But, comparative statics will be only examining when we are sure that we are in a perfectly competitive market. So, in one period model, one of the objectives is that we are trying to understand that if we are assuming a free market economy where firms and the consumers are free to interact and decide about the wage rate, then is it socially efficient also.

If it is socially efficient, then can we examine with some methodology some method that we normally use in our economic analysis. After this competitive equilibrium that we are trying to see where everything is at one place, if you are trying to see social efficiency then we will have to apply certain tools of welfare economics. Certain tool of welfare economics normally comes with the Pareto optimality conditions the first theorem or second theorem of welfare.

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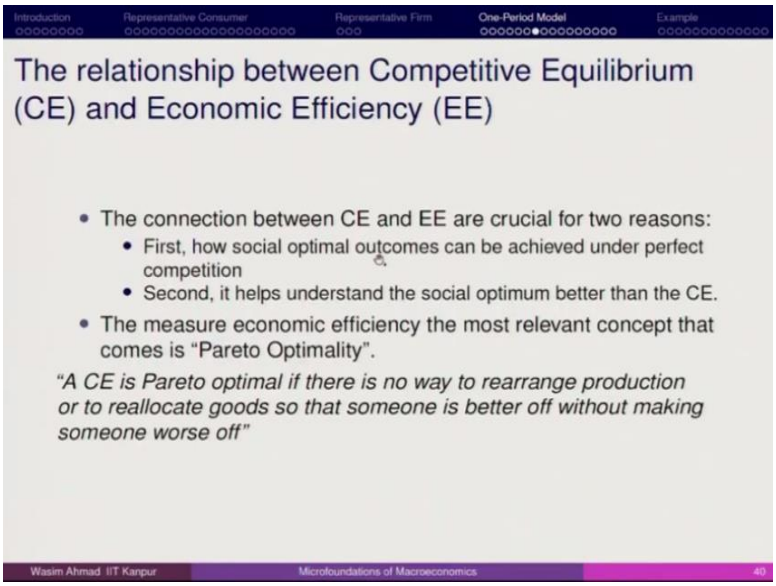

So, here, we are talking a competitive equilibrium where firm and consumer both are price takers. So, both are price taker which means it is a highly competitive market. If that is the case, then can I say that the competitive equilibrium that I have achieved it is socially optimal or it is also satisfying the economic efficiency criteria.

So, here, we are trying to see the connection between competitive equilibrium and economic efficiency. We are trying to see how the social optimal outcomes that we have just we are going to derive can be achieved under perfect competition. The competitive equilibrium that we achieved or whether can we say that the social optimum is better than competitive equilibrium?

So, under the lump sum tax scenario when the government is going to get some amount of output from the consumer, then, in that scenario, is it feasible to say that this representative consumer will always be happy? Whether is this is the ideal situation? So, we are trying to say, now, in the case of when we talk about efficiency, then automatically it comes that how you are going to define about the condition.

How are you sure that perfectly competitive equilibrium is having certain characteristics of economic efficiency. For that, we have a concept of Pareto optimality. So, we assume that a competitive equilibrium is Pareto optimal if there is no way to make someone better off without making someone else worse off. So, we are thinking in that direction.

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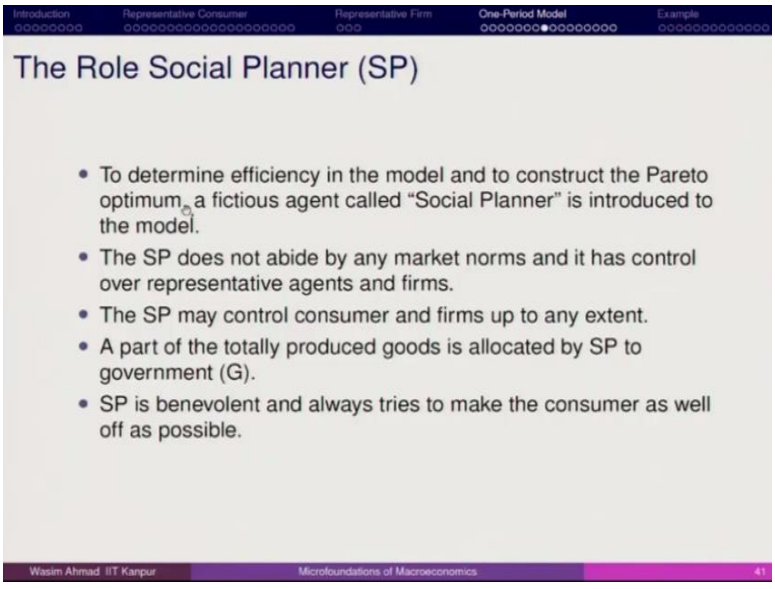

To determine economic efficiency in the model and to construct the Pareto optimality, we are introducing social planner term. What is it? Here, we have the representative consumer and the firm. Now, firm is going to decide about how much labour it will employ. Because firm has to decide about the market price taker it doesn't think about up to what extent we make the representative consumer happy.

The representative consumer has to think about how many hours of labour he would supply and what is the amount of leisure that he will enjoy? So, in order to make sure that this particular combination remains we introduce a new agent. And, this agent is a benevolent and this agent which is called the social planner. The main task of the social planner is to make sure that the representative agent is having sufficient space given.

And, it tries to maximize the utility subject to whatever number of hours he or she wants to supply. This social planner does not follow any market norm. It is just the superimposition. So, apart from the firms and the consumers interacting, this social planner is the superimposition condition on them and it may control consumers and firms up to any extent. A part of the totally produced good is allocated to a social planner.

So, whatever tax that you pay, the social planner is obliged by and this social planner will further take it forward and will make sure that you are not being exploited.

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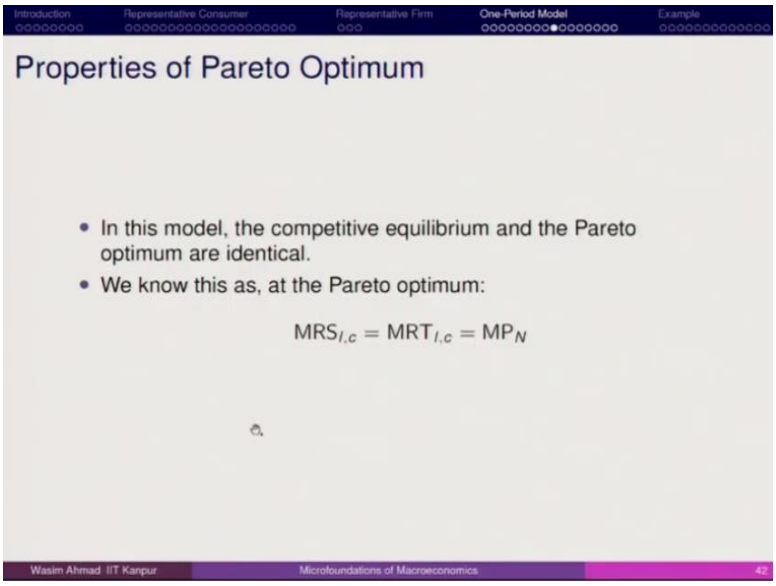

In that environment, if you try to see then this is what the Pareto optimality condition looks like. That if you have the given the hour setup, the marginal rate of substitution for leisure and consumption is equal to marginal rate of transformation of leisure to consumption. Then, at what rates you can convert leisure into consumption.

And, with that, you have the condition of the labour market, the marginal product of labour. So, if you are having these 3 conditions satisfied, then we say that it is a Pareto optimal condition.

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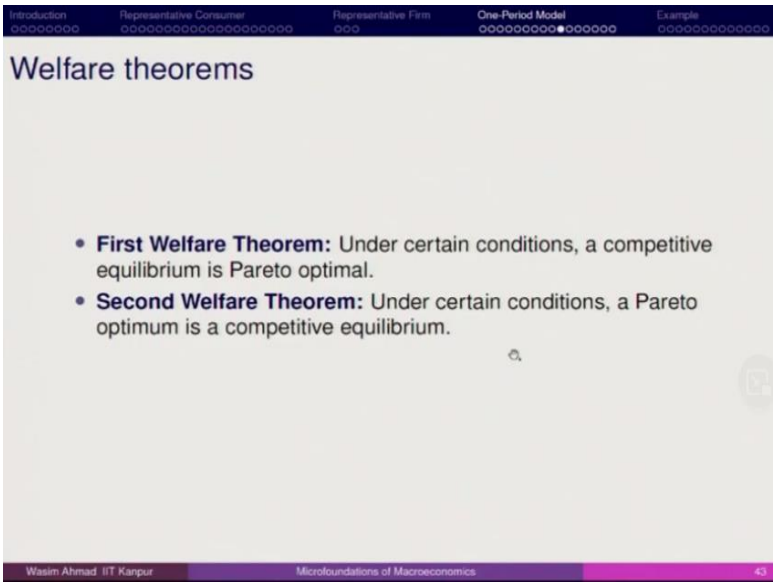

Think about the social inefficiencies that we talk about or the parameters of economic inefficiency. In particular, let us focus on economic inefficiency. Then, here, you have 2 theorems relevant. If you are examining in the context of competitive equilibrium that what happens if you have an open economy and if you have a free market system. If you think that whatever market has decided whether it is a socially optimal outcome if you think about, then we have 2 theorems to focus on.

First is the first welfare theorem. Under certain conditions, a competitive equilibrium is Pareto optimal. Second welfare theorem is that under certain conditions, a Pareto optimal is the competitive equilibrium. So, these 2 are interlinked. So, first, we have a very normal case that is competitive equilibrium is Pareto optimal.

The second is about under certain conditions, a Pareto optimum is a competitive equilibrium. So, there you have the role of whatever Pareto optimality conditions you have assumed then you have to examine whether it also satisfied the criteria of competitive equilibrium. So, these 2 are different but interrelated concepts.

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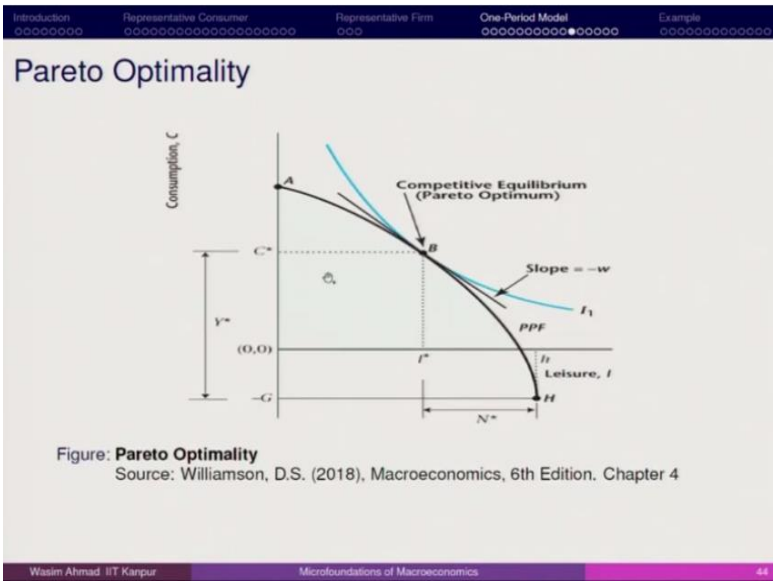

Figure: **Pareto Optimality**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 4

Now, in the case of Pareto optimality, you can see that Y* the output. $h - l$ is the amount of work that this particular guy is doing. In the same way that we have the competitive equilibrium what we see is that the labour will supply h – l amount of labour to produce or to enjoy the consumption of C amount.

And, we know that the downward sloping line has a slope of minus w. So, the competitive equilibrium more or less here satisfies the competitive equilibrium that we are assuming. It is satisfying the Pareto optimum criteria because it is almost equivalent to the same that we have assumed here. It is also having the same characteristics. So, in this case, we are examining the pattern of whether the competitive equilibrium that we have assumed it is Pareto optimal. So, Pareto optimal condition is satisfied at point B.

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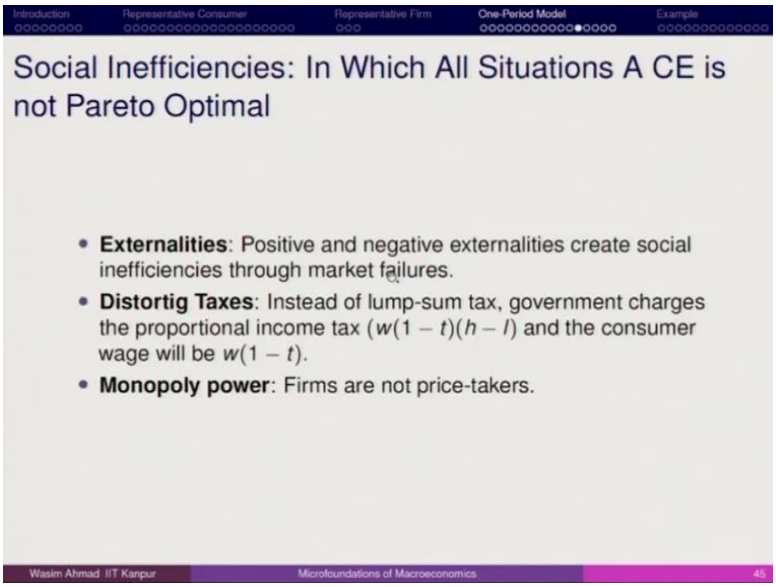

Apart from this, we have certain considerations that when we have this straightforward case that competitive equilibrium became Pareto optimal. So, this criterion seems very easy. But there are certain conditions in which we are not able to satisfy the criteria and the competitive equilibrium is not Pareto optimal. The first is about the externalities. There are two types of externalities positive and negative.

What is the meaning of negative externality? A negative externality example could be that if your house is located nearby a power plant or something and the power plant is releasing some kind of industrial waste nearby your locality, then it's side effect that becomes the negative externality.

A positive externality could be if you live nearby the IIT campus. IIT, employs a lot of people who are nearby. They can come and work easily. But, if you think about the conditions that if we have the power plant which is polluting the nearby area, I am talking about a thermal power plant.

For instance, if it is polluting a nearby area, then nearby residents must be compensated for the side effect that they are facing. So, in such situations, it is very difficult to create a market. For example, I gave you the example that those people who are coming to IIT getting work or having employment. They are not paying anything to IIT because they are living nearby they have the opportunity access to the campus.

They get income. And then, they get employment. So, on their part, it is welfare. But, on the IIT part, it does not give anything. So, in such situations, how can you create a market? So, market failure becomes an issue. And, in that situation, the competitive equilibrium may not have the similar characteristics of the Pareto optimality. The second thing is about the distorting taxes, what happens when we have distortion of tax?

We have so far assumed about the lump-sum tax where a certain part of the income of the consumer is taken. But what happens if the government is going to decide about taxing the wage income itself. If a certain proportion of wage is going to be, then this particular representative consumer is going to face the tax incidence of $w(1 - t)$.

So, if this is the tax rate that the government is going to deduct which is in percentage, then this is also going to create an adverse scenario for the representative consumer. If π is not going to increase or if it is not going to increase substantially, then, in that situation, $w(1 - t)$, the amount of shock that this particular representative consumer is going to see, this has to be compensated by decreasing the leisure.

So, maybe this particular guy will have to work more number of hours and may not be having the competitive equilibrium, which is socially optimal. It may not satisfy. So, further, it requires a different kind of quantitative treatment. But, that is not part of the course. You can further explore that in which all situations a competitive equilibrium is not Pareto optimal.

You also have the monopoly power. When I say monopoly power, it implies in certain economies suppose if you have only one firm dominating the market and the rest of the firms are not able to compete, then that also does not create the Pareto optimality condition. Even, if you have any market dominance strategies adopted by the firm.

So, these 3 conditions are important to note.

Because, in one period model, it looked very easy and smooth going that we had assumed consumer, we had assumed firm, then we arrived at a close economy equilibrium. With the help of the production possibility frontier, we try to arrive at the competitive equilibrium because we superimpose the condition of consumers on that. And then, we see that how this representative consumer is going to decide about consumption and leisure.

But, when we started checking whether the market clearing mechanism that has worked so far whether it is socially optimal or not, then we found that yes the conditions are more or less similar. The only consideration is that if we have the competitive equilibrium achieving the Pareto optimality condition or satisfying the Pareto optimality condition, then in which all conditions these conditions are not satisfied.

So, we mentioned about externality, some kind of tax deduction strategy, and monopoly power.

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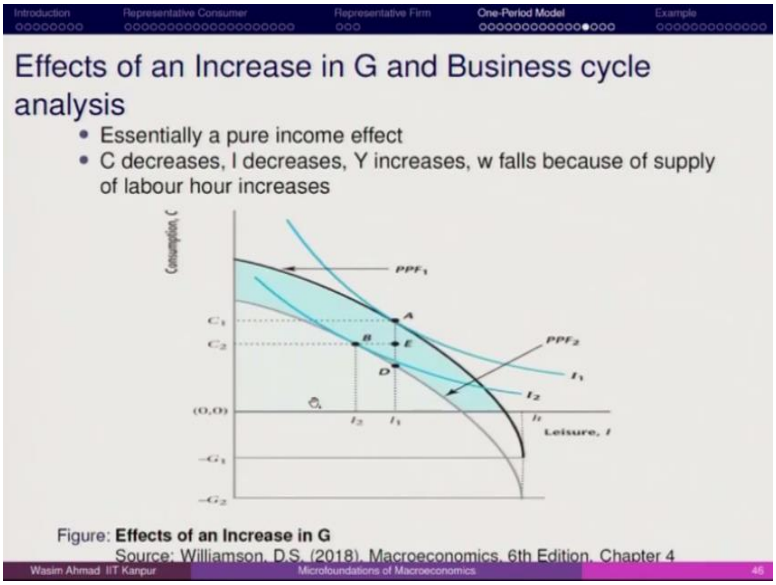

Now we will start a similar topic which is called the comparative statics. What is the part of the comparative statics - that if we are saying that we have achieved the competitive equilibrium then what happens when we are going to change certain policy variables. So, in this, we have set up. If you think about the macroeconomic model.

So, what we are trying to see is that we have set up a model, under that you have the wage, and the leisure and consumption all are determined within the system. But there are 2 exogenous factors which are playing a very important role. One is about the government. That government is coming out of the system. And this government takes away some amount of income from the consumer.

And, it also acts sometimes as a social planner to maintain the welfare or to see whether the firms and the consumers are interacting in an appropriate manner or not. So, if you are going to see that then we have the macro picture ready that in a business cycle setup suppose if we are going to increase the government expenditure, what happens to consumption? What happens to leisure?

Will there be any role of income and substitution effect? If you are going to examine that then that becomes an important topic to be discussed and it can be directly linked to macroeconomic theory. If you have done any macroeconomic course in the past, then this will help you understand why in certain situations we do not go for immediate government expenditure.

Even, if we are facing difficult times but the government does not go for increase in infinite amount of expenditure. Because this creates trouble and will have an impact. So, you can link with your basic understanding of macroeconomic theories. Here, with the help of the micro-foundations, we are seeing the first case. Here we are seeing the effect of an increase in government expenditure.

And, as I mentioned that we have the macroeconomic model. In that, we are trying to see the business cycle phenomena. We are trying to see which variables if I am increasing then which all variables are increasing whether wage increasing whether consumption increasing whether leisure increasing. If all are increasing, then it will be called procyclical.

If 2 are increasing and 1 is decreasing, then the decreasing variable will be called countercyclical. Here, we will have some kind of understanding of the macroeconomic picture also. Here, what we are seeing is that we have the original line going like this. So, suppose when we are saying about the government expenditure which means that when G is going to increase then tax is going to also increase.

So, if the government is expanding more money, it means that it is also going to increase the tax. Here, it is a direct effect. When we are seeing an increase then we have to think about. Suppose if this is the case the original case which is having the A point as the equilibrium point but because of the government expenditure increase and simultaneous tax increase, you have the inward shift of the budget line.

So, here, we have the production possibility frontier which was earlier PPF 1. But now, it is PPF 2. Because, and, at this level, you will see that here you have the leisure demanded l_1. And, here at point A, the corresponding consumption is c_1. But, because of this government expenditure increase if you think then it is leading to an inward shift in the production possibility frontier.

And now, you can see that the representative consumer is at point B. At B, he is having to c_2 consumption and l_2 is the leisure. It is clear that from the original point A which was leading to l_1 and c_1, now here, we have l_2 and c_2. So, there is a decrease in leisure and there is decrease in consumption. But, here, you have to think in 2 terms. One is that when government

expenditure is increasing, it means that it is leading to a decrease in the income of the individuals because the taxes are going to increase.

Once the taxes are increasing, this particular individual is bound to compromise some consumption. Consumption will go down. An increase in expenditure, so, this is the original line with the production possibility frontier, increase in expenditure which is represented by here. So, here, we have minus G_1. Here, we have minus G_2.

So, this is what here we have with an increase in expenditure when it is increasing so production possibility curve has come down. And now, the individual is moving from A to B. The decrease in leisure is leading to an increase in the labour supply. So, once we have the increase in labour supply, we have a decrease in consumption. It is certain. And here, a decrease in leisure is also certain which means that it is leading to increasing in labour supply.

So, here, what will be the outcome? The outcome will be that once you have the increase in taxes, then this forces the individual to work for more number of hours just to meet the requirement of the consumption. Because, if the government is increasing the expenditure, it is charging higher taxes which leads to a somewhat reduction in the consumption or the income of the individual and this will have a compromising effect on both.

The labour supply will increase so because people will be looking to work for more number of hours and less leisure. If the people are looking for a more number of hours to work, then in that situation, you have firms asking firms will go for more bargains, which means that people will be ready to work even at a lesser wage. And, once you have the people working at the lesser wage, then you have the w falling. So, the wage rate will fall.

So, the immediate outcome is that because of this income effect that we saw because of the taxation that strategy that the government adopted by taking not just G_1 but G_2 amount of output from the representative consumers. So, this is certain that consumption is decreasing. Leisure is also decreasing. So, l decreases. This results in w to falling, labour supply increasing. And this labour supply increase will lead to an increase in output.

So, from the business cycle perspective, what is common here? Common here is that when you have an increase in government expenditure, your Y increases but consumption and leisure fall.

So, consumption falls when you have the increase in Y would say the Y increases because N is also increasing because w falls. So, your N is increasing. So, N, and Y are procyclical.

The countercyclical is consumption. So, that is why when you have a government expenditure increase, it is most likely that it will lead to tax implications. And, this tax implication forces the individual to work for more hours. This can also be linked with the analysis that we do in most of the IS and LM framework. When we say that when you have government expenditure increase, it leads to increase the interest rate, and further, crowding out phenomena.

But that is also having some kind of linkage with consumption and government expenditure. So, with G, consumption going down, the wage rate is falling, which means that the standard of living of the individuals will also fall. So, that is why governments are wary of going for immediate release of money, and immediate expenditure whenever they see any kind of uncomfortable situation.

So, I hope this analysis makes it clear to all of you that in microeconomic foundations whatever we have derived the competitive equilibrium through representative consumer and the firm, it is helping us to macroeconomic policymaking. Even in the business cycle, you can understand with these small tools how certain variables react. But, here, in this case, the task is easier because we are assuming only one firm and one consumer.

And these 2 assumptions, these 2 definitions can be extrapolated on a large sample and then over aggregation will give you the picture clear-cut idea that how a particular policy has to be designed. So, this is the beauty of this. So, now, we will stop here, and we will try to cover the next part which is about the competitive equilibrium and further the dynamics. And will be talking about also how the competitive equilibrium can be linked with the Pareto optimality condition.

Whether the optimality conditions can be called as the socially efficient condition? Then, or, the competitive equilibrium can be called as Pareto optimal condition. These 2 dimensions we will be looking. So, thank you so much.