Microeconomics: Theory & Applications
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Lecture – 38
Long-run Equilibrium of a Competitive Firm (Part-1)

Hello welcome back to the lecture series on Microeconomics. Last time we have seen how a competitive firm finds its short run equilibrium and equilibrium output level. Now we are going to study how the firm finds its long run equilibrium. So, if you remember our discussion on the profit maximization exercise, we have derived the first order condition which says that price has to be equal to the marginal cost. When we derived that first order condition we did not assume whether it is a long run or it is a short run. Then we found that in the case of short run, firm equates the given market price to its short run marginal cost curve to find the equilibrium level of output in the short run right.

So, in the case of long run, we have to equate market price to the long run marginal cost. Now, if you remember when we were discussing the theory of cost, we have drawn the long run average cost curve and the long run marginal cost curve. We have some discussion on the derivation of the long run average cost curve, but we have not done so, on the long run marginal cost curve. But as the marginal cost in both short run and long run are so important for firms decision making, let us now have a look at the long run marginal cost in greater detail. So, our first task would be to derive long run marginal cost from a graphical analysis.

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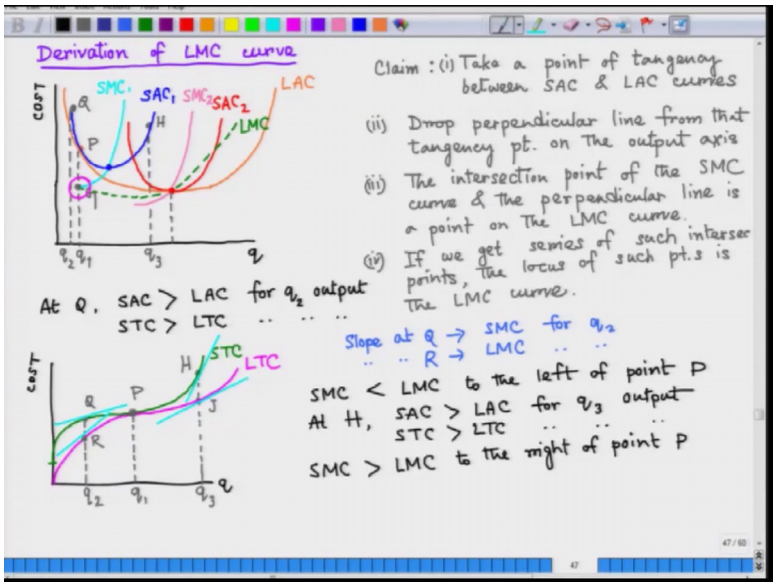

So, as usual I will start with a diagram along horizontal axis, I am going to measure firms output and along the vertical axis I am going to measure various types of cost method in monetary terms right. So, first let us assume that our plant has a fixed short run plant capacity and that will give rise to a short run total cost and corresponding short run average cost and short run marginal costs. So, as we know the short run marginal cost curve passes through the minimum point of short run average cost curve ok.

So, this is for a specific plant size. Now if we have multiple plant size. So, in that case how to generate the long run average cost curve? Just to remind you that the long run average cost curve can be drawn as an outer envelope to the series of short run average cost curves I have not drawn here more than one just to make our graph less clumsy. So, the long run average cost will be something like this, an outer envelope of the short run average cost curves. So, every short run average cost curve will make tangency to this long run average cost curve at a particular point it may not be necessarily the minimum point of the short run average cost curve.

So, now let us see from here how to derive long run marginal cost curve of a firm. I have to draw your attention to a particular point here. So, as we have seen the long run average cost or long run total cost curves are basically the outer envelopes of the short run versions, here we will see although that long run a marginal cost curve is derived from or deduced from the short run marginal cost curve, it will not be envelope of the

short run marginal cost curves. So, now, this is what we are going to show graphically. Now I take two points.

So, one point could be here. So, let me denote this tangency point by point P this has implication that is why you know you need to name these points properly. Now let me talk about some of tangency points like you know this point here, let me call this point Q. And let me take another point on the same short run average cost curve on the upward sloping segment of the short run average cost curve and let me call this point H ok. Now I will draw certain lines. So, I will draw a line perpendicular line from point P on the quantity or output axis, and let that meet the quantity axis to denote a specific output level say q 1 ok.

Now, I will draw another perpendicular line, this time from my point capital Q and let that denote an output level q 2. Similarly I will draw a perpendicular line to denote the output level which is kept q 3 right ok. Now my claim is that this particular perpendicular line P q 1 when it cuts the short run marginal cost curve at point say G that is a point on the long run marginal cost curve that is a claim ok. So, let me write down my claim and then we are going to have discussion to either prove or disprove that.

So, my claim is that, take a point of tangency between short run average cost curve and long run average cost curves, then drop perpendicular line from that tangency point on the output axis right. Then 3 the intersection point of SMC curve and the perpendicular line is a point on the long run marginal cost curve. So, this is the last part of the claim, if we get series of such intersection points, the locus of such points is the long run marginal cost curves right ok.

So, now let me draw another short run average cost curve, which has this interesting feature that the minimum point of the short run average cost curve meets the minimum point of the long run average cost curve. So, the scale size is such that minimum point for both these average cost curves are equal. So, I am talking about a point like this all right. So, for this also we will have short run average cost curve. So, here is the corresponding short run marginal cost curve right ok.

So, now in this case of course, you can see that there will be no intersection if I draw a perpendicular line from this point of tangency between the short run average cost and long run average cost curve right. So, this minimum point is another candidate point for

the long run marginal cost curve. So, now, we can join these two points and there will be other points as well, but; that means let us not make this graph a cluttered one. So, we can get something like this right that is the long run marginal cost curve. Now why is this so?

For that we need to now discuss with this individual points Q and H and P, let us now concentrate on the point Q. So, at point Q the short run average cost curve he is higher than the long run average cost for that particular output level right. So, that output level is q 2. So, now, if I multiply so for q 2 output level right ok. So, now, if I multiply this short run average cost and long run average cost with the q 2 output level then what do we get? We get short run total cost is greater than long run total cost for this output level right. Now let us look at what does that mean in terms of the total cost diagram.

So, I will now draw another diagram which will probably be a recap of our cost analysis, but now this is necessary. So, let me draw another diagram. So, we measure output and cost and then we can draw a short run total cost curve as an inverse a shaped curve like this right and we know that it will start from a positive point along the cost axis because of the fixed cost in the short run. But in the long run we will assume that everything is variable so, there is no fixed cost.

So, the long run total cost curve we will start from origin, and it will make tangency at one point to the short run total cost, and then we get this long run total cost curve. Now from if I want to match these two panels of diagrams, then let me name this point of tangency of short run total cost and long run total cost as the point P ok fine. So, now, how to denote the point q from panel a in this panel b diagram? So, point P corresponds to q 1 level of output right. Now if I want to talk about point Q it will be on the short run total cost curve.

But not on the long run total cost curve, because it is not a tangency point Q is not a tangency point between the long run and short run average cost curves. So, Q corresponds to an output level say q 2 right. Now note, at the slope of these two points Q and say R; now let me talk about the slope. So, if you draw a line straight line tangent to the point Q, we get the slope of the short run total cost and if you draw a tangent straight line tangent to the point R on the long run total cost, you get the slope of the long run

total cost function. Now you can certainly see that the slope at point R is higher than the slope at point Q now what are this?

So, the slope at point Q here is basically the short run marginal cost right for q 2 output level and what is the slope at point R? So, that is basically my long run marginal cost for the same output level ok. So, what do we see? We see that short run marginal cost will be lower than the long run marginal cost to the left of point P right and that is the case we can observe from our graph as well. So, I would like to draw your attention to this intersection point G right; now let us talk about the point H which is also not a tangency point.

So, at H what happens? Again we will see the short run average cost is higher than the long run average cost for q 3 output level right and of course, if I multiply q 3 with the corresponding short run average cost and long run average cost numbers, I can write STC is greater than LTC for this output level right. So, now, in this diagram how can we map this to? So, suppose I have this particular point H on the short run total cost curve and now I am going to draw a vertical line.

So, that I get my output level q 3 right and this intersects my LTC here, let me name this point. So, this is my H point and this I can say point J right. So, now, I have to look at the slopes again. So, you can very well see that the slope at point J, slope of long run total cost curve at point J is flatter compared to this is less compared to the slope of the short run total cost curve at point H. So, I can write that short run marginal cost is higher greater than long run marginal cost to the right of point P right. So, we have derived the long run marginal cost curve graphically now let us look at the long run equilibrium position of a firm, competitive firm.

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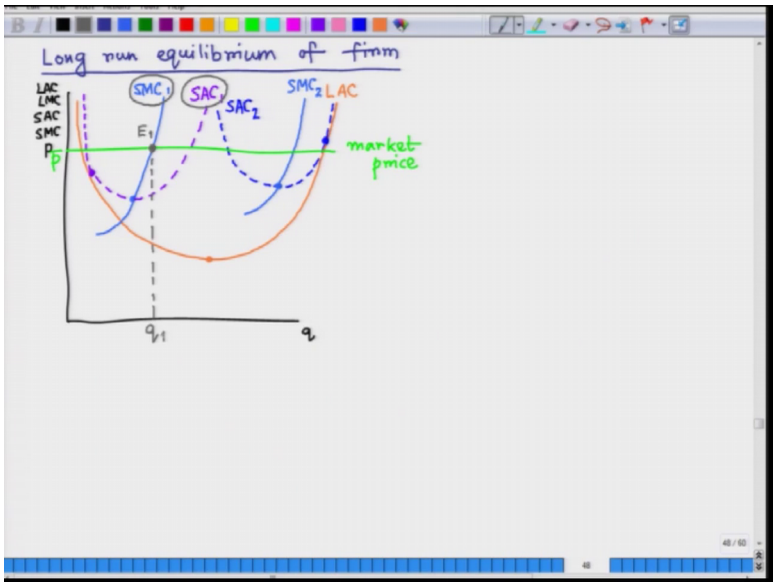

So, again we need to draw a complicated diagram to show the long run behaviour of the firm. So, I measure quantity as usual here and in this axis, we are going to measure a lot of stuff, we are going to measure long run average cost, long run marginal cost, short run average cost, short run marginal cost and then finally, the market price p all right ok.

So, now let us first start with the cost curves. So, I will start with the drawing the long cauldron shaped long run average cost curve and of course, by now we know that the long run marginal cost curve will pass through the minimum point of this loan and average cost curve, but we will not draw this now, we will draw this later. Now I am going to plot two different plant sizes ok. So, for each plant size there will be a corresponding short run average cost curve right suppose this is the tangency point ok.

So, this is my SAC 1 corresponding to plant size 1. Now there will be another large plant size right for which I will have another short run average cost curve like this and I write this as a SAC 2 this plant size two is larger than the plant size one, there will be a point of tangency here as well ok. Now, note that there are corresponding short run marginal cost curves which will pass through the minimum points of this short run average cost curves.

So, let me draw them now. So, as we know that in short run it is only the positively sloped part of the marginal cost curve which plays the role in finding ones equilibrium that is what we are drawing short run marginal cost 1 and similarly we can have a short

run marginal cost SMC 2 right ok. Now let us superimpose the market price in this diagram and see what happens. So, let me assume that we have a market price which is p bar constant and so, this parallel straight line gives me market price, which a competitive firm cannot change and that is basically my p bar right.

So, p bar is the market price with which I start fair enough. So, now, how to find firms equilibrium? Firm we will find, suppose the firm starts with these band size 1 corresponding short run average cost curves and short run marginal cost curves are SAC and SMC once SAC 1 and SMC 1. Now we know that the firm will equate the market price to the short run marginal cost curve right and that is the firm short run equilibrium.

So, let me denote this by point E 1, now we drop a vertical line on the output axis to figure out the output level and let me say that this is q 1 output level. So, now, this is basically for short run equilibrium point; now let us going to talk about the distinction between the short run and long run for some time. So, firm produces in the short run, but it always plans in the long run; because in the long run all inputs are variable inputs firm can choose them optimally.

But in the short run when firm already has chosen some input bundle to produce some target output level, then you know there is some fixed some inputs which are fixed. So, basically a long run is basically a planning horizon for the firm ok. So, now, let us look at this diagram that we have just drawn. We have seen that at market price p bar there is a difference between the short run average cost and the long run average cost because of the suboptimal plant size that the firm has chosen in the short run, we will continue with this discussion in the next lecture.