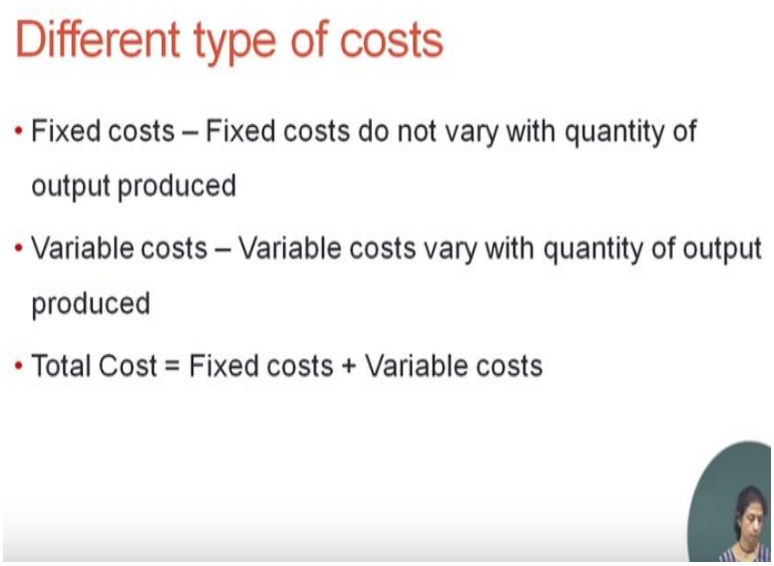
Foundation Course in Managerial Economics
Prof. Barnali Nag
Vinod Gupta School of Management
Indian Institute of Technology-Kharagpur

Lecture - 17
Cost Curves

Welcome back to the foundation course in managerial economics. In this module we are going to talk about cost curves. We are going to look at how the variable cost looks like with increasing units of output how fixed costs look like we are going to introduce various concepts of cost. So let me proceed.

(Refer Slide Time: 00:43)



So there are different types of costs. Now one is called the fixed cost which is where fixed costs do not vary with quantity of output produced and we have variable costs where variable costs vary with the quantity of output produced. So probably you are being able to already relate to the example of the tailoring shop that I took in the previous module and there we said that there is a input of a room or the shop area of 200 square feet where basically the tailoring activity is happening and there are 2 sewing machines which are again fixed.

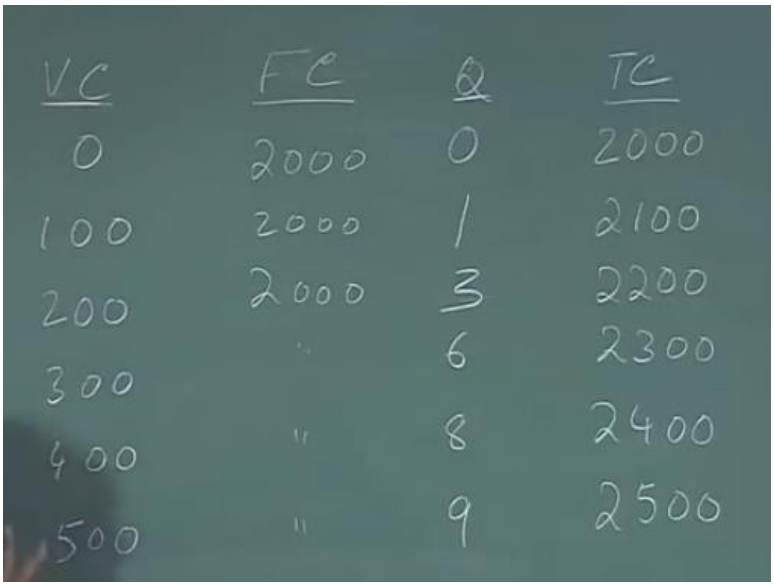
So even if the shop is not producing any garment then also the shopkeeper or the owner of the shop has to incur the costs of the room and the cost of the sewing machine and so these are the cost of the room and the sewing machine is basically the fixed cost that we are defining here and

variable cost is basically if he wants to increase the number of garments that he wants to produce from his shop he has to keep on increasing the number of people he hires to produce the garment. So however there is a diminishing marginal product of labour that we saw in the previous module that he cannot keep on increasing his output forever by keeping on increasing the number of units of labour. Say there is only a limit till which he gets some positive output of the out of the out of hiring more and more units of labour.

So anyway so these are the cost that he incurs by hiring the labour is called the variable cost because this cost depends on the number of units of output he would like to produce. So total cost for a producer is equal to fixed cost plus variable cost.

So next we are going to discuss about cost curves but before we talk about cost curves let me show with an example what we mean by the variable cost, the fixed cost etc. So let us continue with the example that we took earlier.

(Refer Slide Time: 03:23)



So now he is trying to produce some output but first he incurs the fixed cost. He is incurring a fixed cost of the land and the sewing machines. So say he is incurring Rs 1000 here and for the 2 machines he is incurring a amount of Rs 1000. So basically his fixed cost is so let me write it as so basically his fixed cost or FC is 2000 and even when his output is 0. So even when his output is 0 he is having to incur this fixed cost of 2000.

Now he starts hiring labour and labour is his variable cost. His variable cost is labour and here if he has no person to work for him so his output is 0. As soon as he hires one labour his variable

cost is not 1 but 100 Rs because one person gets a salary of 100 Rs. So this is variable cost is 100 and his fixed cost is 2000 and the output he produces is 1 garment. Then his variable cost is 200 as soon as he hires 2 people his fixed cost is still same.

He now is able to produce sorry he is able to produce 3 garments. So similarly so this is how his cost structure looks like 500 and these are the fixed cost stays same and 6, 8, 9, 9 and probably he is not going to hire this additional person because he is still able to produce 9 garments without hiring him. So we will talk about his decision till here.

So let us not talk about this portion because any producer, rational producer is not going to incur extra cost without increasing his amount of output. So this is his so what is his total cost then? So to produce every unit of output so this is his total cost is now fixed cost plus variable cost, for 0 units it is 2000, for 3 units it is 2200, for 6 units 2300, 2400, 2500. So this is his cost schedule. This is his total cost schedule and these are his and these are his output. So he knows it is like this.

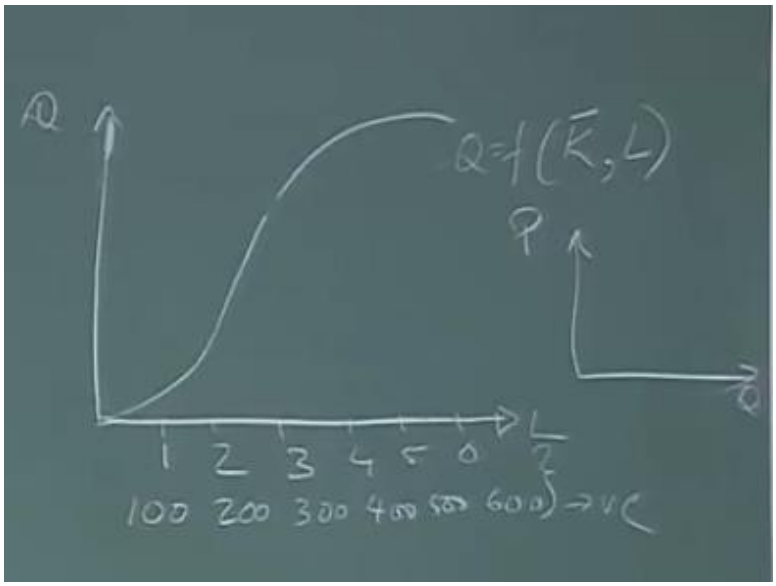
Now let us try to draw the cost curve. Let us try to draw the cost curve because you already have seen the demand supply framework where we have a price on the vertical axis output in the horizontal axis and there was a demand curve the supply curve and similarly we would like to bring our cost curve or production decision everything in that framework of price and quantity and try to be able to see if we can figure out what is the amount of output optimum output the producer is producing, what is the cost he is incurring, what is the profit level that he is expecting, what is the profit that he is making etc. So let us try to draw the cost curve.

Now before I draw the cost curve let me start with the production function. See the production function basically gives me the okay before I talk about the cost curve one more thing is this is the variable cost and this is the fixed cost and when I say fixed cost it is as if right now the producer is not being able to change this like he is not at any point of time he is not adding any additional sewing machine or he is not renting another shop or renting some more amount of space to add to his existing shop.

So this is the reason that it is fixed cost. It is fixed. So he is not increasing the increasing or decreasing the capital that he already owns. All that he is changing is the variable cost. So basically all his decisions are about the variable cost. This decision he has already taken. So all his decisions are around the variable cost that is how many people to hire. Now so his so secondly his cost is about since this cost has already been taken into account like there is he

knows that no matter how many units of output I produce this is going to stay the same. So his decision is about the cost incurred in hiring the labour, the variable cost. So let us start from the production function that we drew in the earlier module.

(Refer Slide Time: 09:17)



So this is his production function and this was his labour, this was his output that he produced and the production function looked something like this. The production function looked like this. So this was the production function and where his capital was fixed and we were basically changing the units of labour. So this is for the fixed area of the land where he is operating and the fixed 2 inputs of machine, sewing machines that he has and he is basically just changing the units of labour here. So this is his production function.

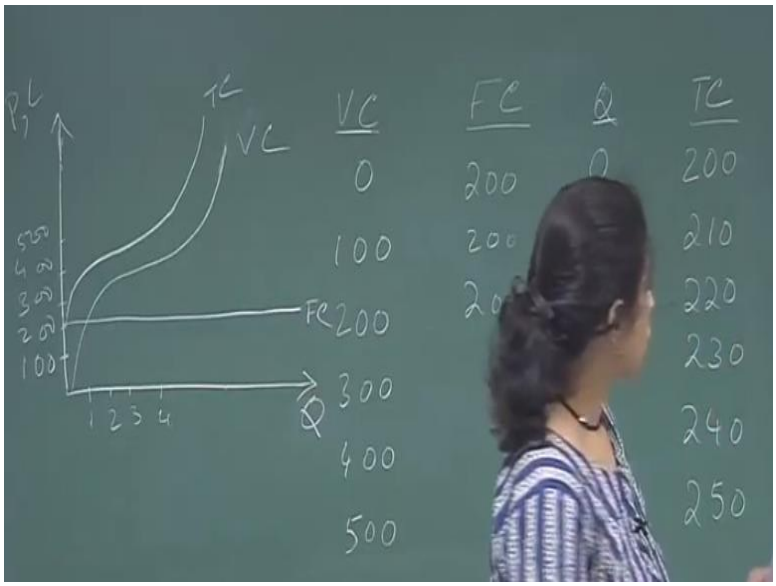
Now cost is about how much money he has to spend. So let us convert this let us look at instead of hiring every unit of labour so labour is basically every person that additional person he hires or additional number of hours that he makes them work. So if instead of writing labour here in physical units lets write it in terms of the wage that he is paying to the labour.

So if I convert it into rupees say first unit of labour he hires he is having to pay a wage of amount of money of 100 Rs. For 2 people he pays 200, 3 people 300, 4 people 400, 6 people 600. So this is in this is the cost that he is having to incur to produce every unit of output here. This is the cost that he is having to incur to produce or this is the variable cost. So this is the variable cost.

Now as you remember from our demand supply analysis that I said that my price is always going to be on the Y axis and my output is going to be the on the X axis. So I think it will be useful for

us if we are able to look at cost also in this framework of having the price that I am having to pay on the vertical axis and the output getting produced on the X axis. So how can I get that from here? So if I am looking at the cost curve how can I do that from this? So this is my production function what I basically do is what I basically do is let me draw on this side.

(Refer Slide Time: 12:27)



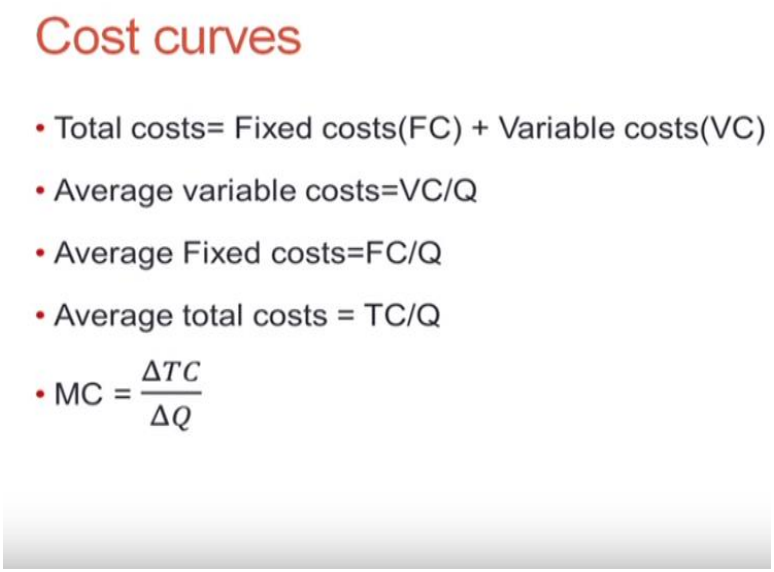
Now I am trying to change the axis of this graph or this diagram here. So I would like to have the price or cost figures on the X axis and sorry I would like to have the output in the X axis instead of Y axis and I would like to have the price or cost figures on the Y axis. To do that all that I have to do is flip this graph.

So basically I flip the curve so that I have the flipped curve in this space and what I now have is a curve which looks something like this, curve which looks like this. So when I flip the curve I have the output on the what output that I have on the Y axis output I have on the Y axis and I have the inputs in cost terms on the Y axis. Output I have on the X axis and I have the inputs in cost term on the Y axis.

So that basically gives me the cost curve. So is this what cost curve is this? This is basically the variable cost curve. So this is my variable cost curve because it shows me gives me the variable cost that is 100, 200, 300, 400, 500. So my variable cost is on the vertical axis, my output is on the X axis and this gives me my variable cost curve because this curve shows how much variable cost I have to incur to produce every extra unit of output.

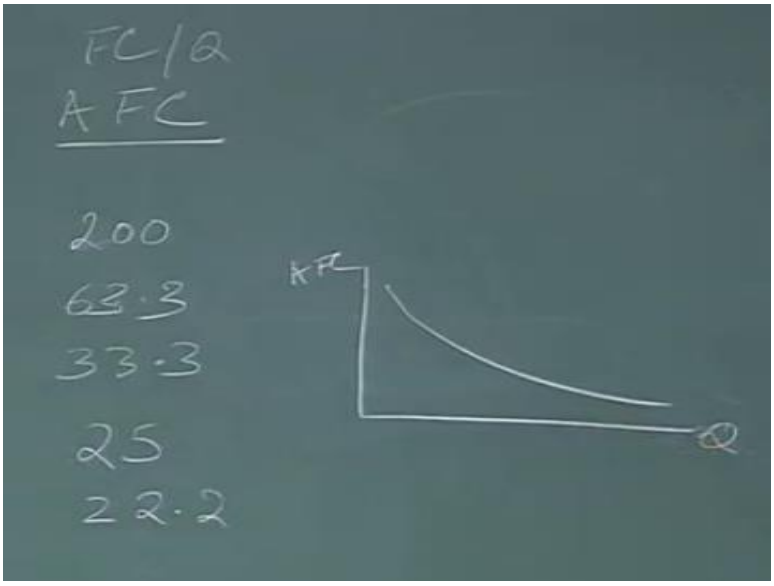
Now if this is my variable cost how should I draw my, what does my fixed cost look like? Now fixed cost is say fixed cost is say it is 2000 here let us bring it down to so that it is I am just making it 200 so that I can draw within this space. So say my fixed cost is 200. So my fixed cost looks like this. This is my fixed cost and so my total cost is basically this is my total cost. So this is my total cost. So this is 200 plus so this is my total cost curve and this is my variable cost curve.

(Refer Slide Time: 15:58)



Now having drawn the cost curves a few more variations of the cost or different that concepts of the cost that we need to understand are the average variable cost that is variable cost produced per unit of output. The average fixed cost that is average average fixed cost that is fixed cost per unit of output. Average total cost which is total cost divided by output and marginal cost I will come to marginal cost later.

(Refer Slide Time: 16:56)



Let me first show you what my let us first define the average costs. So first average fixed cost. So as you can see very well from here average fixed cost what would it look like. Average fixed cost what would it look like? Now average fixed cost would be in the first average fixed cost would be here it is not applicable only 0 units are produced. In the next it is 200, 200. Then it is 100, 2 units produced. Then it is 66, it is 200, 3 yes it is sorry 200, 3 okay I am sorry 200 then 200 divided by 3 it is 66.3 sorry 63. Then 300 Q fixed cost is 200, 33.3 and 200 then it is 25.

So average fixed cost is basically it keeps on decreasing. So what should it look like? So average fixed cost would look like this. So this is my cost again. So average fixed cost and output average fixed cost basically keeps on decreasing. So this is my average fixed cost. Next I am going to calculate my average variable cost.

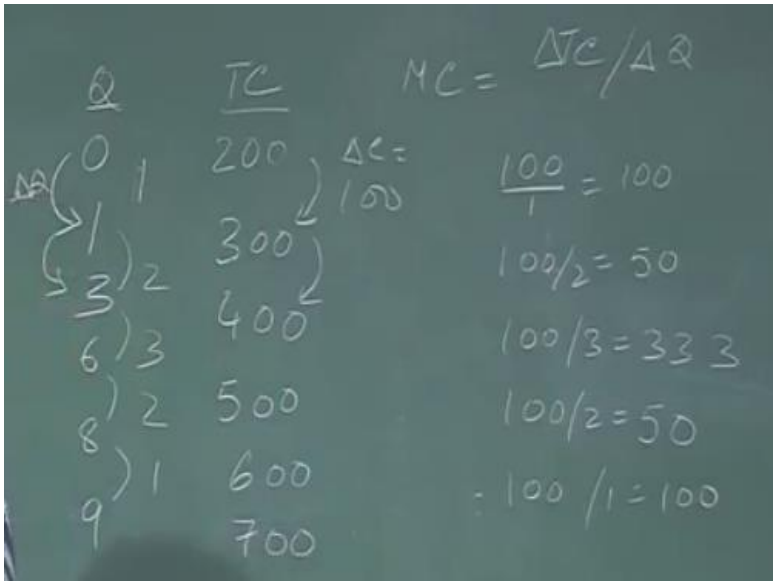
(Refer Slide Time: 19:41)

Now average variable cost is variable cost divided by output and that is variable cost it is 100 then 200 by 3 then 300 by 3, 30; 400 by sorry 300 by 6 and 400 divided by 8 then 500 divided by 9. So average variable cost what we see is average variable cost initially it declines and then it starts increasing again. So that means my average variable cost is a U shaped curve while my average fixed cost keeps on decreasing. So this is my average variable cost.

So this is how my average variable cost and average fixed cost look like and next we are going to discuss about marginal cost. Now as we said people think at, rational people think at margin. So we have already discussed about marginal product and we are going to see what happens to marginal cost. So basically the producer is trying to figure out what is the marginal cost he is incurring by hiring an extra unit of labour.

So marginal cost is basically marginal cost is not going to be influenced by the fixed cost, it is going to be influenced only by variable cost. So basically what we are looking at is let us look at the total cost and total output here.

(Refer Slide Time: 22:15)



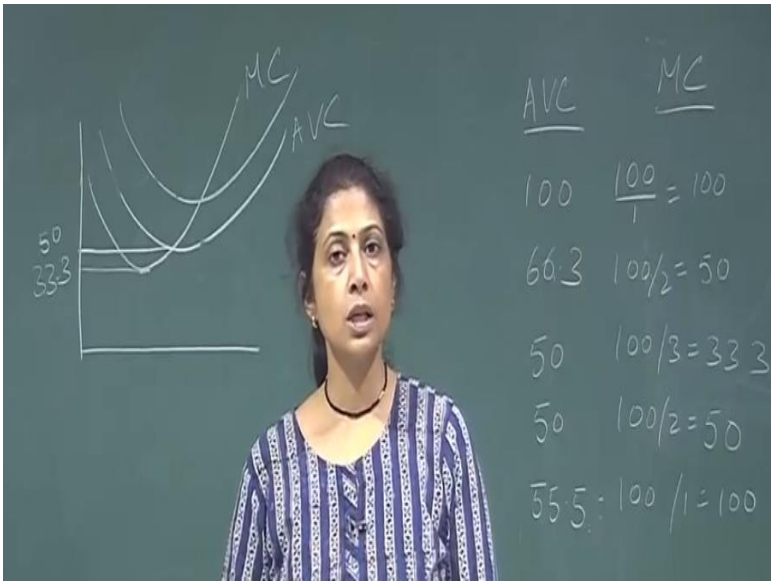
So marginal cost is equal to del total cost divided by del output. So additional output to be produced how much additional cost we incur. That is what we are trying to figure out here. So from 0 to 1 unit what is the del Q that is there. Now del Q is del Q is 1 here. Here del Q is 2. Here del Q is 3. Here del Q is 2.

Here del Q is 1 and here del cost del cost is equal to 10 here. It is again 10 here, 10 here. So it is my additional cost is 10 for every unit. So this is my oh sorry. I have done a major mistake. I deleted the zeros at the end. It is actually 200 now 200 plus this is a gross mistake that I have done here.

This is fixed cost plus the fixed cost I removed one zero from here so fixed cost plus variable cost is here 300. It is 400 here. It is 500 here. It is 600 here and it is 700 here. So apologies for the mistake this is my total cost here and additional cost that I am incurring for producing every unit is here del cost is basically 100. So del cost that I am incurring for producing the changes in output at every level the del cost is 100 and this is my here it is 1. This is 2, this is 3, this is 2, and this is 1.

So my marginal cost will be equal to marginal cost is equal to 100 divided by 1, 100. Second it is 100 divided by 2, 50. Then it is 100 divided by 3, let us put 33.3. Then it is again 100 divided by 2 is equal to 50 and 100 divided by 1 is equal to 100. So this is how my marginal cost curve looks like and let me now draw the marginal cost curve.

(Refer Slide Time: 26:00)



So let me draw the marginal cost curve. So my marginal cost curve now looks like so it initially decreases, my marginal cost initially decreases and then it moves up again. So my marginal cost initially falls and then it moves up again and marginal cost is minimum at 33.3. Marginal cost is minimum at 33.3 and another thing if you may note from I have removed the average variable cost. You may remember that in the variable average variable cost the average variable cost kept on decreasing till it reached a level of 50 and then it started increasing again.

So average variable and when average variable cost was falling so let me write the average variable cost also here. So this is my marginal cost and this is my average variable cost. So my average variable cost looked like 100, then 66.3, 63.3 I think 66.3 and then 50 then 50 then 55.5. So I think my average variable cost looked like this and if I draw the average variable cost with the marginal cost I am going to see that initially my average variable cost is more than my marginal cost till it reaches a level of 50 and after that my average variable cost so this is my then my average variable cost is actually less than my marginal cost.

So my average variable cost is less than my marginal cost and this is the level 50 where my marginal cost intersects with my variable cost and after that my variable cost is actually less than my marginal cost. Now why does that happen? So basically marginal cost when marginal cost is declining variable cost is marginal cost is less than the average variable cost and when marginal cost is increasing it is more than the average variable cost and the average variable cost and marginal cost they intersect at the point where average variable cost is minimum. They intersect at the point where average variable cost is minimum.

So what is the intuition behind it? So the intuition behind it is very simple that say for example we are imagining a CGP of a person, so the grade point average of a person, and say he has got the grades of all the subjects except economics and the average that he has got of all from all the subjects is say 5.0. So now if the grade that he receives from economics is the additional the additional amount that will be added to the average.

So that you can imagine as the marginal cost and that marginal amount when it is added it will reduce the average if it is less than the average. That is if the grade that he receives from economics is less than 5 that will bring down his average and if the grade that he receives is more than 5 that will raise his average.

So obviously it intersects, the marginal cost intersects the average variable cost at its minimum and that is the reason behind it and so that basically so this is how basically how our cost curves look like so this is my marginal cost, this is my average variable cost and another reason for the variable cost and the total variable cost is also looks like this.

Now the total variable cost also is U shaped because the average variable cost is initially decreasing and then it is increasing but average fixed cost basically brings down the total cost. So that is the reason that the average total cost is also U shaped and that brings us to the end of the discussion about cost curve.

So we have basically introduced the cost curves and in the next module we are going to see how the cost curves look in the short run and the long run. We are going to introduce the concept of long run and short run and how the producer basically makes his choices in the short run and in the long run. Thank you.