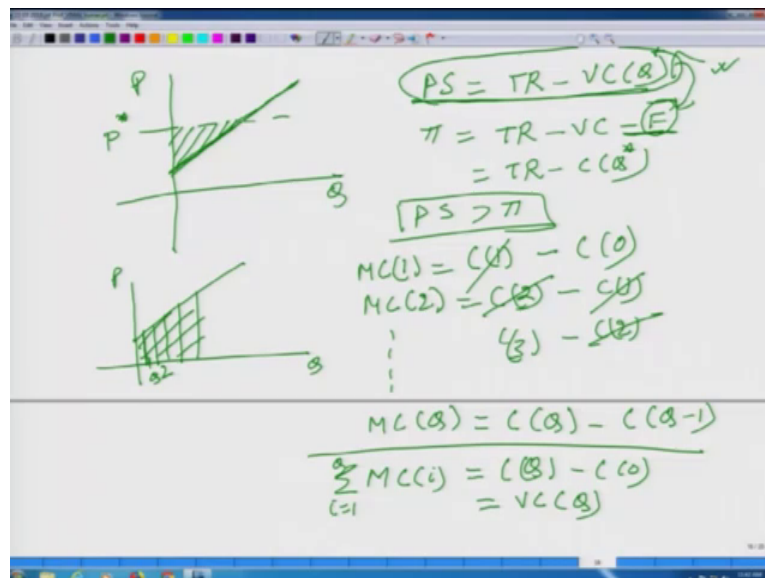


An Introduction to Microeconomics
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Lecture – 119
Producer's Surplus revisited

So now we have learnt about supply function for a perfect for a firm operating in perfectly competitive market for the salt rack. So, remember, long back we talked about consumer surplus and producer surplus. So, we are going to focus on producer surplus once again.

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So, if you remember how did we obtain the producer surplus, here we have q , here we have P , and here is the supply function. And let us say if market price happens to be P^* , then this area left to the supply curve is called producer surplus. Now we are in a position to give better definition. We can define producer surplus as let us say producer surplus as total revenue minus variable cost at the level of production. Let me also write the profit, how much is the profit? Total revenue minus variable cost minus fixed cost. In other word total revenue minus cost to produce Q amount of output.

What is the difference here in these 2 equations? That this fixed cost term is missing. Which one is going to be larger? Of course, producer surplus is going to be larger than the profit, because fixed costs appear as a negative in the profit, and fixed cost is a

positive number typically, and that is why we are going to get producer surplus as greater than profit. Now why do we define producer surplus in this particular manner?

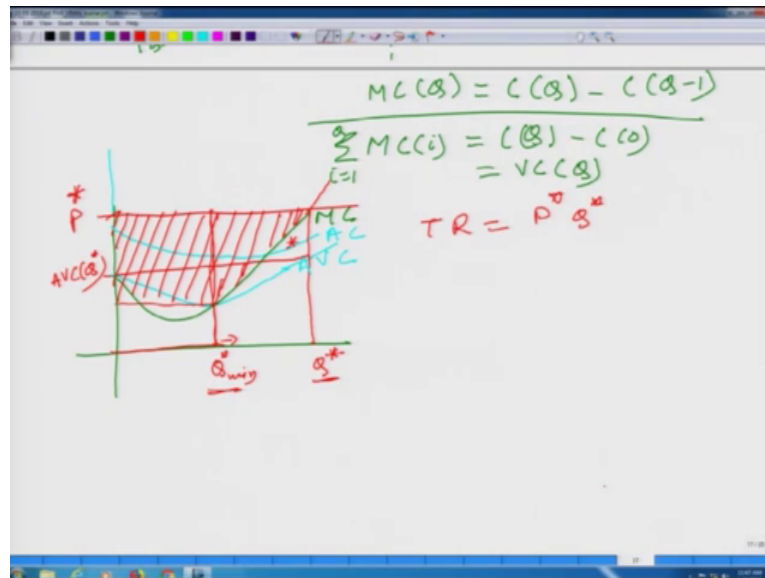
Let Us go back to the graph, how did the, we generate this supply function? This supply function again I am repeating because that is very, very important, that supply function is nothing but upward sloping marginal cost curve, which lies above the average variable cost. So, this is the marginal cost curve, ok, upward sloping part of the marginal cost curve to understand why we are using this particular definition of producer surplus. Let us pay attention to the graph giving supply function; this is the supply function upward sloping part of the marginal cost curve.

If we look at here let us say Q is equal to 1, what do we have? This is basically how are we getting the marginal cost at this point? Marginal cost at one how are we getting, the total cost, total cost to produce one unit of output minus total cost of producing 0 unit of output. Similarly, the next is at Q is equal to 2, this is MC of 2 is nothing but cost to produce 2 units minus cost to produce, one-unit marginal cost is defined as extra cost to produce.

One more unit and similarly, we can do up to MC of Q , which is the total cost to produce Q minus total cost to produce Q minus 1. And if we sum it up basically we are going to sum it up sum all these areas, what are we going to get? If we sum the right hand side, we are going to get C_1 will get cancelled here, and similarly here C_3 minus C_2 C_2 will get cancelled here.

So, if we sum it up this is what we are going to get C_Q minus C_{naught} . And here we are going to sum of MC I , I is equal to 1 to Q . And this is this is nothing but the variable cost to produce Q unit of output. And that is why exactly from this we are giving this particular definition. So, producer surplus is nothing but total revenue minus the variable cost to produce Q unit of output.

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Now, let us pay attention how to calculate in a more complex graph. What we have here is, let us let me draw the marginal cost curve, and then we have average variable cost curve, and then here it is average cost curve. Now let us store this graph because this graph we are going to use again and again.

So, let us see that if price happens to let us extend this the price happens to equal to P, how much is the producer surplus. So, there are different ways to calculate this. Of course, if market price is P star, the firm is going to produce Q star. So, the total revenue is going to be P star multiplied by Q star. Now to obtain the producer surplus, we need to take away the variable cost part of this variable cost part to produce Q star amount of output.

So, if we see here, how much is the average variable cost to produce? Q star it is given by average variable cost to produce Q star. So, this particular area is equal to the producer surplus, ok. That is one way to figure out. Now let us look at slightly different way to figure out. So, again we are back to the same graph, and we can say that how much is the producer surplus, from here we can say that at this point where average variable cost is minimum, we can say that producer surplus can be calculated by slightly different way and here, what I am doing it will become clear in a moment.

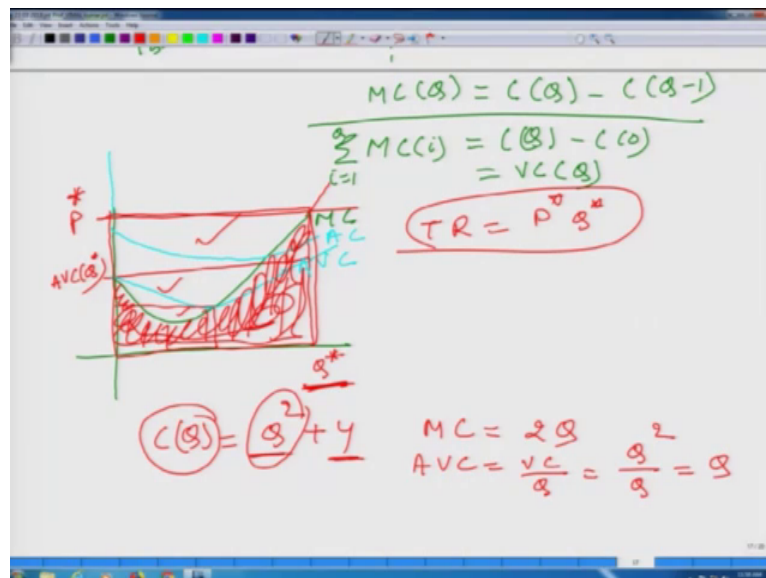
That this is going to be producer surplus. Notice that we missed this area, but we added this area, although in a graph they do not look equal, but they should be equal why this is

also equal to producer surplus, let us say that we are calculating up to let us say, let us name it Q^* men a firm, that would be you know the minimum amount that firm would be when to supply. At this particular level, marginal cost and the average variable cost are equal.

So, what we do this particular gives the total revenue up to Q^* minimum output, and we are taking out the this particular part, because this particular part gives us, this particular part gives us the variable cost for Q^* minimum amount of output. And from here onward, we are following this marginal cost curve why because we have just learned that the area below marginal cost curve will give us the variable cost to produce Q^* minus Q^* min amount of output.

So, when we add these 2 up, we are going to get total variable cost to produce Q^* amount of output. And that is why this graph also gives us the producer surplus. There is one more way we can calculate let us look at it. Let me again go back and remove these lines. I want to use the same graph so, it is clear so, again we are back to the same graph.

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And the third way to calculate would be that of course, we are familiar with how much is the total revenue, that this particular rectangle gives us the total revenue. If we take this part out, this area is also equal to producer surplus.

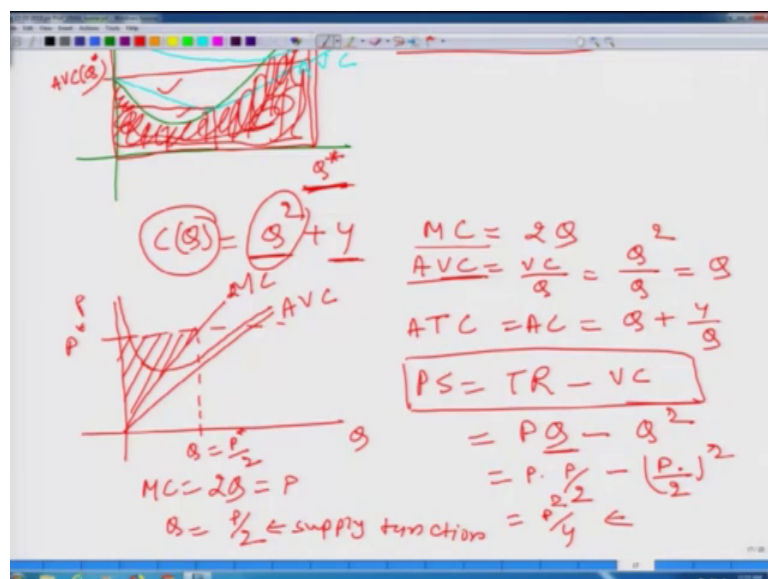
Here what I am doing? I am calculating total revenue and I am getting the area below the marginal cost curve removed, why? Because we have just seen that this area gives us the variable cost to produce Q star amount of output. And the producer surplus is defined as total revenue minus variable cost to produce Q star amount of output. That is why; we get 3 different ways to calculate the producer surplus. Let us look at one example which is from the textbook variant and which will help us understand this concept of producer surplus. So, what we have?

Let us say that the total cost is Q square plus 4. This Q square is the variable cost part, and the 4 this 4 is fixed cost part. So, what would be the marginal cost? Marginal cost if we differentiate the variable cost with respect to Q, or if we differentiate the total cost with respect to Q. Both will give us the same answer, why? Because when you differentiate a fixed number with respect to a variable you get 0.

So, marginal cost is equal to 2 Q, ok. Now how much is the average variable cost? Average variable cost is equal to variable cost divided by Q. How much is the variable cost? It is equal to Q square divided by Q. So, equal to Q if you look at these 2 graphs, these 2 equations, MC is equal to 2 Q, and AVC is equal to Q. It is clear that MC is always going to be larger than AVC.

So, we do not have to worry about what if marginal cost curve lies below the average variable cost curve. So, I can draw here this is average variable cost.

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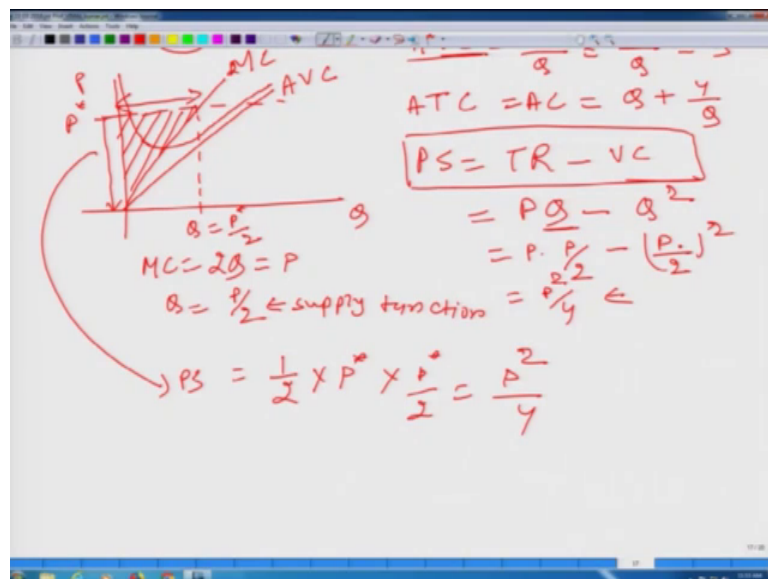


Here is P, here is Q and the marginal cost curve would look like this, this is marginal cost curve. And the third is we can also draw the total average total cost curve or average cost curve, which is equal to Q plus 4 by Q. And this is going to look like this, ok. Now we have all the graphs, what we can obtain is the producer surplus. And how much is the producer surplus? Let us say if market price is, P star then this area is the producer surplus. And what can we get? Let us use the formula that producer surplus is equal to total revenue minus variable cost, ok.

So, to use this formula we have to convert Q as a function of P, and which we can use this marginal cost curve MC is equal to 2 Q to do exactly that. So, 2 Q has to be equal to P. So, Q has to be equal to P by 2, and this is what supply function is. So now, let us get back to the formula of producer surplus, which is TR minus VC. And TR is P multiplied by Q, and VC is of course, in this particular case is Q square.

So, P how much is Q, Q is P by 2 minus how much is Q square? P Q square is P by 2 whole squares, why because Q is equal to P by 2 on the supply curve. So, what we get is basically P square by 4 that is what is the producer surplus. Do we get the same equation when we use the graph just so, that if this is P star, and at where it would cut the MC curve? MC curve it would cut the MC curve at Q is equal to P star by 2.

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So, this is P star by 2. So now, we can obtain the area of the triangle which is this area of the triangle which is PS is half multiplied by this height, this base is P star and height is P

star by 2, we get again P a square by 4. So, we get exactly the same formula, and this is what this is the way I wanted to revisit the formulation for producer surplus.

Thank you.