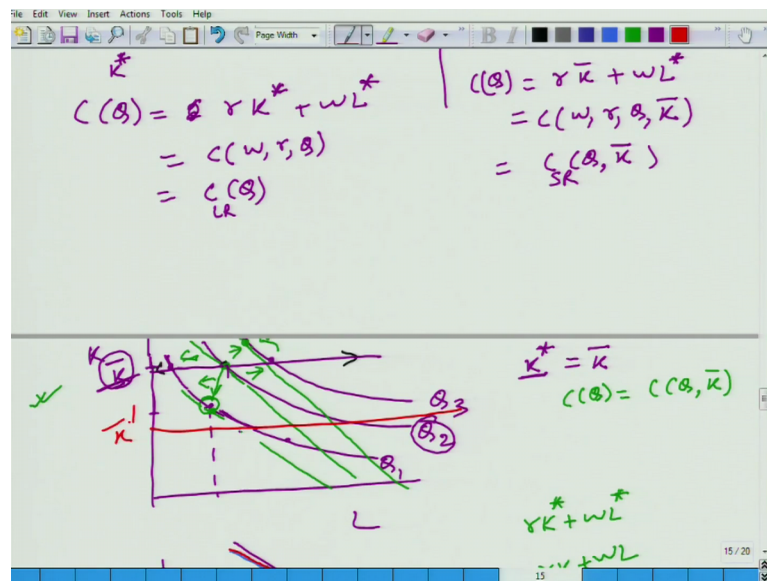


An Introduction to Microeconomics
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Lecture - 107
LRAC Vs SRAC

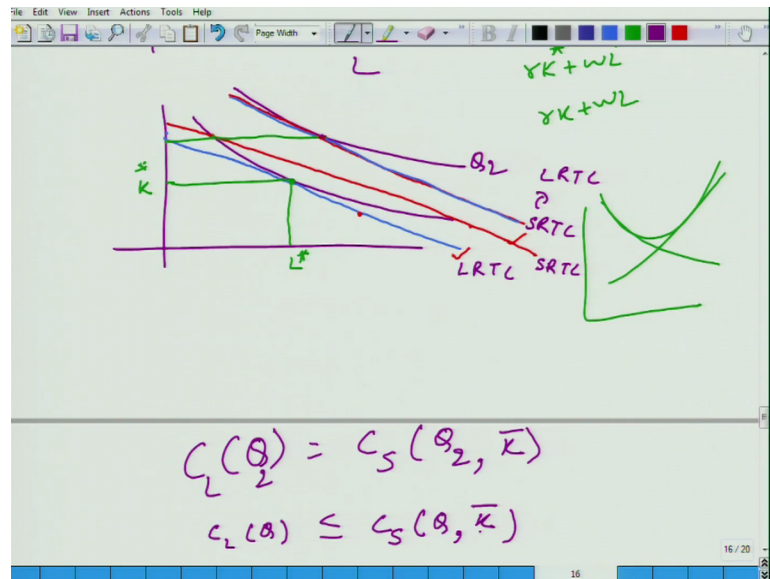
Fine.

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So, in this graph we have already learned that we have already learned that the short-run cost, and long-run cost in this particular Q 2 quantity they are going to be the same.

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So, I can write it here that cost C_Q let us write it l to denote that this is cost in the long run what we see from the graph that see short-run Q_2 with this particular level of k^* this is not now an arbitrary k , k , k bar, it is this particular k bar that I am talking about this is what we have figured out.

What more do we figure out that from this graph if you look at this graph in this particular case this is short-run total cost and also run total cost. At all other levels at all other output levels; what we have this is long-run total cost while this line indicates short-run total cost and clearly from here, it is clear to us that short-run total cost is more than long-run total costs.

So, what we figure out if we keep this graph in the mind that this long-run cost again now I am not putting Q_2 , I am just putting any Q this is of course, this represents Q_2 . This is always going to be less than or equal to cost in short run Q at some arbitrary level of k bar, here this k bar is fixed from the graph. But here now I am taking an arbitrary level of k bar depending on that and when these two are going to be the equal when this k bar is k^* it is optimal for that particular level.

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The image shows a whiteboard with handwritten mathematical derivations. At the top, the long-run total cost function is defined as $C_L(Q) = C_S(Q, \bar{K})$. Below this, the long-run average cost (LRAC) is derived by dividing both sides by Q_0 , resulting in $\frac{C_L(Q_0)}{Q_0} \leq \frac{C_S(Q_0, \bar{K})}{Q_0}$. The right-hand side is identified as the short-run average cost (SRAC) at Q_0 and \bar{K} . A note indicates that \bar{K} is a function of Q , $\bar{K} = \bar{K}^*(Q)$. The final result is $LRAC|_{\bar{Q}} = SRAC|_{\bar{Q}, \bar{K}}$. A circled note (w, r) is also present.

At all other points this term is going to be more than this term it means at all other level short-run cost is going to be more than long-run total cost. And at one particular level short-run cost is going to be the going to be equal to long-run cost.

So, what we can do further we take any particular Q let us say that Q ; Q naught just to denote that now I am taking a particular value of Q . If we divide both side by Q naught, what we will get? $C_L Q$ naught. Let us say now we are taking the value at the Q naught this is less than C_S of Q naught \bar{k} divided by Q naught, and what is this average cost and I am putting here LR just to indicate this is average cost in long run.

Now, if you look at the right hand side what do we get short run average cost at Q naught with \bar{k} level of capital. This short run cost is determined not only just by the output level and of course, remember we have already stopped using w and r in the function because we are saying that it is fixed, it is a given its not changing. So, we are not worried about it, but here it will change if the fixed level of capital will change.

So, what we get here is that long-run average cost for Q naught is less than or equal to short run average cost for Q naught for different level of \bar{k} . Of course, corresponding to this \bar{k} there is going to be a particular level of Q . Let us write it that \hat{Q} \hat{Q} is such that it is optimal level given this \bar{k} level of capital in that case what is going to happen LR AC, \hat{Q} is going to be same as SRAC \hat{Q} comma \bar{k} .

So, in a way I can say if you just interpret it that short run average cost curve touches the long run average cost curve at one point and at all other levels of output short run average cost is more than long run average cost curve is it clear fine.

Now I am not saying the lowest I am not saying the lowest let me explain it to you what is k bar go back to this graph what I said this k bar is fixed and in the short run we have to move along only this line given that k bar is fixed, but in long run we are allowed to change capital as well as labour ok. We can change and how will we change to produce a particular level of output we will select a combination of capital and labour such that the cost is least.

So, now you have seen the optimization graphical we have used the graph to show the optimization. What happens at this level that the capital required to produce Q_2 amount at the list price list possible price it is k bar, but here k bar was given. So, let us look at it it is in a way that here the short-run cost. And long-run total cost they are going to be the same because just because that k bar is optimal given that particular level of production in the long-run. So, that is what I am saying here this Q is Q bar is optimal given this k bar.

Let us look at it in this graph let us say I change the I change the level of capital level of capital is like this, so even in this case there will be a particular level of output where the capital required is going to be now k bar dash. So, I am talking about that k bar is it clear.

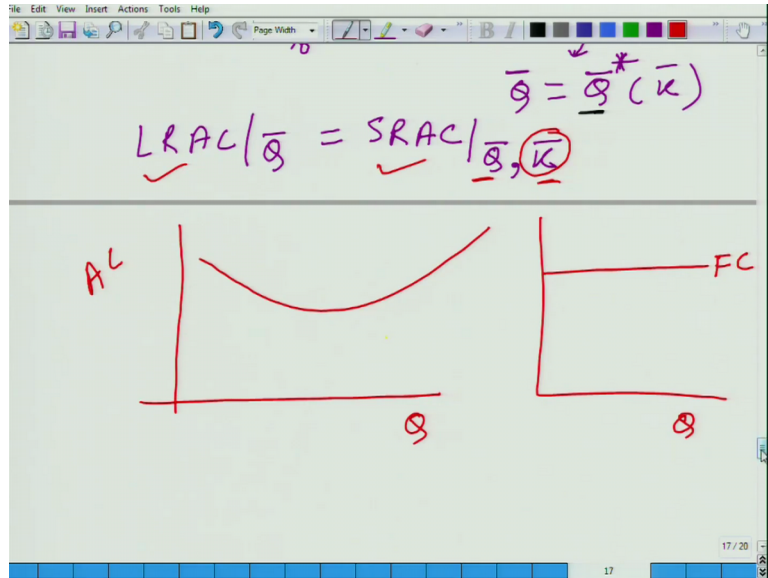
Student: Q bar among these state of all Q 's like Q is one of the subset of Q it is one of the point.

It is one of the point.

Student: Q , so can we say anything about Q bar like.

That is what I am we are going to talk about we are going to talk about that here it is very clear to us that at Q bar LR AC and SR AC means long-run average cost and short run average cost will be equal.

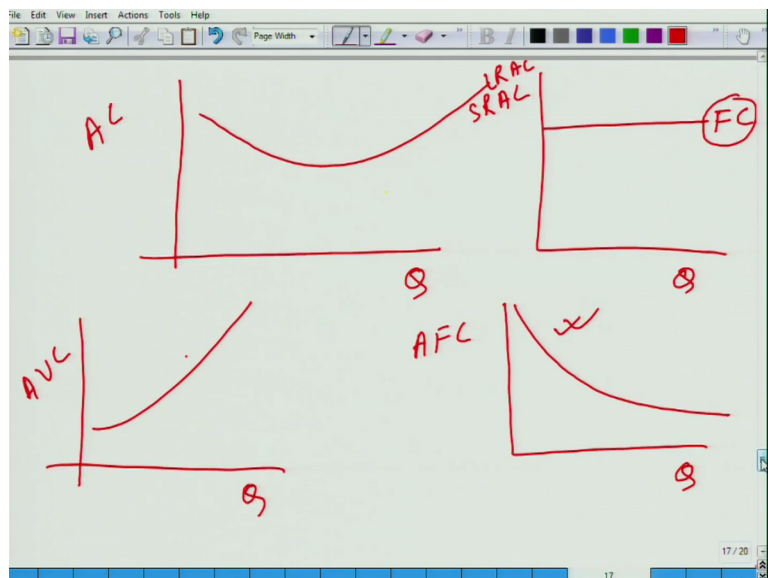
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Now of course, if we change the \bar{k} SR AC will change means short run average cost will change. So, short average cost is specific to not only \bar{Q} , but also to \bar{k} . Now, let us see in the graph if we have already studied how the average cost curve behave.

Let us say I am going to draw here average cost and here \bar{Q} typically we take it as a u shaped curve it is not it might not be a u shaped curve we take it like that this is the u shaped curve why do we take it like this because let us look at it how much is the fixed cost fixed cost does not change with the does not change with the output.

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And then we take it average fixed cost its always decreasing and asymptotically reaches to 0 it means for very very high Q; it will be almost equal to 0, this is average fixed cost. And now what we have average variable cost what happens with the average variable cost it may increase it may decrease, but in most of the cases we from experience we know that it increases as Q increases this is average variable cost.

So, what will happen to the total cost if you look at these two graph this we have already discussed in the beginning at the low level of Q this graph will dominate this graph and at later level this graph will dominate this. So, as a result we will get a u-shaped curve for average cost.

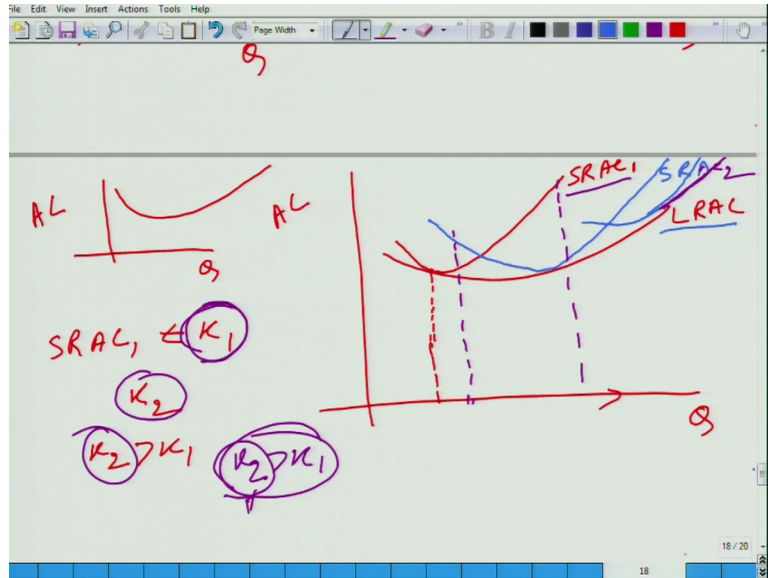
Again let me tell you the example I gave you earlier from Cobb-Douglas function how will the average cost curve look like this example I talked about remember. Let me make your life little easier by his taking $\alpha + \beta$ is equal to one then you have constant return to scale and when you have constant return to scale average cost is going to be same at all level it is not going to be its not going to change. So, it is not going to be a u-shaped curve it is going to be a straight line a flat curve. So, again this is just for illustration I am no way I am saying that average cost curve will vary in this particular manner always this is just for illustration ok.

Student: A request between just for one or anyone state for any function.

This is this is of course, this is longer than average cost I have drawn it does not matter right now let us say it is a long run average cost curve it is a u-shaped curve. Here of course, you because you are talking about FC I am talking about AFC that is why it is that if that is way you take it its will be short run average cost curve.

But what we are saying typically we take average cost as u shaped curve for whatever the reason is right. Now that is not the aim to figure how the curve will look like, our aim at present is to study short run average cost versus long-run average cost. So, what we are taking they we take them that both of them would be u-shaped curve one might not be ok.

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So, what we see here let us look at it; let us say if this is the long-run average cost curve here we have average cost, here we have Q, Q is increasing in this direction. Now if we want to draw short run average cost curve, it will not only depend on Q, it will also depend on particular level of k bar. Let me say that I am drawing it a one particular level of k bar and again let us say it is a u-shaped curve. How would it look like something like this, fine?

What I am saying here is this is short run average cost 1, y 1 what does it correspond to SR AC corresponds to a particular level of capital that capital is fixed at k 1. Let us say capital is fixed at k 2 which is more than k 1, what will happen to the it will shift rightwards why

Student: because as k increases (Refer Time: 12:08).

As k increases that is not the reason think about it, what is happening think about it, why it is going SR AC first, it is going down ends going up because right now let us say when there is no production and you are just beginning the production the fixed cost is shared by very very small amount of output.

So, as you increase the output the fixed cost is being shared by more and more units. So, it will decrease the average cost, but at the same time as you increase the production average variable cost starts increasing which is not always true I am saying in this case it is has to be true then only we will give get this particular curve ok. So, it will go up.

Now, what is happening in SR AC 2 see what why we are getting the u-shaped curve in the short-run that first let us say you have certain fixed cost 100 rupees, and you are producing only 1 unit this fixed cost will be shared by only this unit.

So, the cost if you are producing only 1 unit your cost fixed cost component is going to be contributing 100 rupees. But if you are producing two units what will happen the each unit will share 50 rupees of the fixed cost, if you have 3 components, 3 units of output, then each unit will share 33.3 rupees and so on.

So, in the beginning, it decreases, but what is happening as output is increasing average variable cost starts increasing which is not always true, but in this case we are taking that it is true that is why after some time average variable cost effect will take over and you will get an increase in average cost as you increase the output. So, that is why you get like this first u shaped curve.

Now, what is happening we have increased the k_2 k_2 is higher than k_1 fine. Now you are again producing let us say you are producing your first unit of output. So, earlier the first unit of output was sharing the cost this is k the fixed cost here is because of k_1 capital is fixed now you have fixed capital, but that is higher than earlier fixed capital so, the cost of the extra capital will be shared by the first the first unit alone.

So, at this level the average cost for SR AC 2 should be more in the beginning and that is what I am saying, but eventually as you increase the production k_2 will be utilized maybe you will reach near to the optimal level required to produce that much of output. So, that is will decrease eventually producing higher amount of output using k_1 amount of capital is not a good idea you should have higher amount of fixed capital.

In other way you can think of it that you want to start a production and you know that you cannot change the capital later on for some reason. Because it is difficult to buy in the market you have you may have export whatever the reason is let us say you cannot change the capital in the middle of the production.

When you are think of a scenario when you are planning to produce on average 20 units, 40 units, 200 units, 1000 units, in which case you will have highest amount of fixed capital when your output is 1000 so that is what that is that is precisely is the reason it

becomes more economical to produce higher amount of output with higher amount of fixed capital and that is why we get this shift.

So, look at it compare SRAC and SRAC 2 at lower level at lower level of let us say this is take this level of output at lower level its good idea to use k_1 amount of fixed capital. But at higher level it is good idea to use k_2 amount of capital and so on that is what I am trying to say is it clear now Divesh.

Student: Yes sir.

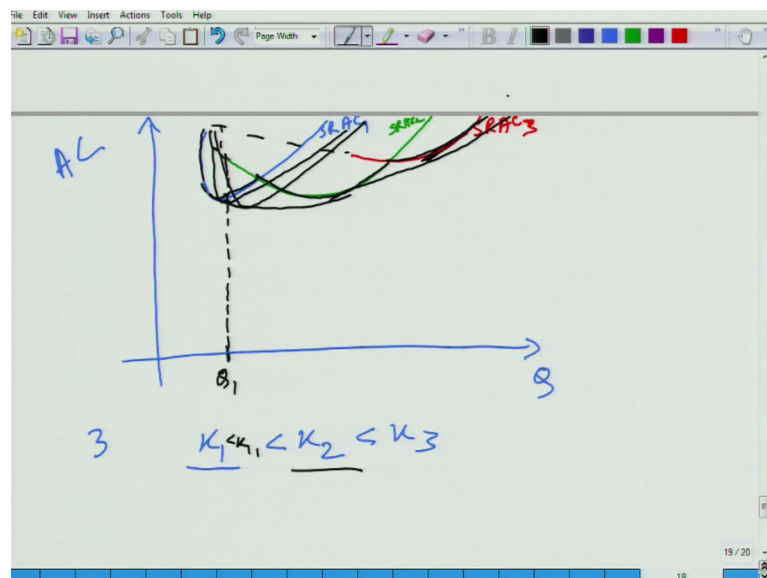
And similarly if you take let me extend this curve and then you have third short run cost curve with the same logic you get it like this. Now although I have you know I have drawn it in the other way I had drawn LR AC first and SR AC later just because it is easier to draw in this manner ok.

What you should notice that long run average cost curve envelops all the short run average cost curve from below. How do we get the long run average cost curve from not from the minimum that will be

Student: (Refer Time: 17:24) for the going for the;

That will be easier to understand let me show you that will be easier to understand if you take the fixed amount of discrete number of fixed amount of capital ok.

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Let us take discrete amount discrete number probably let us take 3; k_1 , k_2 , and k_3 , where k_3 is more than k_2 and let us say that only 3 levels of capital are possible here you have Q , here you have average cost only these 3 levels are possible.

Now, what will happen draw the short run average cost curve how will it look like let us say it looks like this fine I am just making it up that is not the it does not represent the reality it is just for illustration this is short run average cost one representing k_1 amount of fixed capital

Now, if you have this is short run average cost curve when the fixed amount of capital is k_2 and similarly we can draw it for fine ok. These are the 3 short run average cost curve this is SR. Let me how can we get the long run average cost curve what will be the long run average cost curve here.

Student: a curve is passes through the output minimum (Refer Time: 19:07).

Let us say if we want to produce Q_1 amount we see that if we use this technique it will cost on average this much. If we use the second SR AC 2 it means k_2 amount of fixed capital it will cost this much and although I have not drawn, but assumption is its like this so it is even more.

So, for this level of course, we are using SR AC 1 curve it means we are using k_1 amount of fixed capital. So, we can draw it like this if I draw it will be like this, but at this point it is no longer good idea to produce using k_1 amount of fixed capital. So, production should move to k_2 and then it should move to k_3 .

So, here I am using only 3 levels now imagine that you have in between in between k_1 and k_2 you have something called $k_{1.1}$. How would it look like probably like this, probably like this. So, how it is going to happen this and then from there you will jump in this direction ok.

Similarly, let us say if you have $k_{1.2}$ again it will jump in this direction. So, eventually if you have really large number of short run average cost curve you can draw an envelope that is enveloping the all the short run average cost curve from below and you will get the long-run average cost curve sorry this is fine is it clear, this part is clear.

So, it does not pass through the minimum of all the short run average cost curve where does it pass through wherever, wherever the average short run average cost curve is tangent to long-run average cost curve ok. But tangency does not happen at the minimum level, fine.