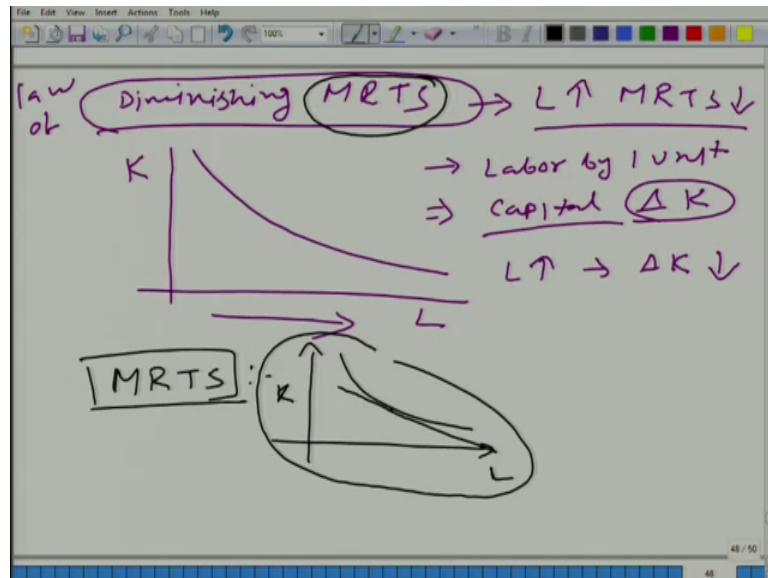


An Introduction to Microeconomics
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Lecture - 83
Decreasing MRTS

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Now, we are going to talk about diminishing marginal rate of technical substitution or diminishing technical rate of substitution, technical rate of substitution is just the another name of marginal rate of technical substitution. So, again just what is MRTS just to revise it, what is MRTS? What does it major?

Student: Slope of isoquant.

It measures the slope of isoquant, but that is very mathematical answer what does it mean in economic sense.

Student: That how much amount you have to substitute if you of capital if you add one more unit of labor.

Student: to get the same out.

So, broadly speaking it talk about the marginal rate of technical substitution is nothing but rate at which one input can be substituted for the other input while keeping the output

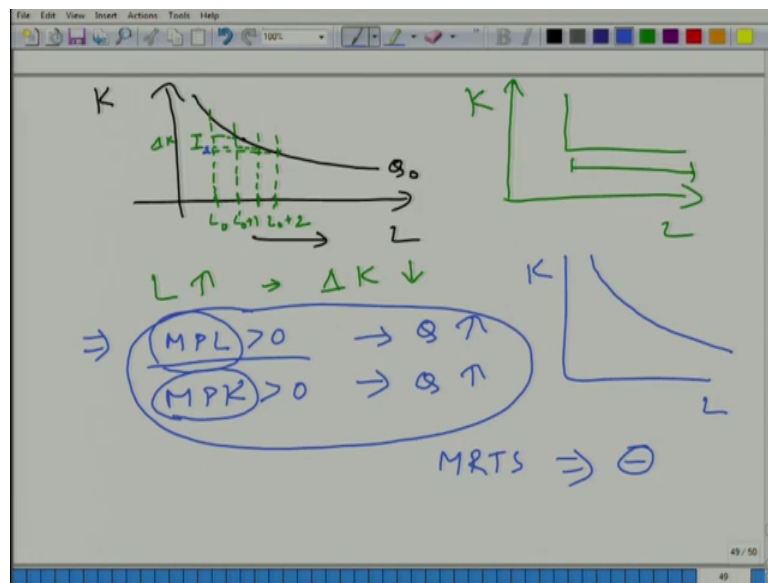
fixed. We have to be on the same isoquant ok. And when we are talking about capital and labor as we had done in the past this is the amount of capital that needs to be decreased to have the same output when we increase labor by.

Student: One unit.

One unit.

Student: One unit.

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That is how we have defined. So now, the thing is if we keep on increasing the labor. So, whenever we increase labor, what does it mean? That here on this graph this is one isoquant let say we are producing Q naught and we are increasing L it means we are moving in this direction. And on this isoquant, we are moving along this curve ok. So, whenever we increase labor we have to decrease the amount of capital to obtain the same amount of output.

And if just we keep on increasing labor without decreasing the capital, what will happen? Output will increase if marginal productivity of labor is positive ok. And it will decrease if marginal productivity of labor is negative ok. So, unless unless we have marginal productivity of labor equal to 0 and we want to we would not beyond the same isoquant if we increase the labor. And when marginal productivity of labor is 0, how would this isoquant look like?

At that point it should be horizontal it should be horizontal as we get in the case of perfect complement when we are talking about this horizontal arm. So, basically, we have to decrease the amount of capital. So, what do you think? What happens to the amount of capital, that we need to decrease whenever we increase labor by 1 unit? And we want to be on the same isoquant, what happens to this amount of capital ? That needs to be decreased in order to be on same isoquant.

Student: It.

Should it be should it increase or should it decrease.

Student: Decrease.

Why should it decrease? Why should it decrease ?

Student: (Refer time: 03:50).

Of course, this is what diminishing marginal rate of technical substitution, what does it say ? That when we are on the same isoquant and we keep on increasing L ok. We keep on increasing on L. So, then respective decrease in capital to maintain the same level of production is decreasing so, Δk that is required will decrease as we move in this direction ok. Just look at it here, here we have let say this is roughly saying here we have L naught, here we have L naught plus 1, here we have L naught plus 2.

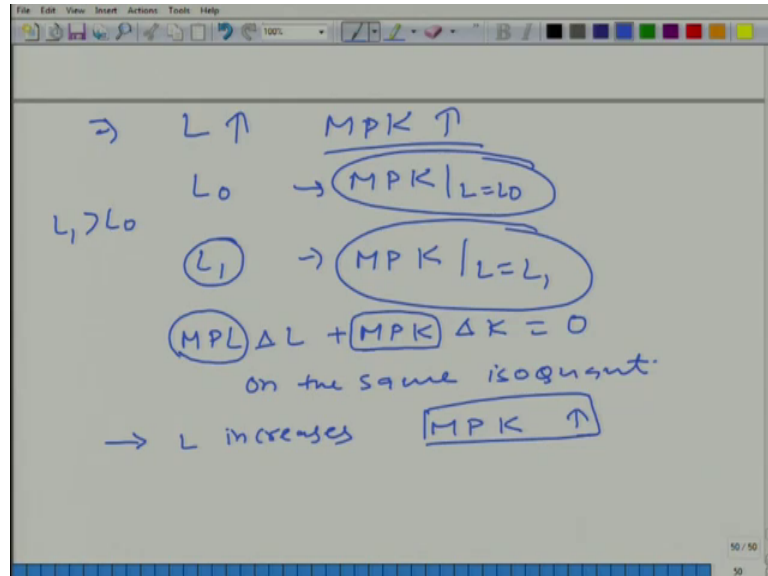
Let us take this and let us take one more fine. So, earlier this is the ΔK in the next turn this is smaller. So, if this is the set of course, it is specific to the shape, it is specific to the shape. So, what we are talking about remember let us think about it MPL is positive typically we take it as positive it means if we keep the capital fixed and increase the labor what will happen.

Student: Output will.

Output will increase and MPK is also positive what will happen Q will increase whenever we keep the labor fix and increase the capital fine. Now that is why we we get this particular shape, isn't it? This particular shape of isoquant we obtain because what we take MPL is greater than 0 and MPK is greater than 0 ok; it means MRTS the way we

have defined is negative. So, we will always get a downward sloping isoquant that is also the reason is also because we have talked about monotonicity earlier.

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So, this is the shape we get fine, but what happens as L goes on increasing MPK also increases what is MPK marginal product of.

Student: Labor.

Capital.

Student: (Refer Time: 06:48).

Think about is the scenario is that of course, we have now again whenever we are talking about MPK we are fixing at 2 particular label. So, let us look at it we have label L 1 and label L naught and L 1 and L 1 is greater than L naught. We have MPK marginal productivity of labor at L is equal to L naught and we have marginal product of capital at L is equal to L 1. And what happens that this one is greater than typically this one is greater than this one why?

Can you think of a reason?

Student: So, by example it is very easy to understand

So, tell me one example.

Student: like sir if you have 7 computers and 7 laborers. Now if one more labor come like 8 laborer and 7 computers now if you increase the one computer more it is productivity would increase more rather than if you.

Decreasing.

Student: Ha if you have 6 product sense if we have 6 computers and a 8 laborers.

is it clear what we have here is $MPL \Delta L$. Plus $MPK \Delta K$ this should be equal to 0 on the same isoquant, is it clear? Now what happens as L increases as L increases, what happens to MPL?

Student: Decreases.

We do not know all the time we do not know we do not know what happens all the time ok, it may increase it may decrease as we have talked about earlier fine ok so, but how about here MPK?

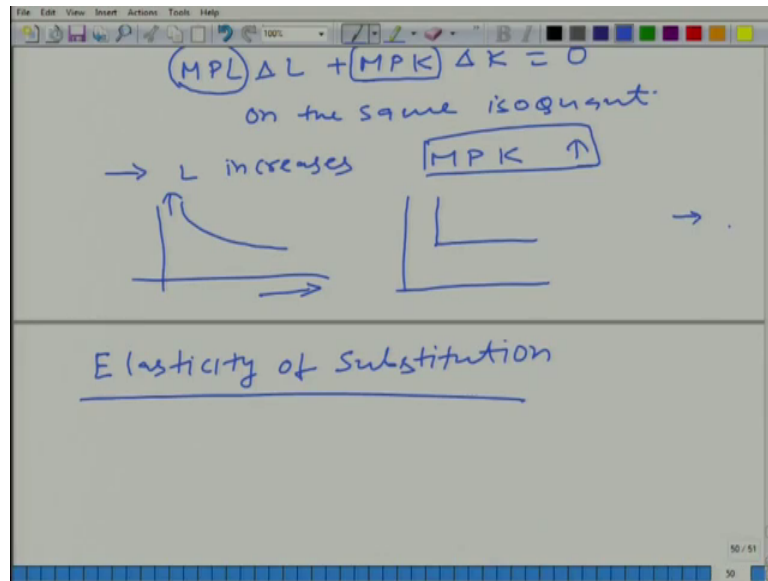
Student: It would increase.

MPK typically increases. So, basically what is happening the capital is becoming more and more productive, capital as with more labor capital is becoming more and more productive.

Student: (Refer Time: 09:27).

So, small amount you take out and you get equivalent reduction because more productive goes in the both direction and that is why; marginal rate of technical substitution diminishes as L increases.

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Or in other word it becomes because it becomes it tends towards it becomes more horizontal as L keeps on increasing, and in the opposite direction it tends to become vertical, but see one exception is here one exception is here, where we have both the factor of production as compliment there it is not applied there it is not applied. So, this is a property of convexity this is the property of.

Student: Convexity.

Convexity that we have talked about earlier ok. So, when production technology is convex what do we get? That marginal rate of technical substitution diminishes as the first input amount of first input increases.

Student: Increases.

Is it clear? Now let us talk about elasticity of substitution ok. What is elasticity of substitution?

Student: Sir can you repeat the last sentence once more I can note that down.

Which one?

Student: About the MPL and MPK (Refer Time: 11:13) to write now.

Here in this case?

Student: Yes sir.

As L increases MPK increases typically.

Student: Yes sir.

So, but it goes in the MPK is increasing at that point it is not marginal product of labor is not just in one particular direction it is in the both direction. So, to compensate for the same you know to know to just because labor has increased. So, output will increase. So, what we do we need we need to take out little bit of we need to take out some capital.

So, that we come back to the same level of production so MPK is increasing. So, if we take little bit of capital, what will happen? We will come back to the same level of production as MPK goes on increasing we need to take less and less amount of capital out to come back to the same level of production, and that is why; we get diminishing marginal rate of technical substitution is it clear fine? Ok.