Microfoundations of Macroeconomics
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Lecture – 02
One Period Model II

Welcome back. So, in the last session, we discussed why we have to study the firm and the consumer.

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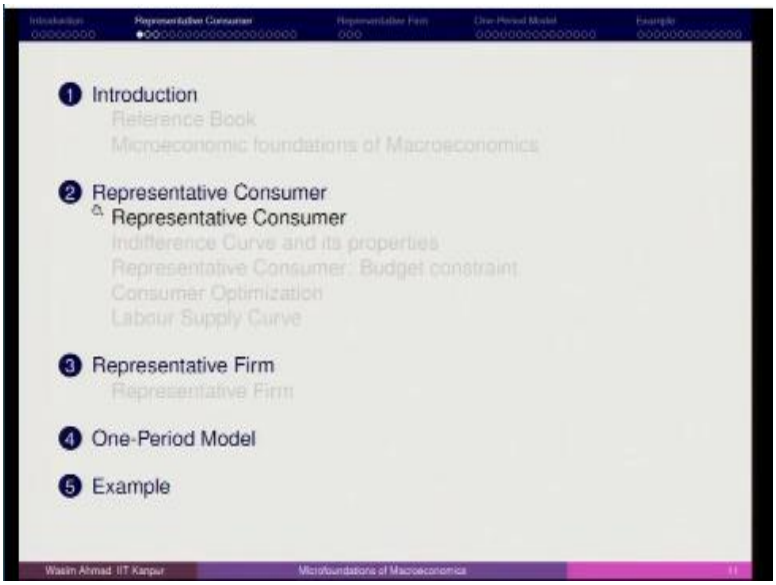

And we will be now extending the one-period model to the next level and we will be trying to see how we can define this representative consumer.

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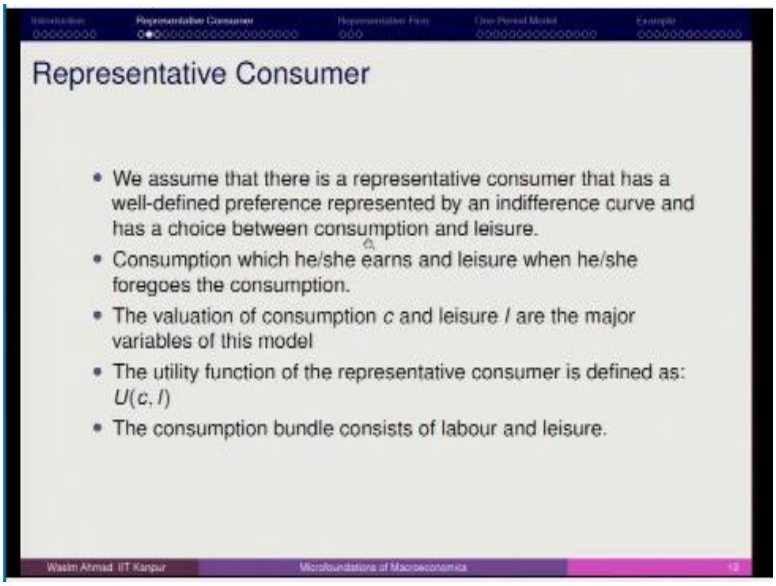

Here we assume that there is a representative consumer and this consumer has a well-defined preference and this preference is represented by what we call an indifference curve. And this indifference curve will show the choice between consumption and leisure which means that the consumption that we are saying is also reflecting how much this representative consumer is earning.

And leisure is the second product that this particular representative consumer will be thinking of. This representative consumer has to make the choice that whether he would like to have more consumption, less leisure or more leisure and less consumption. So, under the convex framework, we will be trying to replicate this idea with a downward sloping indifference curve.

There is an implicit understanding in the case of consumption and leisure. Consumption is directly linked to income-generating activity. So, the representative agent has to work, he will be spending some hours out of the 24 hours that he or she has. He or she is free to decide about how many hours he or she should be selling in the market. So, if he or she decides to work for 4 hours or 5 hours, those things will be counted. Consumption is when he or she earns, and leisure is when he or she forgoes the consumption.

We represent the consumption by c and leisure by l. These are important variables in this model. The utility function is represented by c the consumption l is the leisure. So, here, we have $U(c, l)$ and for the sake of simplicity, we try to capture both labour and leisure into the consumption bundle of the representative consumer. So, as I told you in the beginning, consumption and leisure, both are normal goods which means that when you have a price increase, we will look for alternatives.

But it is not inferior goods. Inferior goods mean that when you have income increasing, you will not buy these goods. So, that is not the case here. And any kind of foregoing phenomena is a common thing in case of the normal goods.

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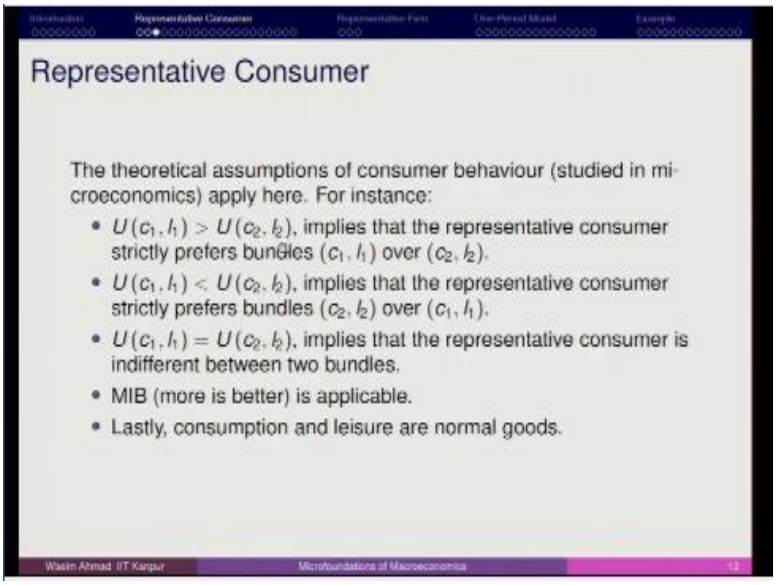

There are some critical assumptions. So, here if you have read Hal A Varian, intermediate micro then there we talk in detail about such properties, but here, we have just mentioned the strict case, not the revealed preference that has WARP and SARP kind of analysis which is not done. Here, it is simple, if utility from the bundle (c_1, l_1), if it is greater than utility bundle (c_2, l_2), then we say that the consumer is strictly preferring bundle (c_1, l_1) over (c_2, l_2), which means that the consumer is having more likeness and he thinks that he will have more utility by consuming (c_1, l_1). Similarly, we also have $U(c_1, l_1)$, which is less than $U(c_2, l_2)$.

Now, this will be the opposite case, which means that representative consumer strictly prefers bundle (c_2, l_2) over (c_1, l_1) and this implies that this particular bundle gives more utility, but here these 2 inequality conditions are not that important for me. For me, the important is that at what level of consumption and leisure which bundle makes the representative consumer indifferent.

So, here, we have $U(c_1, l_1)$ is equal to $U(c_2, l_2)$ and that shows that representative consumer is indifferent between these 2 bundles, which means that whether he would like to have (c_1, l_1) bundle or (c_2, l_2) bundle, both the bundles are going to give him same level of utility. Second thing is the more is better. Now, once I say about more is better, more is better is applicable, because a consumer would like to have more of both goods.

He would like to consume more, and he would like to have more leisure but now, this particular representative agent is going to face a budget constraint. He cannot have both

increasing scenarios. But as a normal human being, this representative consumer expects that he should have more of both. Lastly, since the consumption and leisure are normal goods, we will have the scenarios under the convex setup.

And we are also not dealing so much with the complementarity and substitutions here, whether the goods are substitutes and complements. So, those things will of course, be part of once we are assuming the normal good, but we are not dealing those cases here as special cases. We are just trying to see that if we are deducing the macroeconomic model at the firm level then how it looks like? Or at the consumer level then how does it look like? So, here we are seeing the consumption, the consumer part.

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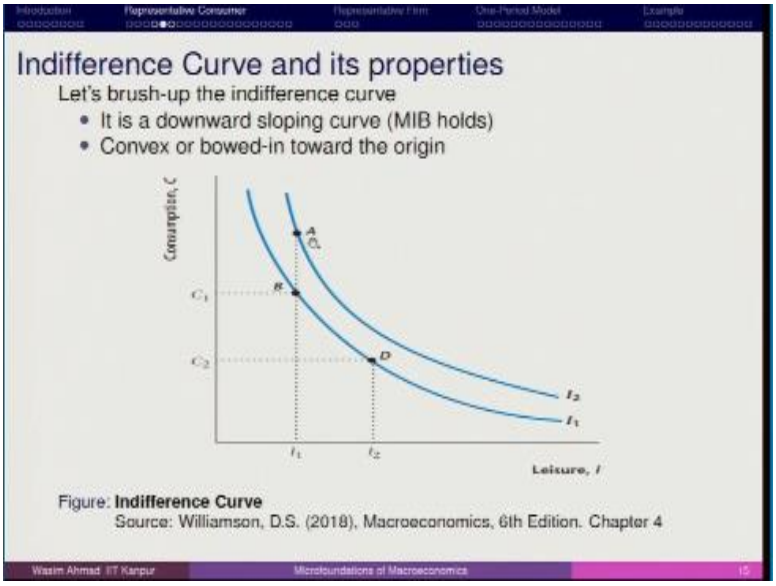

This representative consumer has well defined convex indifference curve. The indifference curve is the downward sloping curve, and it has certain characteristics. If you have two bundles here, which is having this characteristic that you are going to exchange c_1 with c_2 and l_2 with l_1 in this setup then you will be consuming more of one and consuming less of other, but on this line at any point, you will have the same level of utility.

A gives higher utility than B because in case of indifference curve, as me move rightwards on indifference map, we get better utility scenario.

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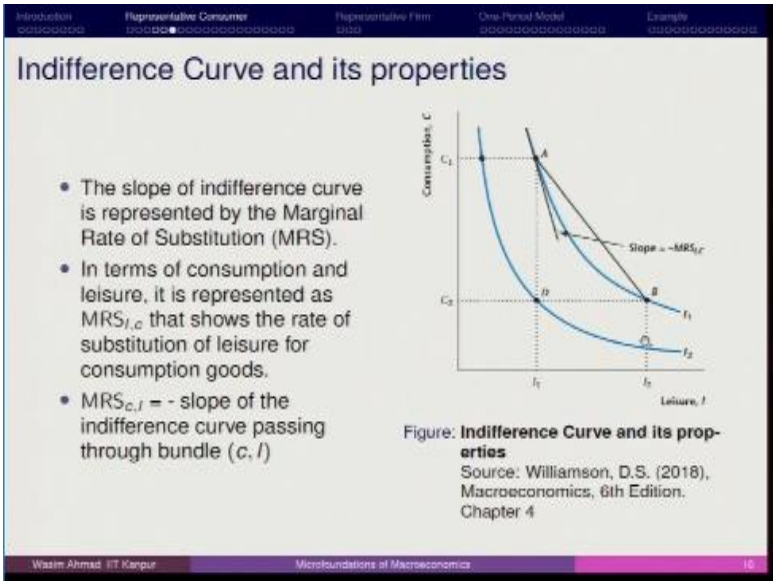

Figure: **Indifference Curve and its properties**
Source: Williamson, D.S. (2018), Macroeconomics, 6th Edition. Chapter 4

Now, we will be talking about the representative consumers. We will also define that this representative consumer is going to have the marginal rate of substitution, or we will work out the slope of indifference curve. We know that the slope of the indifference curve be nothing but the marginal rate of substitution. Since indifference curve is downward sloping, it has a minus weight. This is because you are simply foregoing something to get something better.

So, in terms of consumption and leisure, it is represented as $MRS_{c,l}$. It shows the rate of substitution between leisure and consumption goods. So, here we have the slope of the indifference curve this particular line, the A to B that we are mentioning. You can also think about how the curvature of this particular line decided about and if you just go from A to point B, so, here you have the rate of transformation of both these goods. At B you have less of consumption, more of leisure; at point A, you have more of consumption, less of leisure.

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Then we are working out so, from here it is clear that the representative agent is very normal case where we are not putting up any condition as such, it is just marginal rate of substitution is not it just the ratio of marginality of these 2 goods l and c. But here, we have to keep in mind that we are not considering any special cases like whether, the consumption, leisure are normal, or whether the consumption, leisure are complementary goods or substitutes, those things are not considered.

Here, we are just defining the normal case. So, this is the utility part. We assume the representative consumer and we define how the representative consumer when he or she has been given the choice between consumption and leisure, chooses. And these are the characteristics. Now, we will have the budget constraint.

Now, in this budget constraint, you must understand that as we have mentioned in the beginning the representative consumer has 24 hours represented by h. Labour and leisure are represented by N and l, and h is the total number of hours that this particular guy is having.

So, everyone is having 24 hours; out of this, this particular representative agent has to think about how many hours he would like to work keeping in mind the time constraint that the consumer faces. So, here this is with regard to the utilization of the total number of hours. It is leisure plus the number of hours that the representative consumer supplies in the market. So, here it is l plus N^s.

Now, consumption goods act as a numeraire because this is the representative price, in these prices will be expressed. So, prices are in units of consumption in the real term. So, we are talking about real wage and then we will be also talking about how this real wage change is going to impact consumption.

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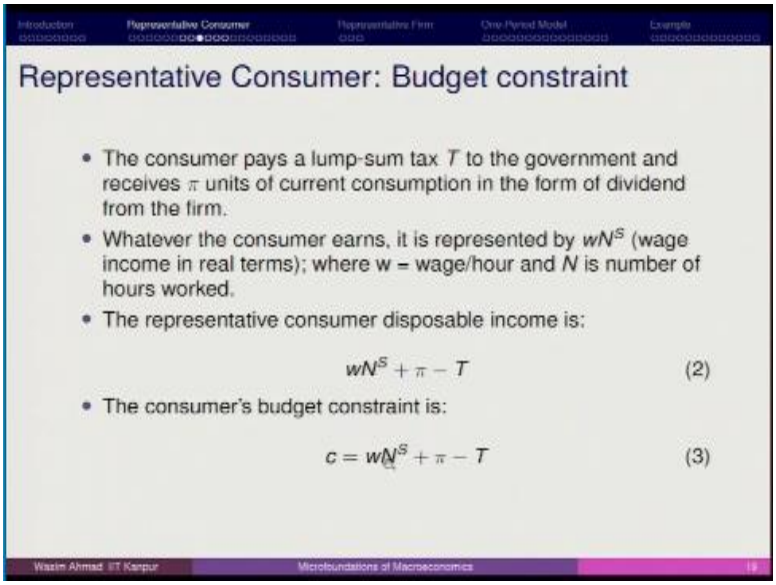

Now, on top of this, so, when this particular guy is going to supply N^s, it means that he or she will be getting some amount of income. When I say he or she is getting some amount of income, wherever he or she is applying, then that will be income to this representative consumer. The consumer also pays a lump sum tax T to the government and receives π units of current consumption in the form of dividends from the firm.

Here we are introducing the macro variable one. So, what is the macro variable we introducing here? It is the lump sum tax T. And another factor that we have is that the representative consumer is also having some extra source of income. So, apart from the N^slinked wage rate, this representative consumer is also going to get some amount of dividend.

In the economy when you are born, then two things are certain. One is death and another is the tax. So, every agent is supposed to pay some amount of tax to the government and government collects that tax. So, once the government is going to collect the tax, then this will be an amount, we are not considering in terms of proportional tax, we are considering only in case of lump sum tax, which means that some fixed amount of income will be deducted as a tax by the government.

And π is represented in terms of dividend. Dividends are always declared in some percentage amount. Whatever the consumer earns is represented by wN^s. So, wage rate is linked with the amount of labour supplied where w is the wage per hour and N^s is the number of hours worked. Now, let us talk about disposable income. The total income is $wN^s + \pi$. π is the dividend that this particular guy is getting; w is the wage rate and N^s is the labour supply. So disposable income is $wN^s + \pi$ - T. So, this T is important, because this T goes to the government. So, disposable income, is the personal income minus the tax bearing that you have. So, whatever tax incidence you have on you, you deduct from personal income and that becomes your disposable. So, this is disposable.

Now, if you write consumer's budget constraint, so, how does it look like; it looks like this.

$$C = wN^s + \pi - T$$

Where C is consumption.

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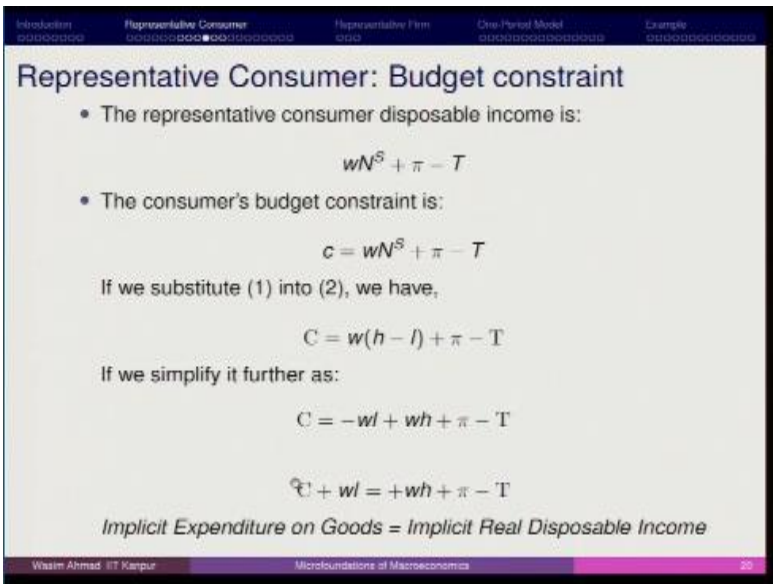

Now, till here we are clear. Now, if we substitute this so, here, we had equation 1. So, here we have $h = l + N^s$. If I solve for N^s here, so, what it becomes? It becomes h – l. So, if you put h – l in the budget constraint then it becomes $C = w(h - l) + \pi - T$. If we simplify this further, then what are we going to get?

$$C = -wl + wh + \pi - T$$

$$C + wl = wh + \pi - T$$

So, here it is the consumption of the consumer plus the leisure that he has which is also linked with the wage rate. So, if you think in terms of expenditure, how much of the wage rate this particular representative consumer will have to forego attach for leisure plus how much he is spending on consumption.

So, here, we are indirectly hinting that c + w l; it represents nothing but the implicit expenditure on goods. And here, we have $wh + \pi$ – T and it is nothing, but it is the implicit real disposable income. This is what we have. This particular guy is going to have the w h which means that he can decide about how many hours he has to work. And the same way, he has also to decide about how many hours he should not work.

Now, he is the king of his 24 hours plus he is going to get the $\pi - T$ dividend income after paying tax. This is how it looks like, how much he is spending and how much he is getting.

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Now, if you try and see, how does it look like, then here it is. So, if you just work out here, with $c = -wl + wh + \pi$ – T, what happens when you have leisure equals to zero. So, when I am saying that leisure is zero, we will have $c = wh + \pi$ – T. What if c is equal to 0? So, if c is equal to 0, then after solving l is equal to $(h + \pi$ – T)/w. So, this is how it looks like..

So, this is what we mentioned. So, this particular $(h + \pi$ – T)/w is this. This is the budget line. The slope of this is nothing but the wage rate. So, – w l, how much this particular guy's consumption is going to change with respect to leisure. If we are going to calculate that, then this will be only minus w. So, this is how it works here. So, c is equal to minus w l.

If you just draw a line very nicely drawn line, so here, you have no leisure. So, if the consumer is working full 24 hours, this will be his income. If you have here full leisure, no consumption, then this particular representative agent is going to get this. If he will be moving around here and here, then it is up to him that how much he forgoes the consumption and how much he has the leisure. So, that will be decided by the representative consumer.

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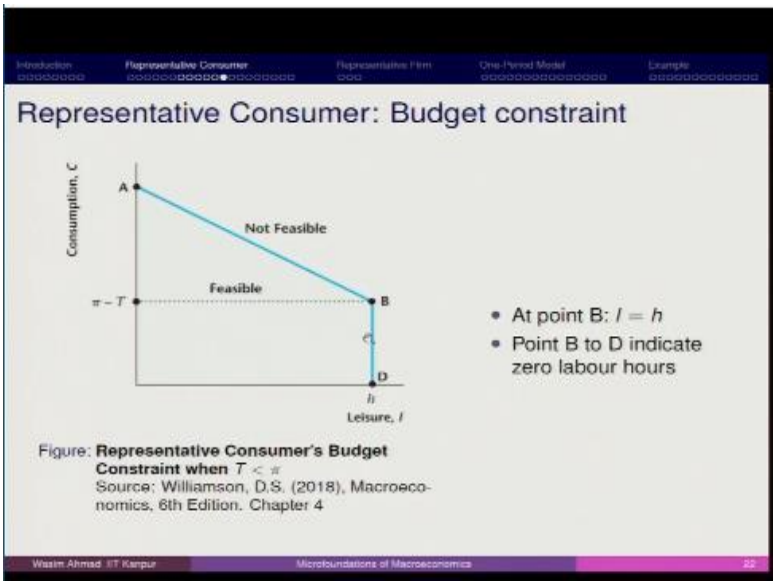

Now, we will be moving to the next part. Now, here we have what happens when we have the pi which is greater than T. If we have $\pi > T$ which means that this representative consumer is having higher dividend compared to tax. If this representative consumer is going to have higher dividend income compared to taxes means that he would not like to work for more number of hours; he would reduce labour supply.

So, your N^s will be lowered. N^s that we wrote in equation 1; this is going to be lower. Now, if this is going to be lower, then you will have the kinked budget line. So, from B to D, we assume that this representative consumer would not like to work. He will start working only when π is almost equal to T, then this is the scenario, where this particular representative agent who would like to work and then think about consumption and leisure; in this zone, where π is greater than T.

So, that is why he does not have to work from point B to D. Here, this representative agent has zero labour supply, no supply at all. The increase in dividend is more than sufficient for him.

So, for example, suppose you have invested somewhere in the market, say in bit coin or in the stock market. Suddenly you saw an increase in income. The stock market did well and then you had a good return incurring from that investment. If you have incurred a good return, then you do not have to work more.

So, you think that now, earlier I was working 8 hours and I had a very difficult time and I used to even work for 12 hours. Now, I think for me 8 hours is sufficient because I have the income. So, which means that the kind of adjustment that you are making, the significant adjustment that you are having, that is represented by this that this particular guy has chosen not to work.

So, which means that you have taken leave for 2 months, 3 months from your office and you do not care about your loss, you left your job also because you have sufficent income now and you are thinking about some alternative plans. So, this particular line speaks about those things that when you have a sudden increase in income, then this is going to have the impact on the labour supply. So, this is how it looks like.

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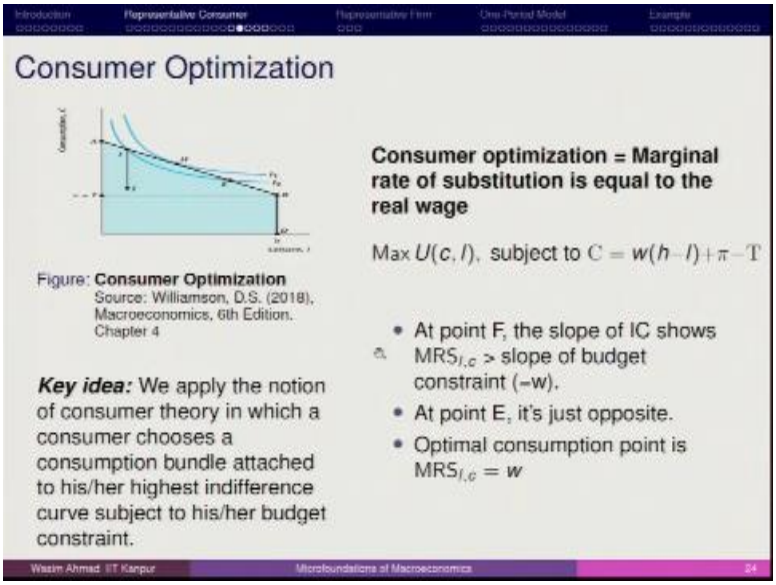

So, here we have the consumer optimization, what is that? The $MRS_{l,c}$ that is marginal rate of substitution is equal to real wage. So, this is how it looks like. So, here we have the h. So, here we have I_1 and here we have F and E. So, here you can think about the F point, it is cutting down the budget constraint. So, here you can think about the slope, $MRS_{l,c}$ is greater than the slope of the budget constraint.

At point E, I_1 cuts budget constraint from below and slope is less than that of the budget constraint. At point H, it is the appropriate case because it is on the higher indifference curve and it is also tangent to the budget line. Here, the idea behind kinked budget constraint is that we have already superimposed the condition π is greater than T.

So, we will be trying to see that given this opportunity that this representative consumer is having, how much he is going to utilize from this. So, whether he will be moving from this side or from here, he will now be deciding about. So, at point H, the corresponding consumption and corresponding leisure is the consumer optimized consumption and leisure.

In terms of optimization framework, this is how it looks like that we will be setting up the optimization problem then with the help of the method of substitution or logarithm multiplier, you can optimize it and get the c and l. So, here it is

$$\text{Max } U\ (c, l), \text{ subject to } c = w(h - l) + \pi - T$$

So, here you can write it as

$$U\ (c, l) + \lambda(w(h - l) + \pi - T - c)$$

and then you can take the first order condition with respect to c and l and find it out. So, then you will easily come to know that what is the optimal level of consumption and leisure that we have.

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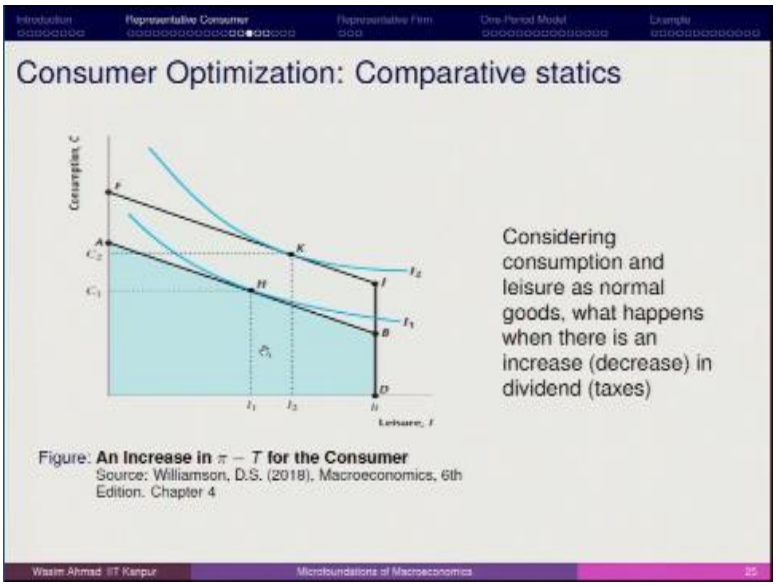

Now, here, we have the comparative statics that I had mentioned that we will look into. So, once we have worked out with the consumer optimization. So, in case of consumer optimization, we saw that the point H become the natural choice for the consumer optimization. Now, what happens when we have different types of comparative statics?

Suppose there is an increase in π – T for the consumer. So, when this particular guy is having more of π – T, then how he or she is going to change the level of consumption and leisure. Now, ABD is the baseline budget constraint.

Now, with the increase in π – T, here, you can see that there is a parallel shift in the budget line. So, budget line shifts parallelly to FJD. On this we are having a point K.

This representative consumer will have more income effect, which means that his income will increase, which also shows that he would like to go for more of a consumption and more of a leisure. So, which means that this increase income will of course, be higher from the consumption side and it will also lead to augmentation of the leisure.

So, maybe he is now having more π – T, then this will of course, will have positive bearing on consumption but at the same time, he would also like to work for less number of hours and this will be leading to increase in leisure also. So, this is how we are talking about.

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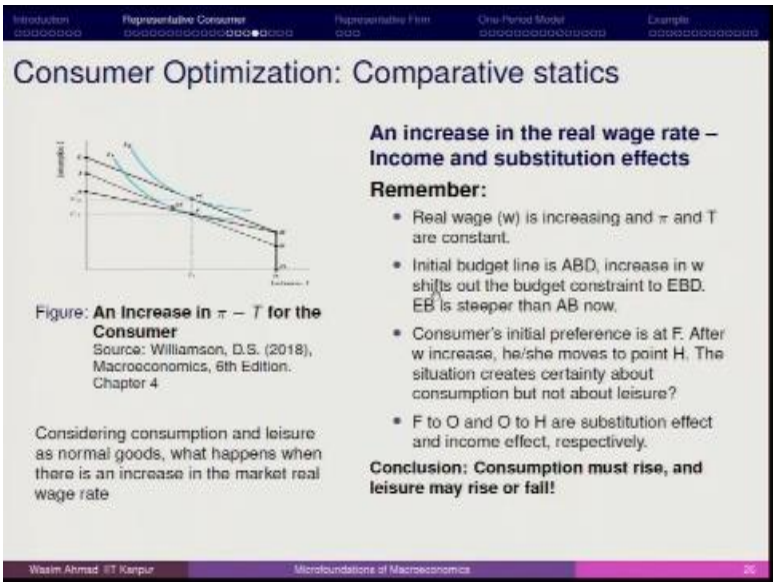

Now, here we have the increase in real wage. Now, here the increase in real wage has a lot of implications. Once we have the increase in real wages, then you have to understand that here we are talking about 2 things. First thing is that when I say that when you have the increase in wage rate, then whether we are sure that the consumption will increase.

But what will happen to leisure whether leisure is going to increase or not? If the leisure is not going to increase, then how are we going to decide about it? So, in that context, it becomes critically important to understand from the perspective that suppose for example, if I give you the example that you used to work earlier for 8 hours. Now, your income increases or there has been a promotion and then your income has increased.

So, whether this increase in income, the kind of income effect that you have, whether this is leading to the substitution effect also, whether you were earlier working and earning 4000. But now, your salary has increased or your per day salary has increased. Now, you think that earlier I used to work in a month, almost 28 days, but now, my salary has increased, and I am satisfied with that I do not want more consumption.

I think if I work for even 20 days, then also I will save 8 days for my rest of the activities, and have the same level of income and will not have to compromise on my consumption. So, it is always good to go for less number of working hours. So, those conditions we are trying to superimpose here in this scenario. So, here we have to consider consumption and leisure as normal good and what happens when there is increasing in wage rate.

So, the original budget constraint is ABD and the consumer is at equilibrium at F, he is asking for $c_1$and l_1. Now, when we see an increase in wage rate, so this shift upward.Now, the new budget constraint is EBD. Now, the consumer is at point H, but at this point the consumer have the income effect, it is leading to increase in consumption but leisure remains same.

And this is partly because despite this income effect that this guy is having; there is substitution effect also playing a role. So, we now work out with this we keep the income of the consumer same, which means that we just make sure that we do not give him enough dividend or we are not working out with for the taxes so that he remains on the same original indifference curve.

Now, if it tried to bring him on the original indifference curves, then we draw a parallel line which will have the same slope like the new leisure shifted budget line. Now, you can see that now the consumer is moving from F to O so, at point O, you will see that the consumer is having the consumption but leisure is declining. So, consumption has marginally increase but leisure is declining.

Now, what we saw here, at point H that with this income effect the consumer was having good time so, which means that he was having more of consumption, but no effect on leisure,

but, because the substitution effect that you have, we can see that the leisure is also getting costlier and then here you have the impact on the consumption though it is on positive side.

So, the moment from F to O that we call it as the substitution effect and from O to H, we call it as the income effect. So, both these are having important role. The underlying idea is that, because both substitution effect and the income effect both are having reinforcing effect on the consumption, consumption will simply increase, but we can see that the income effect is not impacting the leisure.

But the substitution effect is impacting the leisure which means that it will depend upon the representative consumer whether the increase in wage rate will lead to increase leisure or decrease in leisure, but from the income effect side, one thing is sure that consumption will increase. So, overall conclusion from this is that your consumption will rise as a result of the increase in wage rate and leisure may rise or fall depending upon the preference of the representative consumer.

So, what is the learning here? Learning here is that in most of these scenarios, when we think that we have the consumption and leisure framework or the income and substitution effect. If the income and substitution effects are having reinforcing effect on one particular variable, then the result become clear. If it is not, then you have the confusion over there.

And in real life also, it has been seen in many countries that even if you have the wage rate increase, it does not translate into more labour supply or the increase or decrease in leisure. People are they are rational. And they decide about how much, how many number of hours they have to supply and how many number of hours they have to use it for leisure. But the ultimate result is not very clear from this analysis. I am stopping it here. We will continue in the next lesson. Thank you. Thank you so much.