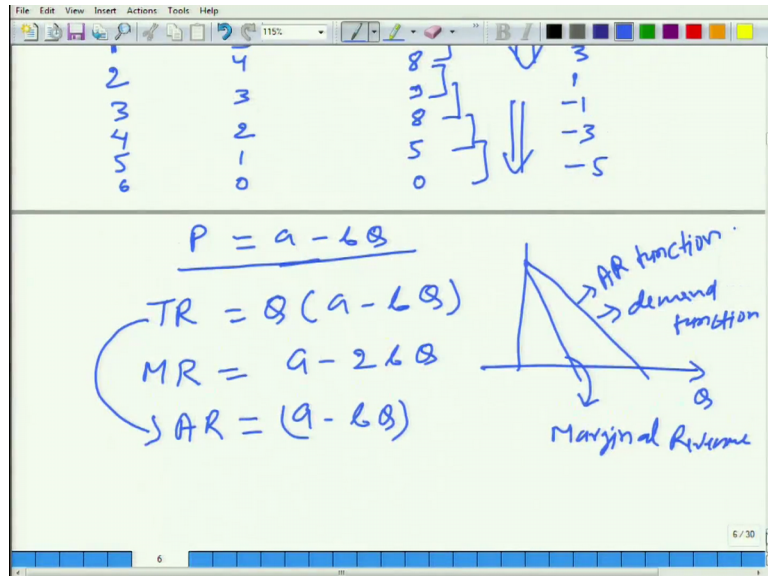**An Introduction to Microeconomics**
Prof. Vimal Kumar
Department of Economic Sciences
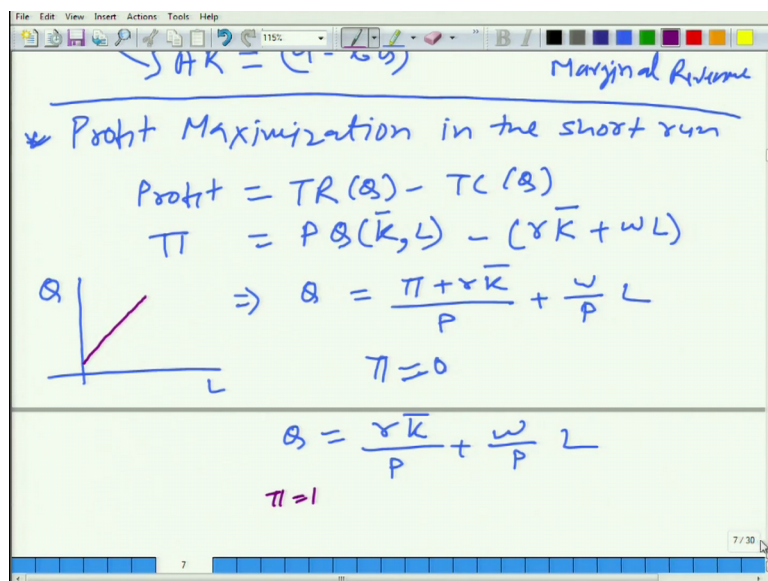**Indian Institute of Technology, Kanpur**

Lecture - 111
Profit Maximization in Short Run Through Graphs

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Now, let us look at it from input side ok.

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We let us talk about we have been in a way, we have been talking about profit maximization in the short-run ok. Let me write it again profit is going to be and this we can write it as P multiplied by Q and Q is of course, a function of K and L and in short run remember what did we say for illustration purpose that we will keep the fixed cost will come from keeping the capital fixed while we can vary the labour. So, we can say let us say capital is fixed at K bar. So, it is going to be r K bar plus w L w L and here also we will get K bar, fine.

Let me write it here profit capital pi not the small pi; the small pi is reserved for the maximized value the maximized value of profit that can be achieved, fine. So, this is capital P I, and what we can say what we can do we can rewrite it if we draw let us say on y-axis, we put y and on x-axis we put or on y-axis we put Q, and on y axis x axis, we put L ok.

Similarly, you can also think of this that instead of profit maximization in the short run we are talking about profit maximization in one variable, where only one input is required and that input is L you can take that it is some fixed number does not matter fine. So, if we rewrite it how can we write we will take this on the left hand side, Q will be taken on the left hand side and I can write it like pi plus just rewriting nothing fancy here fine is it clear.

Now, with this what we can get is iso-profit line y is equal to 0 will denote you know because we are drawing in Q L L Q axis, L is on x axis, Q is on y axis. So, we are going to draw remember like we had drawn iso cost line, how did we draw the iso cost line. What we did there that r K plus w L is equal to a fixed number fine.

Here also we can draw iso-profit line in the sense that profit on that line would be the same and how can we get that let us say if we put pi is equal to 0 what we will get we will get r K bar divided by P plus w P by L and this is an equation of a line and this line will give us profit is equal to 0 from here we get intercept.

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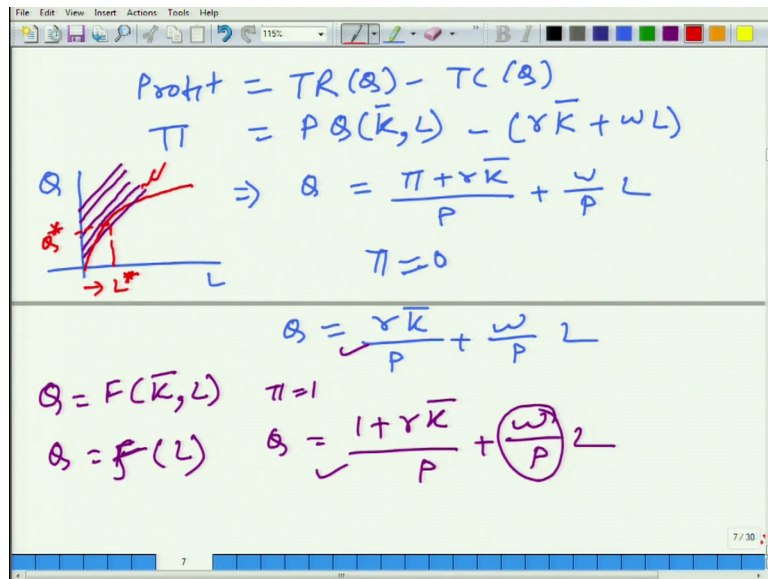
So, we can draw something like this Let us say instead of taking pi is equal to 0 we take pi is equal to 1, what we will get Q is equal to 1 plus r K bar divided by P plus w P by L and what will happen just a parallel shift because slope remains the same what does change from here though from this point from this line to this line the only the intercept. So, there is a parallel shift and shift is equal to 1 by P.

And so similarly, we get like this and we can keep doing this is it clear also of course, we are talking about production in short run. So, Q is equal to F of K bar L you can also think of it that Q is equal to F of let us say let us use another function F of L that it is production in 1 variable.

So, that also we can draw and if we allow for diminishing marginal productivity with respect to L how would it look like it would look like this so this is the maximum profit that can be achieved. This one is the maximum profit that we can achieve and how much will be the production from here we can get the production here we can get the amount of L star from here we get the amount of Q star is it clear

What is the idea to get as much profit as possible? So, what is happening let us say if you keep on increasing L let us say you start with 0 at L is equal to 0 you are not producing anything. So, your profit is equal to it, it cannot be you know it may be negative because you already have some fixed cost.

But if you start producing more what happens you are able to earn some revenue and of course, you will be incurring some cost as long as your revenue is more than the cost you

will earn a positive profit. So, as you move in this direction profit as we see from this these lines that in this case profit is increasing, but beyond this point what is happening profit starts decreasing. Why can you tell me?

Student: Sir because beyond this point the marginal productivity of labour.

Is so, low that we would not be able to you know adding labour would not add the output by match. So, the idea is to produce at this point and that is where you want to be fine is it clear ok. Now we can do it using calculus also, but before that let us understand let us try to do some comparative statics.

What does it mean that if we vary w or if we vary L or if we vary R sorry if you vary what are the parameters here the parameters are r K R w and P. So, vary one of these what happens to the optimal amount of labour and how what happens to the optimal amount of output to maximize the profit can you tell me let us say if w increases.

Student: (Refer Time: 07:32).

Think about it think for a minute and say if output if w increases what happens to the optimal amount of labour used for the production and what happens to the output labour decreases and so is the Divesh, can you think?
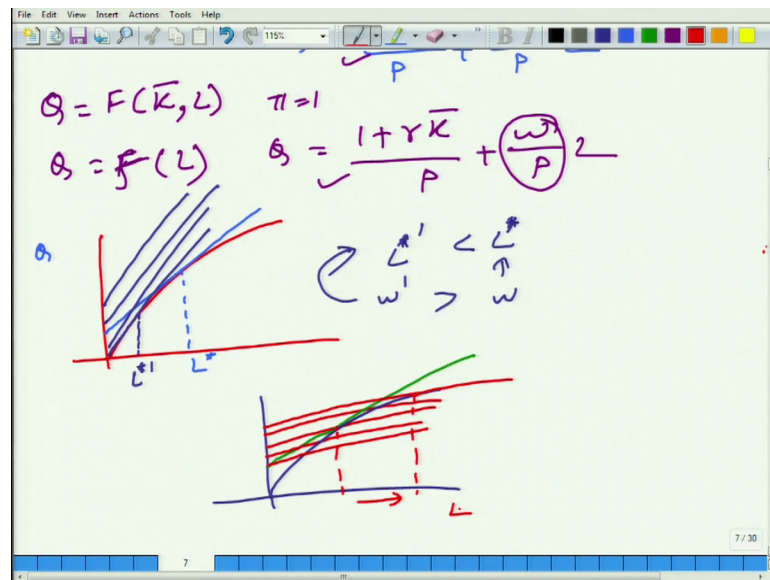
Student: Sir output we can obtain sorry.

You can tell both let me show you just.

Student: We need to decrease the profit line.

Fine, let us say the this is the;

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Iso-profit line ok.

Student: This is sir (Refer Time: 08:14).

This is where we are correct this is where we are and here we are at Q and of course, we have parallelized the profit line. When w goes up what happens to the iso-profit line they become steeper so they will be like this of course, these are parallel. So, let us say now new point is here ok. So, L star dash and L star dash is less than L star, L star corresponds to w and this correspond to w dash and w dash is more than w and this is the implication, fine.

Similarly, can you tell me what happens to when P increases both labour and optimal amount of output will increase why because let us see here let us say earlier this is the now what is happening iso-profit lines are becoming even flatter. Look at this iso-profit line what will happen it will become like this if it is becoming flatter..

So, of course, this company can make more profit by increasing it will be producing at this point. So, earlier we were at this point. So, there is an increase in labour and thus output will also increase is it clear, no.

Student: Yes sir.

Ok.