

An Introduction to Microeconomics
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Lecture - 80
Law of Diminishing Marginal Returns

Now, we have learned about marginal product of labour and average product of labour.

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$(MPL = APL) \Rightarrow \frac{dAPL}{dL} = 0$
 $L \uparrow \Rightarrow APL \downarrow$

$\frac{d^2(APL)}{dL^2} < 0$

the law of diminishing Marginal
return

$Q = F(K, L)$
 $L \uparrow$

Now, let us talk about something called the law of diminishing marginal return. In our example, we started with a production function where we had two inputs capital and labour and Q output is given as a function of K and L.

And what we said that we talk about production in one variable and we explained it in two ways; either really that one way to look at it either that capital is fixed or second way to look at is that capital is.

Student: (Refer Time: 01:14).

Absent that we are we are not able to vary capital for whatever reason and one reason that I gave you was that let we are talking about short run fine. So, now, still let us keep the capital fixed and let us keep on increasing the L.

What would happen to the MPL; Marginal Product of Labour?

Student: Decreasing.

Not necessarily.

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The whiteboard shows the following derivation:

$$\frac{\partial APL}{\partial L} = \frac{\frac{\partial Q}{\partial L}}{L} - \frac{Q}{L^2}$$
$$= \frac{1}{L} \left(\frac{\partial Q}{\partial L} - \frac{Q}{L} \right)$$
$$= \frac{1}{L} (MPL - APL)$$

It then states:

If $MPL > APL \Rightarrow \frac{\partial APL}{\partial L} > 0$
It means $L \uparrow \Rightarrow APL \uparrow$

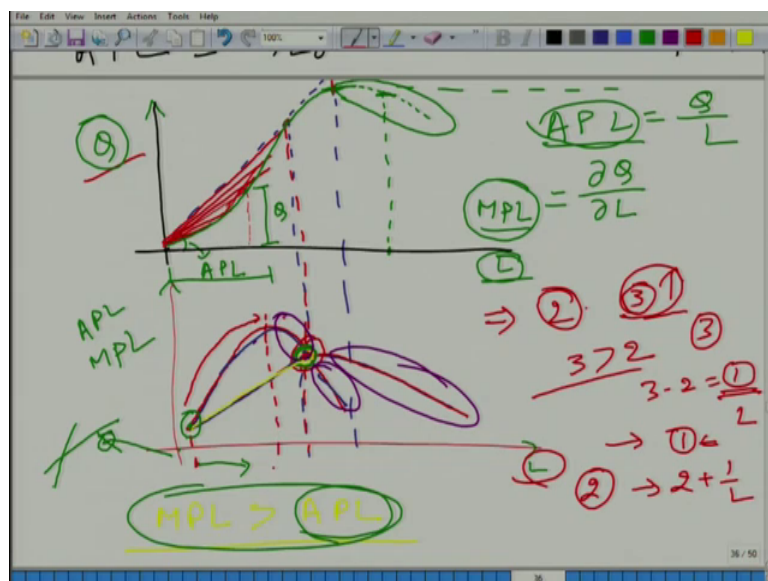
If $MPL < APL \Rightarrow \frac{\partial APL}{\partial L} < 0$
 $\Rightarrow L \uparrow \Rightarrow APL \downarrow$

Student: (Refer Time: 01:43).

Not necessarily.

Student: (Refer Time: 01:46) it will increase.

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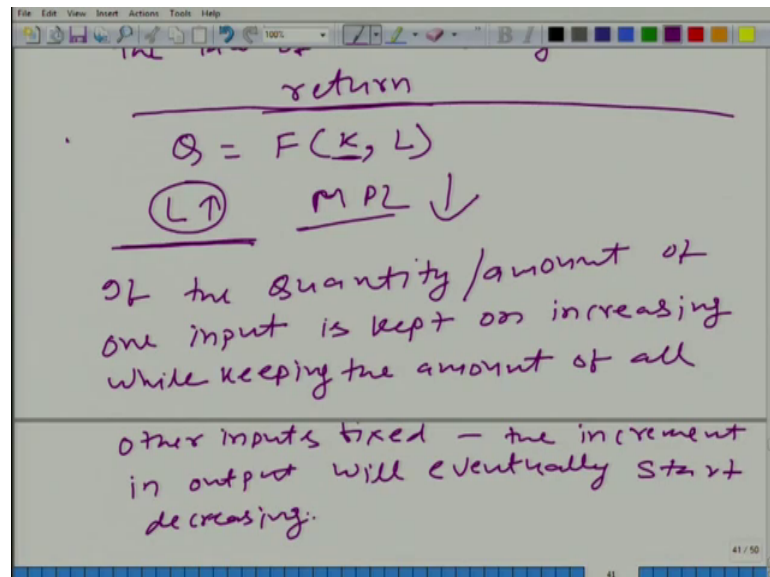
Look at it look at it is increasing and then it starts decreasing.

Student: It would increase (Refer Time: 01:52).

So, we do not know what would really this is just an example; it may so, happen that it would start decreasing right in the beginning, but that is.

That does not happen in most of the cases, but what is almost certain and we take it as law that if we keep on increasing the L, if we keep on increasing the L then eventually not I am saying right from the beginning eventually that MPL will start decreasing.

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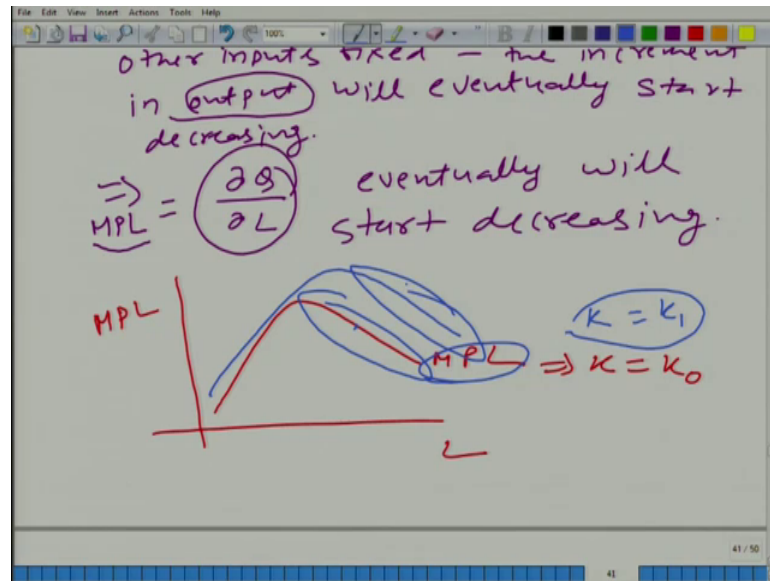


Student: Yes sir.

So, what we can say that if the quantity of quantity amount of one input is kept on increasing, if the amount of one input is kept on increasing while keeping the amount of all others; all other inputs fixed. The increment in the output not the total output; the increment in the output increment in the output will eventually start decreasing is it clear?

So, pay attention here what I am saying not the output, but increment in the output. In other word if we keep on increasing let us say in this example we have only two factors of production capital and labour and let say that we keep the capital fixed and we keep on increasing the labour.

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So, eventually the increment in the output with respect to labour what this is what basically MPL.

MPL eventually will start decreasing fine is it clear?

Student: Sir one question.

Yes.

Student: If this diminishing marginal product diminishing rate of [FL] diminishing marginal returns law.

The law of diminishing.

Marginal return.

Student: Returns is only valid for labour.

No, for any that is why when I gave you the definition what did I say if the quantity of one input is kept on increasing.

Student: (Refer Time: 04:46).

So, I am not saying it is true for only this production function; take any production function where you may have more than two factors of production and you keep the

value of all the label of all the factors of production fixed and keep on increasing just one input eventually the incremental output would start decreasing. Or in other word the marginal product with respect to that input will start decreasing eventually not necessary.

See what is the reason take an example of this labour and capital; now you have a lab where you have 5 computers; Let say you have 0 labour in the beginning no production now you bring one worker one software engineer and then of course, you will have some output. So, output will start increasing if you bring 2; probably those 2 can collaborate together and rate of increase would even go up.

So, output may start increasing at increasing rate because I am just making it happen story ok; let me complete. And then you add on more workers more workers probably at 5 or may be let say they can do two shift. So, 10 people can use 5 computers or may be 3 shift 15 people can use 5 computer.

So, it may keep on increasing at increasing rate, but eventually may be at 5, may be at 10, may be at 15 may be at 12 we do not know that here I am not making any comment about it, but eventually it will start decreasing why? Because other inputs are fixed why we are crowding out one particular input; so, though that input would not be able to use other inputs efficiently. And that is why the marginal product with respect to that input will eventually start decreasing; you had a question.

Student: No sir [FL] eventually.

I answered.

Student: Eventually actually it was.

Student: Actually I was putting an example like if there were 4 labourers like Facebook is a company.

Student: He has 4 experts; it has 4 experts in computing now they have working on 4 computers right now if they keep on adding CPUs and adding memory and adding capital then their output would certainly increased.

May increase, but eventually eventually.

Adding one more unit of CPU would not help any more ok. So, eventually I am not making any comment about what would happen in the middle in between, but eventually it would start decreasing not output necessarily may be in some cases output will also start decreasing, but this statement is not this law is not about decrease in output; this statement is about decrease in incremental output. This statement is about rate of change in output with respect to one particular input would start decreasing.

So, in this graph this is what we are talking about if you pay attention here this is what we are talking about; that look at it this graph has already become two. So, here it is increasing, but at this point of beyond this point; the marginal product of labour starts decreasing. I am not talking about this point; I am not talking about that output starts decreasing beyond this.

I am talking about that marginal product of labour starts decreasing beyond this or beyond this point certain point.

Fine is it clear?

Student: Yes sir.

Now, what happens of course, the label let say let say this is the MPL of course, I am using basically I am using labour as an example for an input, you can have a different input. And here you have MPL and of course, here you have kept the K equal to K naught. What will happen if you increase K to K plus 1? Let me write it here what will happen to MPL? Again this is hypothesis I am saying probably.

Student: Increase.

It will increase may be this point will shift here; may be it you would have something like this or maybe you will have something like this or maybe you will have something like this. So, we cannot say what we are talking about that keep we are not jumping from this when we are making this statement or we are when we are talking about this law; we are not jumping from this MPL curve to this MPL curve; we are we are keeping the other inputs fixed.

So, eventually it starts decreasing here, it starts decreasing here that is what we are talking about fine is it clear?