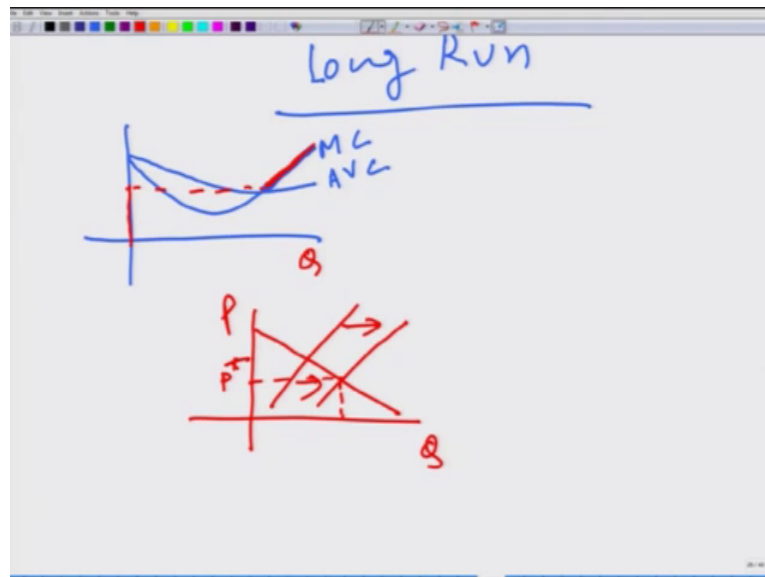


**An Introduction to Microeconomics**  
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**Lecture - 122**  
**Long Run Equilibrium and Supply Function**

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So, we are going to talk about long run equilibrium and long run supply function in the case of perfectly competitive environment, as well as for a firm operating in the perfectly competitive market. So, long run, what we saw earlier, when we were talking about a firm operating in short run? And what we saw that in the short run, the supply function of a firm operating in a perfectly competitive market is the upward sloping part of marginal cost function which lies above the average variable cost.

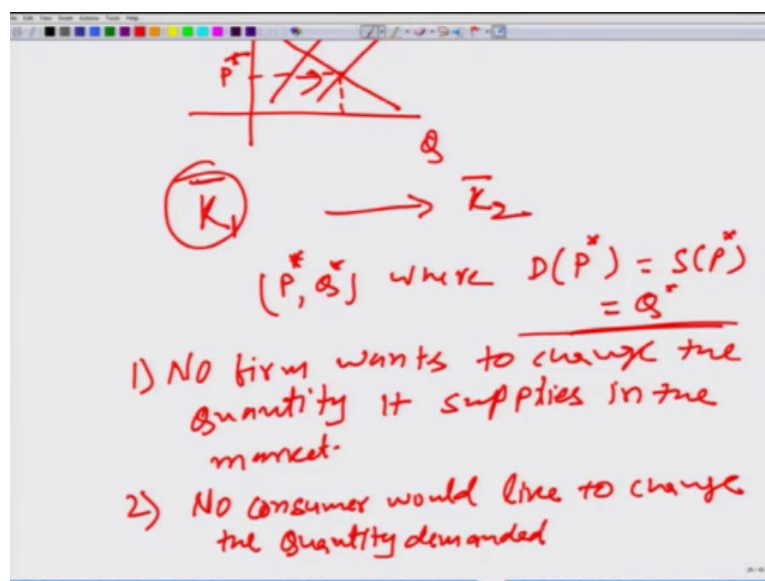
So, if I draw here this is the marginal cost curve, and then we have average variable cost function, then this part, let me put it some different colour, this part is the curve given in red is the supply function of an individual firm operating in the perfectly competitive market for short run. And now we can get the market supply function, again in the short run by horizontally adding up these supply functions. What we also saw that in short run it is very much possible for a firm to make profit. We also saw that in short run. it is very much possible for a firm to make a loss, we learned a condition that firm would not shut down keep on operating even if it makes loss.

Now, whenever firm forms or in profit, it induces; it incentivizes other entrepreneur to enter in the market. When more firms enter in the market the supply increases. The market supply increases because market supply is the horizontal sum of individual supply curve. So, more firms in the market, more would be the market supply keeping everything else constant.

So, as market supply increases what happens if we look at it? That here is the demand curve, and here is the supply curve. So, if supply increases; here is the increase in supply what happens the equilibrium market price goes down. Remember, that we are talking about perfectly competitive market, what it means that all these forms take P star as given, they act as they cannot influence this P star.

Now, what happens, that these profit incentive or entry because of this profit incentive or exit because of thus that loss, there is another possibility also that we can think of in the short run, that a firm which is present may want to change the level of capital.

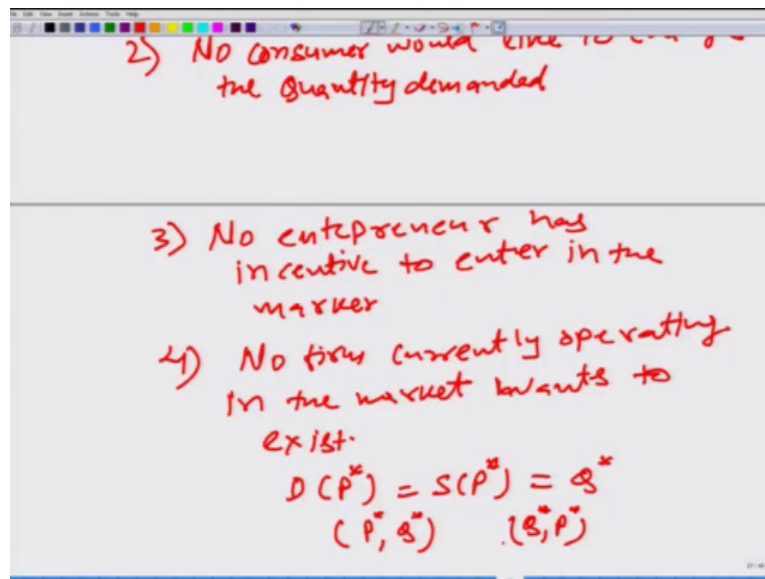
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Remember, in the short run we have been taking capital as a fixed. It is also possible for a firm which is currently operating with  $K_1$  amount of capital may change, it to  $K_2$  amount of capital if it is beneficial for firm to have this different amount of capital. So now, these were the adjustment that we can we have to think about, when we are moving from short run to long run.

I should also add the definition of a long short run equilibrium was very simple, that sort of run equilibrium is P star Q star, where the demand at price P star is equal to supply price P star equal to Q star. This is the short run equilibrium. Now when we talk about the long run equilibrium we have to extend this definition. What should we say that; in the long run equilibrium, first no firm wants to change the quantity. It supplies in the market. Second, no consumer would like to change the quantity demanded.

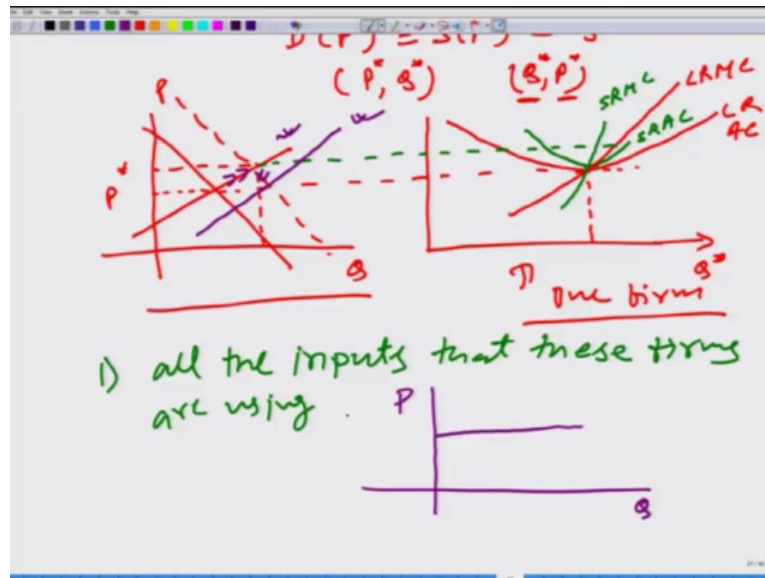
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The quantity demanded let us go down, no entrepreneur has incentive to enter in the market. And similarly, no firm currently operating in the market, in the market wants to exit. And beyond that, we also need to have that  $dp^*$  is equal to  $sp^*$  is equal to  $Q^*$  star, then only we will call P star Q star and in fact, more correct would be to write Q star P star is the long run equilibrium.

Why did I change the sequence, because traditionally the first number indicates entity on x axis and the second indicates the entity on y axis? So, here is the definition of long run, basically in long run no one has none of the firms and none of the consumers have any incentive to change the current level of production. And as well as at their current level of production and given the market price the market clears and this is the market clearing condition. So, this is what the long run is.

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So, let us say that market is in long run equilibrium, what does it mean that this is the demand curve, and this is the supply curve just indicative, what we have? This is the price, and I am extending it to the other graph, what I want that at this price  $P^*$  none of the firms should be making any profit. If firms are making in some profit, then some entrepreneurs would have incentive to enter in the market. So, if this is the long run equilibrium then the firms should not be making any profit. So, we can say if we draw this is long run average cost curve, and let us say this is the long run marginal cost curve, ok.

So, this is the scenario, because only in this case the firms are not making any profit. And of course, here I am assuming for convenience, and later on, I will change this simplifying assumption, what I am assuming this is for one this is for the whole market, and this is for one firm only. And I am assuming that all the firms are same in the market, they all the firms are homogeneous in the market.

Now, let us say for some reason what happens that the demand goes up. As demand goes up, what would happen to the equilibrium price? The equilibrium price would go up. So, we if we draw the short run short run average cost curve here, and this is short run marginal cost and this is short run average cost. So, at this increased price, the firms would start making profit. What it would do? It would induce other entrepreneurs, to

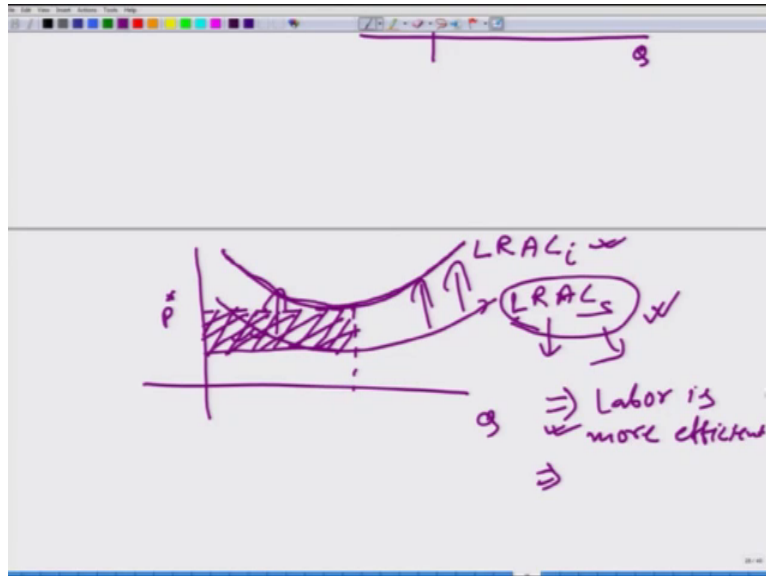
enter in the market, because they are looking for profit making opportunities, ok. So, then of course, what would happen the supply would increase?

Now, what would be the new long run equilibrium? It depends how much the supply increases. So, let us make an assumption that all the inputs that these firms are using are sold at the fixed cost. What it means that this particular the input requirement for these firms is not that large in comparison to the whole input market. Otherwise, they would be able to influence the input prices in the market. What it means that still at the same price firms should be able to supply the output, ok.

So, it means that in the constant cost industry the supply would be such that that we again get the  $P^*$  price. So, it is going to look like this, ok. These 2 line this line and this line; they should be parallel to each other. And of course, so, this is this is the way first it would change and this is the way it would come back. So, if the price of inputs do not change because there is a higher supply of output, then the firms should be willing to supply this output at the same prices. So, this would give us the long run supply curve of the firm in constant cost input case. And this is the way it would look; this is going to be horizontal, ok.

So, remember the simplifying assumption that we made that I said that all the firms operating in the market are the same; they are homogeneous. They are not different from each other ah. So, let us consider a case in which there exists a firm which is different, in a way that its input costs are lower. And why is the case? We will talk about it.

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So, let us say that this is the long run average cost curve for all the firm. And here is the long run average cost curve, curve for this a special firm. A special yes, now what is happening? let us say, that all the firms would be supplying their output at this particular price. Because if this is not the case, then all the firms would be making the profit and that would induces other entrepreneurs to enter in the market. You remain so; you notice that entering and exiting are quite important concept.

How about this particular form? This particular form is making profit, and that profit is equal to approximately this shaded area. Then we have to think about why does not this induce the entry from other entrepreneur. First of all, I have said this is a special firm. So, it seems we can say one of the reason that we can say, that this firm has an access to a special kind of input or better-quality input. And which is helping it lower the average cost at all level of production.

So, the assumption is that all other entrepreneur cannot copy this special ability or a special quality of these inputs. So, one thing that we have to notice because in economics remember if you remember the concept of opportunity cost, because if this input is a special, then it should have higher opportunity cost.

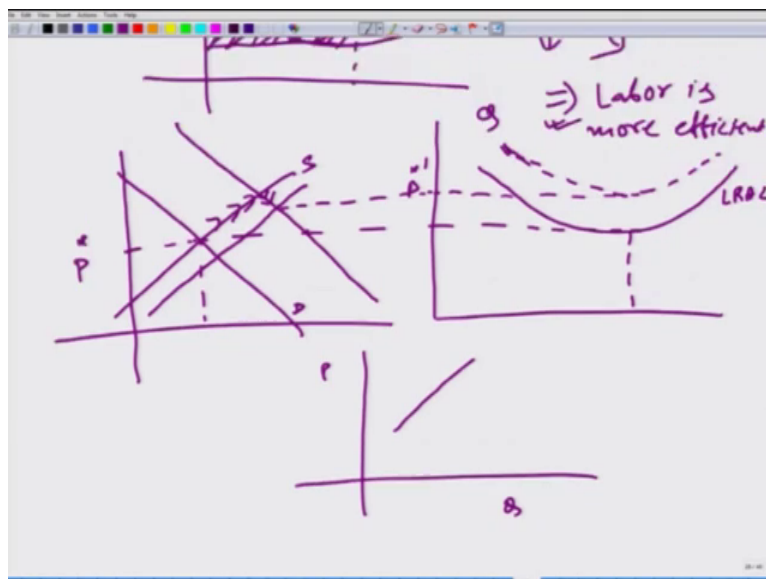
So, if we account for it this up all this input should also get paid higher because it is a special, and there may be you know if it is a special and it is not getting paid the higher return to it is effort then probably the this factor of production would move out, or this factor of production this factor of production needs to be compensated. So, if we

compensate for this particular special ability, then this curve would also shift back to this particular curve.

So, when we are talking about an one what we can say this shaded reason is basically the economic rent paid to this especial firm because of the special ability of that input. Now let us talk about a special ability, what can be the special ability? Let us say that labor is more efficient, other that let us say the factory is located near railway station so, it is cheaper to supply the output. So, whatever is the reason if labor is more efficient than the labor should be compensated for it is effort if the factory is located near railway station then the rent should be higher than what is being considered? So, this economic rent that this special firm is earning that has to be taken into account as the opportunity cost, and when we do that this would also shift here.

So, again if we account for it, then all the firms have exactly the same long run average cost curve. So, we are again back to the same scenario. Let us consider a case in which the input prices increase if we have a more demand for inputs, ok. So, if quantity produce increases then of course, it would need more inputs to produce the higher amount of quantity, and then it means the higher demand for input and if higher demand of input means higher price of input then of course, we will have a different type of long run supply function.

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So, let us see what happens here? So, again we start with same thing this is the demand curve, this is the supply curve and this is the equilibrium price.

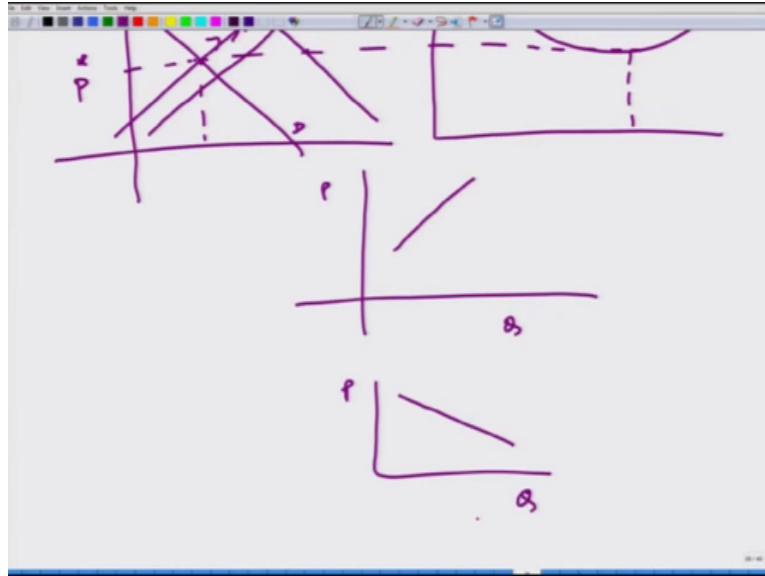
Now, let us say demand increases. So, of course, demand increases price does increase. Now what happens? Earlier we were assuming that there is no change in input prices, because input demand has gone up. Now we are considering that input prices would increase. So, what is going to happen if input price would increase? What would happen to long run average cost curve?

Let us say, the long run average cost curve would increase for a all level of production, the reason being that inputs are more costly more quantity is being produced. So, it would shift perhaps up. And if it shifts up then of course, we would not get this P star price back, we will get something different and let us say this is P star dash.

So, in that case the new supply curve is going to be like this. So, the adjustment would happen like this, and in this particular case the long run supply function of a firm is going to be an upward sloping curve. And of course, when for a firm it is upward sloping it is going to be upward sloping for the market. Because the market supply function is nothing but the horizontal summation of all the individual supply function, ok. One can also consider one more case, and I will leave it to you to think about it. What happen? If input costs decrease when there is a higher demand of inputs, this is less likely, but one can theoretically think about it. And in that case, you will get a downward sloping long run supply function of a firm, ok, but you can draw the graphs on your own.

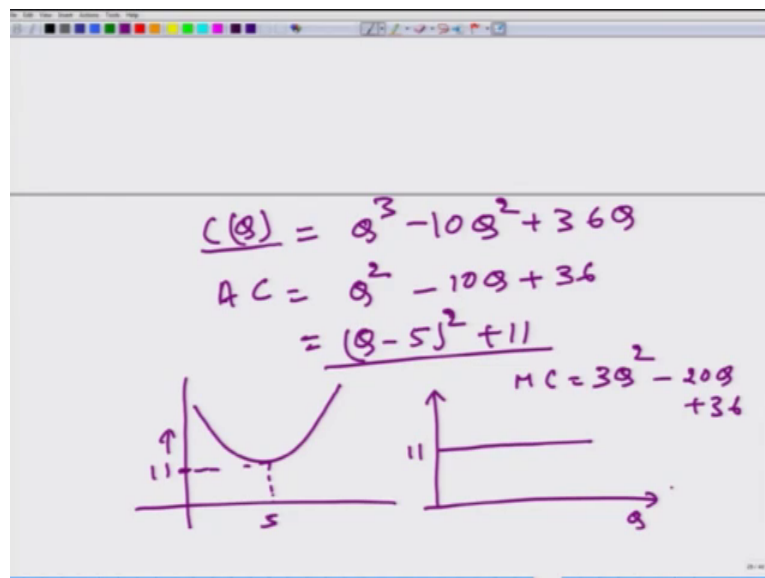
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So, let us look at a simple example to wrap up this topic that let us say that all the firms in the market have this particular supply function.

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What we have to do is to obtain the long run supply function of this particular firm. So, from here we can get how much is the average cost? Average cost is when we divide the total cost by  $Q$  we will get the average cost. So, which comes out to be  $Q$  square minus  $10Q$  plus this should be  $36$ . And this can be rewritten as  $Q$  minus  $5$  square plus  $11$ . This is a quadratic equation if you are aware. So, this is the way long run average cost is going to look like.

So, this is 5, this is 11, ok. That is the minimum price, what is going to be the marginal cost? Marginal cost is going to be just for the sake of obtaining it we are obtaining  $3Q^2 - 20Q + 36$ , ok. What is the key thing? That if price is higher than this in the market, then many entrepreneurs would like to enter because they have profit incentive. So, the only price at which we will have equilibrium in this scenario is  $P$  is equal to 11. And if we assume that inputs cost would not change, well; even if there is a more demand of it, then this is this is the way we can draw the long run supply function, that firms would be willing to supply any quantity at price 11.

Thank you.