**Managerial Economics**
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**Lecture - 43**
**Theory of Cost (Contd..)**

So, in this session, we will continue our discussion on relationship between the total cost total revenue profit and loss. The break even analysis what we discussed in the last session also; and we will see, what is the profitable and non-profitable range of output, how the business activities planned on the basis of profit and loss.

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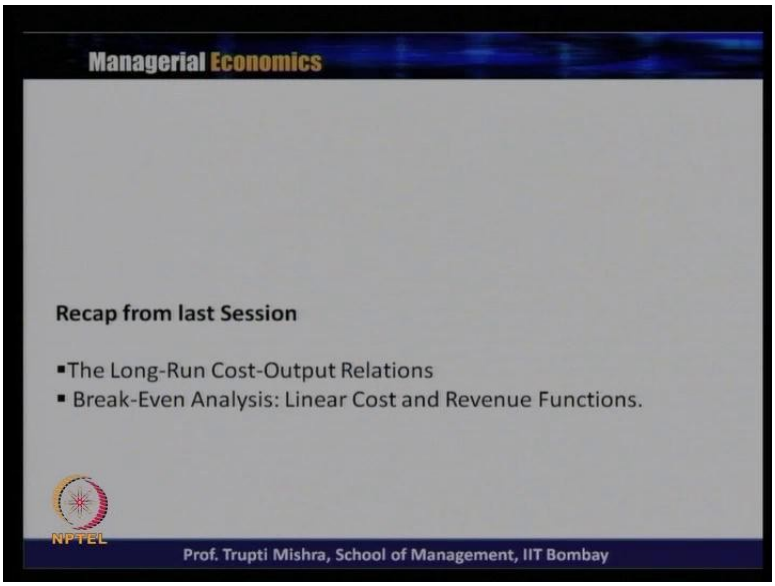


So, if you remember in the last class we talk about the long run cost and output relationship. Generally, how the long run cost is derived from the short run cost curves and how both of them they are related, in which case short run cost curve is use, and in which case the long run cost curve is used. Then, we introduce the break even analysis to specifically in case of linear cost and revenue function, when linear cost and revenue follow a straight line. So, the breakeven point is one where the total cost is equal to total revenue. Beyond that it is a profitable range of output, because total revenue is more than total cost and before this it is a non-profitable range, because the total cost is greater than the total revenue and the breakeven point is one, where the total cost is equal to total revenue.

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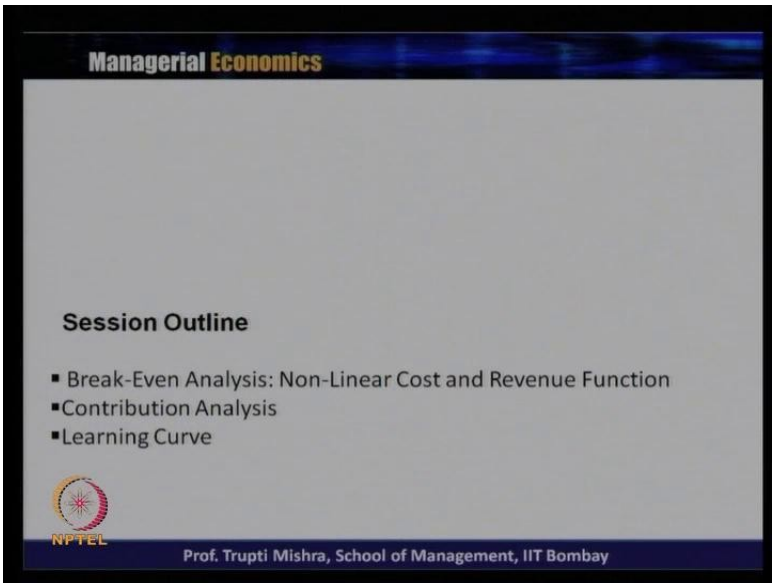


So, we will to start with we will continue again our discussion on the linear cost function. We will just look at the algebra behind the linear cost and revenue function, specifically in case of breakeven analysis. Then, we will discuss about the non-linear cost and revenue function. Then, we will do the contribution analysis and then finally, we will discuss about the learning curve, which is the again with the background is on the shape of the long run average cost curve.

Generally, the practice is that we follow that there is economics of scale because of which the average cost is decreasing, but learning curve is the alternate method to understand or the expand that why the long run average cost is decreasing.

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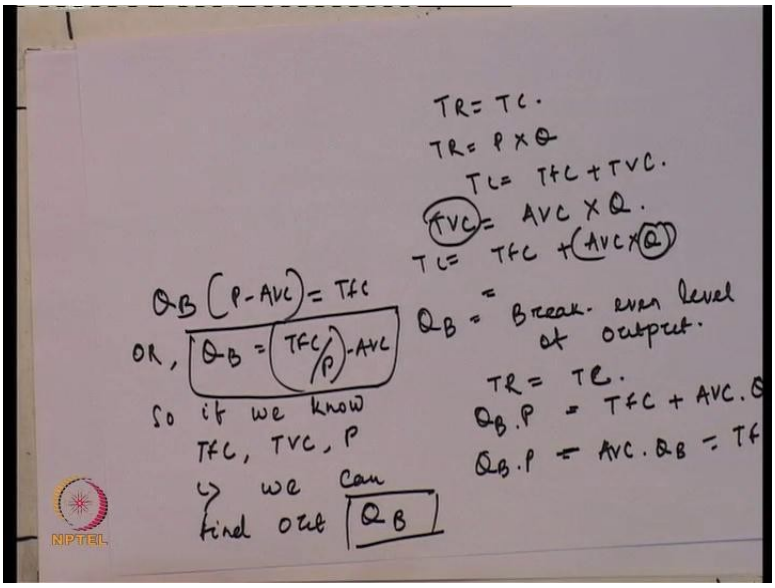


So, to start with we look at what is the algebra behind the breakeven analysis. So, actually, we know that at the breakeven point the total revenue equal to total cost. So, actually know total revenue ($TR¿ = P \times Q$and total cost has two parts; that is, total fixed cost$(TFC)$ and total variable cost$(TVC)$. Now, this total variable cost is alternatively, we can say this is the average variable cost$(AVC)$ multiplied by the quantity Q and total cost is total fixed cost $TC = TFC + TVC$. And instead of TVC, if you write$(AVC \times Q)$, then $TC = TFC + (AVC \times Q)$ is this comes as total fixed cost, and in place of total variable cost, we use average variable cost multiplied by Q.

In this case, we can write this as the $Q_B$ is the breakeven level of output. If it is a breakeven level of output, putting this total revenue is equal to total cost. Total revenue is $TR = Q_B . P$ So, $Q_B P$ and total cost is total fixed cost plus average variable cost. $TC = TFC + (AVC \times Q_B)$ And in case of this Q since $Q_B$ is the breakeven level of output we will use $Q_B$.

So, $Q_B$ multiplied by P is now simplify this again, this is $Q_B . P - AVC . Q_B = TFC$. Again simplifying this, we will get, if you take $Q_B$ is out that is $(P - AVC)$, which is equal to total fixed cost or we can say $Q_B = \frac{TFC}{P - AVC}$. So, if you in know or if the producer know what is the level of TFC. What is the level of TVC and what is the level of P then, we can find out the quantity that is the breakeven level of quantity through this that is $Q_B = \frac{TFC}{P - AVC}$

So, the algebra behind this is, if you know the fixed cost and if you know the average variable cost and if you know the price of it, generally, you can find out the find out the breakeven level of output, but when it comes to break even analysis.

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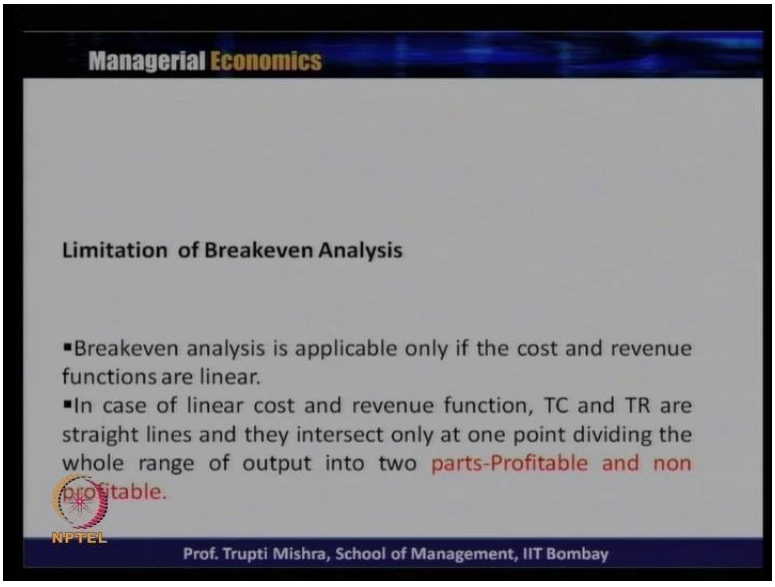


Specifically, in case of linear cost and revenue function, it is applicable only if the cost and revenue are linear. So, in case of linear cost and revenue function the total cost and total revenue are straight line they intersect only at one point dividing the whole range of output plus two parts that is profitable and non profitable like in the previous.

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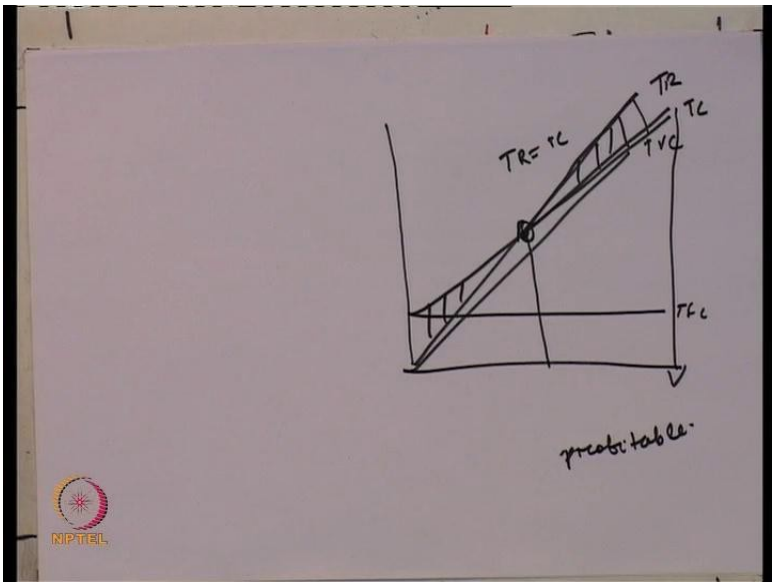

So, that this is our total fixed cost, this is total variable cost, this is total revenue cost and the total costs starts from here, and this is the total revenue cost, total cost this is the breakeven level of output because total revenue is equal to total cost. And this divides the entire range of output in to two level; that is non profitable and profitable. This is possible only if it is a linear total revenue function. Linear total cost function because they intersect each other only at one point and that is the reason clearly we can divide that this is the profitable range of output and this is the non profitable range of output.

But if it is not a case of linear then the possibility is that they intersect more than twice or may be more than once and in this case, it is difficult to find out what is the profitable range of output and what is the non profitable range of output. So, what is the implication for this? If it is a linear cost and revenue function, we get two range of output; profitable range of output and non profitable range of output.

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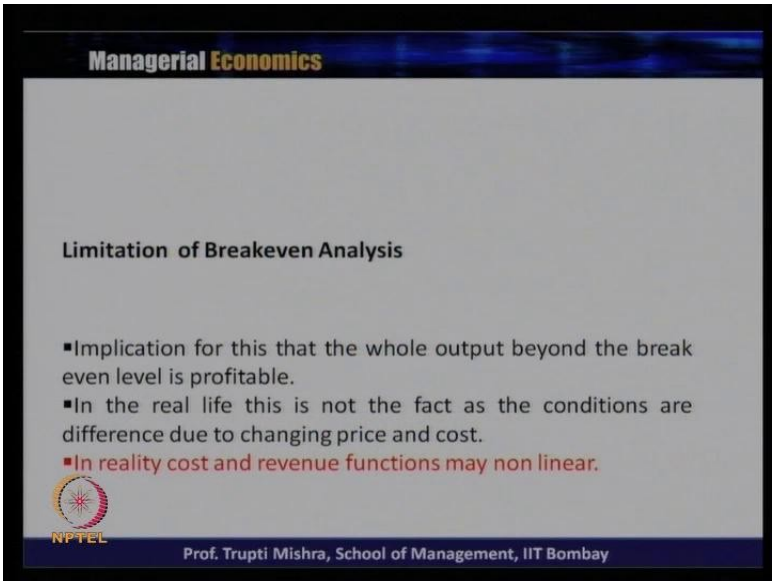


But, the implication for this that the whole output beyond the breakeven level is profitable right because the point behind which the total revenue is equal to total cost. The total revenue is more than the total cost beyond all the level which implies from the linear cost and revenue function, but when it comes to the real life this is not the fact as the conditions are different due to changing price and cost. So, it not possible that the you get a when it say it is a case of linear cost and revenue function.

So, if you look at the graph beyond this point, we say any level of output is profitable right. So, implication of linear cost and revenue function is that beyond the breakeven level any level of output is profitable. But in the real life the fact is, condition is different due to the changing price and cost and that leads to the fact that the cost of the revenue and function may not be linear they may non-linear.

The cost function and the revenue function is non-linear because of the fact that the incase of real life, there is a changing price which leads to change in the cost changing price of inputs and changing price of raw materials, which leads to the variation in the cost and which leads to the possibility that the cost and revenue of a non-linear.

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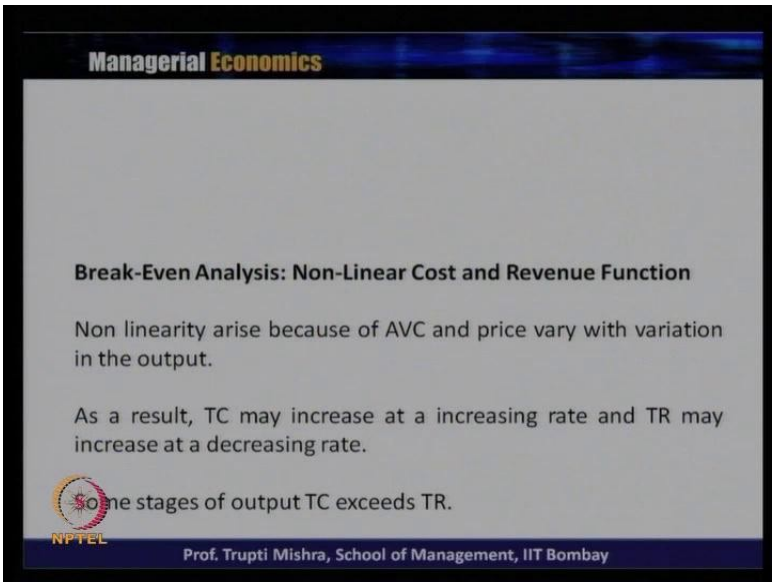


So, the non-linearity arises because of average variable cost and the price vary with the variation in the output, since the average variable cost changes due to change in the price which vary with the variation in the output. And as a result total cost may increase at the increasing rate and total revenue increase at the decreasing rate.

Since, there is a non-linearity because of average variable cost and price change with the variation in the output. That leads to the possibility that total cost increase at the increasing rate and total revenue increase at the decreasing rate. So, the stump stages of output total cost exceeds the total revenue, but in case of linear cost how it was happening. It was like after the break even level, the total revenue is always greater than the total cost, but in case of non-linear since total level will increase at the decreasing rate and total cost will increase at the

increasing rate. At least at some stage of output the possibility is that the total cost will increase the total revenue.

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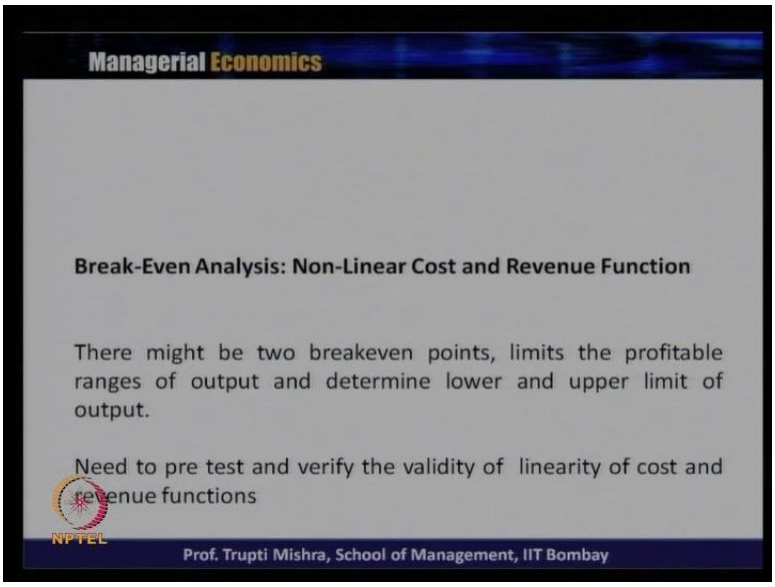


So, in this case may be we get two breakeven point. That is the one breakeven point when total cost is equal to total revenue and the possibility is that the other breakeven point is again. The total cost is that the total revenue which limits the profitable range of output and determine the lower and upper limit of output.

So, it is not the profitable range of output is unlimited rather, it is the its define the lower and upper limit of the profitable range of output. So, there is a need to pretest there is a need to verify the validity of the linearity of cost and revenue function before assuming that the cost of the revenue is the linear.

So, in this case there is a need of pretest. There is a need of verification before taking the cost and revenue as the linear function. So, what happens in case of non-linear. There is two break even points. There is not only one breakeven point, two breakeven point and that decides the limit upper limit and lower limit of the ranges of the output.

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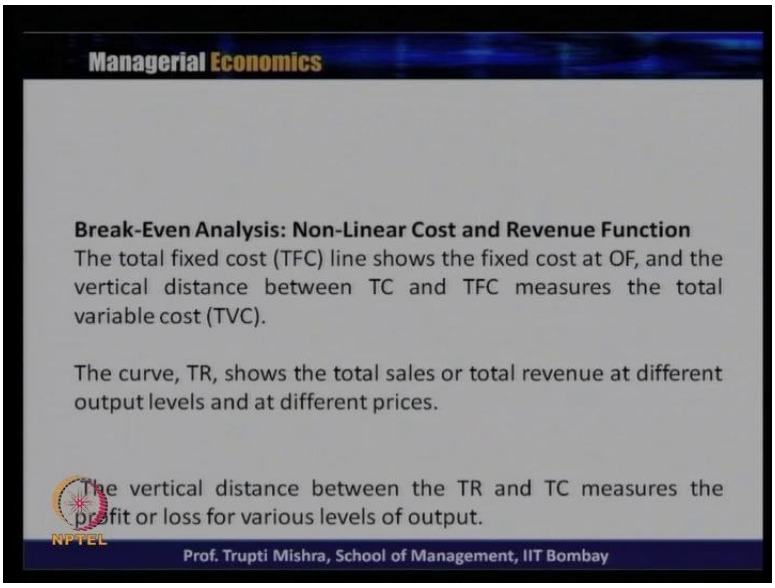


So, let us find out the graph for the non-linear cost and revenue function. In case of a break even analysis, this is total cost and revenue, this is output suppose, this is total fixed cost this is total revenue.

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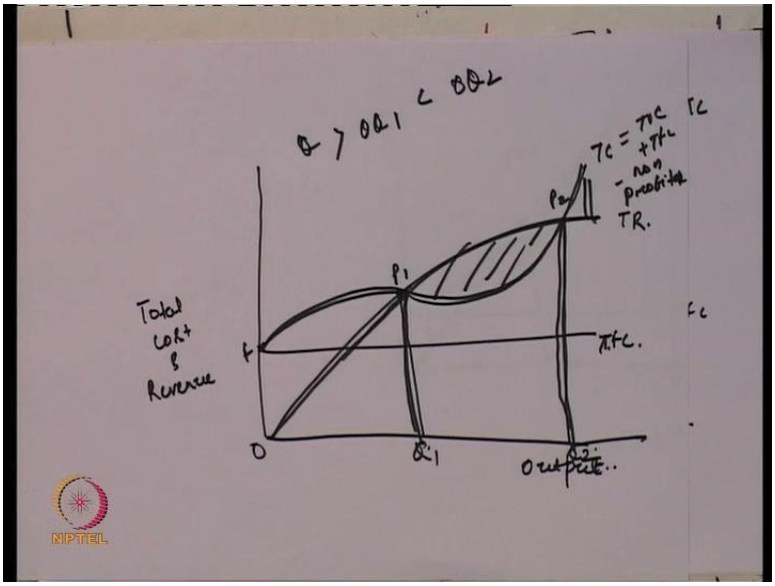


So, this is total cost this is total revenue and this is total fixed cost. So, here the total fixed cost line, it shows that the fixed cost that of this is fixed cost and the vertical distance between total cost and total fixed cost. It measures the total variable cost because this is the total fixed cost and total cost, which always the summation of the total variable cost and total

fixed cost. So, the vertical distance between the total cost and total fixed cost that gives us the total variable cost.

The curve total revenue shows that the total sales or total revenue of different output level at the different price and the vertical distance between the total revenue. Total cost measures the profit or loss of variable level of output. So, the vertical distance between total revenue and total cost that will give you the various level of output.

So, corresponding to that we get two various level of output one is $Q_1$ second one is $Q_2$. So, we can say this is $P_1$ and this is $P_2$. So, total revenue and cost intersect to each other at two different point one at the point $P_1$ second at the point $P_2$ where the total revenue is equal to total cost.

Before the level $P_1$, the total cost is greater than total revenue. So, this is the non profitable range of output beyond $P_1$ any level of output up to $P_2$. This is the profitable range of output, but like in case of linear cost and revenue function, it is not unlimited. The profitable range of output is unlimited because we get another breakeven point at $P_2$ which leads to the fact at beyond this point total cost is greater than total revenue and again this range is non profitable range.

So, in case of non-linear cost function, we get two breakeven level and which also identify the lower limit and upper limit of profitable range of output. So, $Q_1$ is the beginning of the profitable range of output and $Q_2$ is the end of the profitable range of output. This is the lower limit of profitable level of lower range of output where the profit can be achieved. This is the higher level of output where the profit can be output. So, this represents lower and upper breakeven point.

$P_1$ is the lower breakeven point $P_2$ is the upper breakeven point and for the whole range of output between $OQ_1$ and corresponding to the this and this $Q_1$ and $Q_2$ is the breakeven point correspondent to this output level. The total revenue is greater than total cost. So, this is the profit this is the lower breakeven point this is the upper breakeven point.

So, if the farm is producing more than $OQ_1$ then or less than $OQ_2$, they are making the profit. So, if the farm is producing more than $OQ_1$ it should be more than $OQ_1$ the Q should be

more than $OQ_1$and less than $OQ_2$ then only the farm is making the profit. So, the output level should be more than $OQ_1$and less than $OQ_2$.

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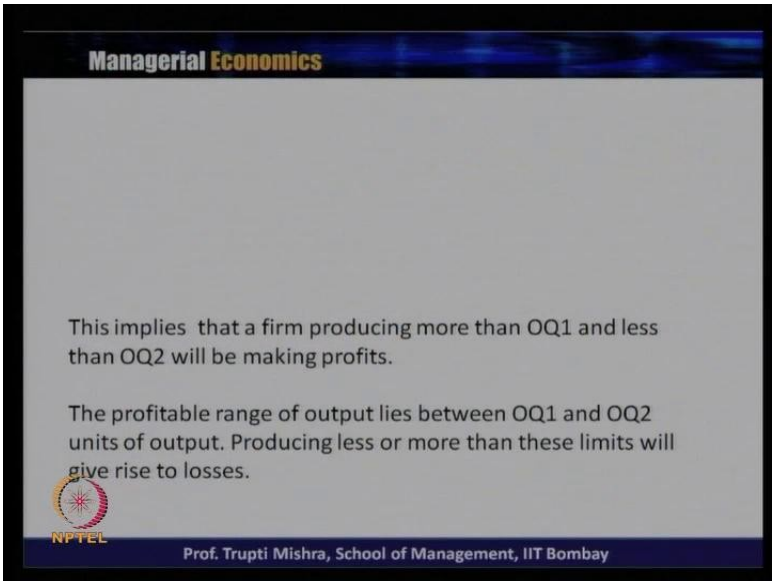


Generally, the farm is making the profit and producing less or more than the age limits gives rites to the losses. So, basically the essential difference between the linear and non-linear break even analysis is, incase of linear break even analysis is profitable range of output is unlimited, but in case of non-linear analysis there is a limit of profitable range of output.

Beyond that producing more before that producing less will lead to the loss. So, if you look to that this is the loss because total cost is greater than total revenue. This is also loss because the total cost is greater than total revenue. This is the profitable range of output where the total revenue is greater than total cost. Then, we will come to the one more type of analysis may be in relation to this break even analysis that is called as the contribution analysis.

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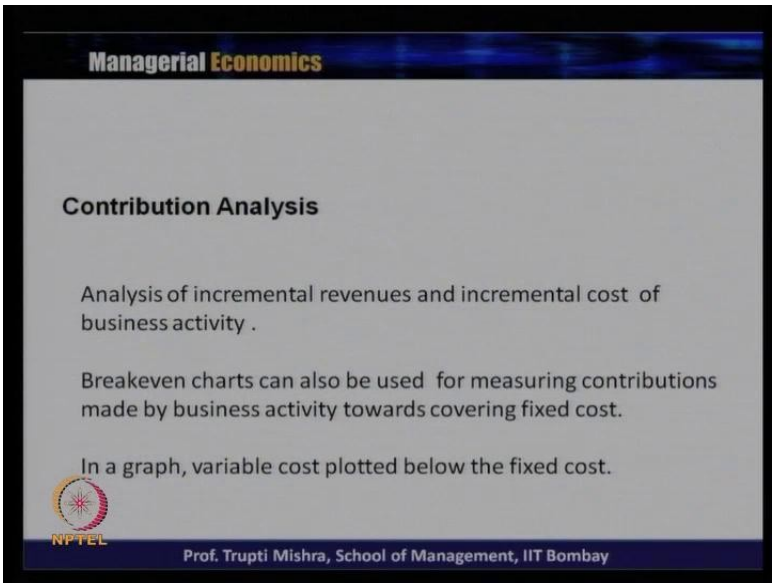


So, till the time here we are considering the total revenue total cost to understand the break even analysis, but in case of a contribution analysis we are not taking the total cost total revenue. We are taking the incremental revenue and incremental cost of the business activity. So, contribution analysis is the analysis of incremental revenue and incremental cost of business activity.

And break even charts can also be used to measuring the contribution made by business activity towards covering the fixed cost. So, through contribution analysis will use some break even charts and the what is the role of break even charts? Here the role of break even charts over here is to measure the contribution made by the business activity towards the covering the fixed cost and in the graph always the variable cost is plotted below the fixed cost.

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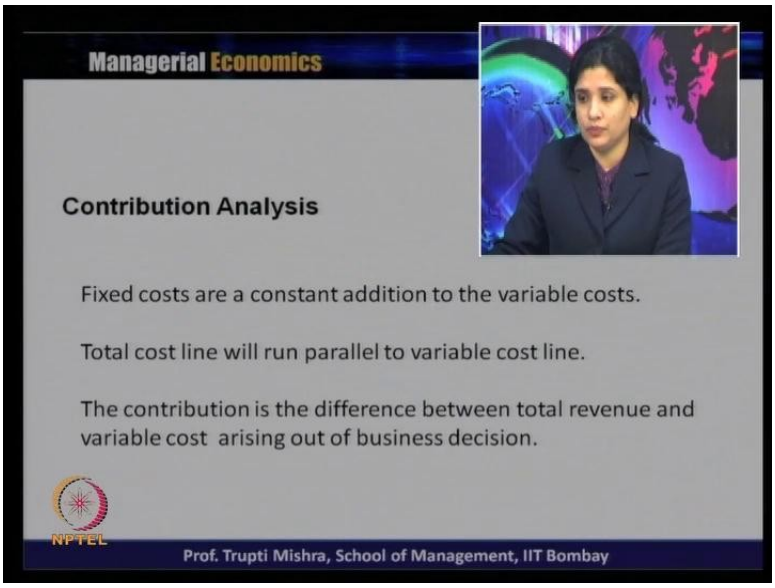


So, fixed costs are a constant addition to the variable cost. Total cost line will run parallel to the variable cost line. The change in the total cost is depend on the change in the total variable cost and the contribution is the difference between the total revenue and variable cost arising out of the business decision. So, there will the difference between the total revenue and total cost keeps us the profit and contribution which is strictly defined as difference between the total revenue and the total variable cost.

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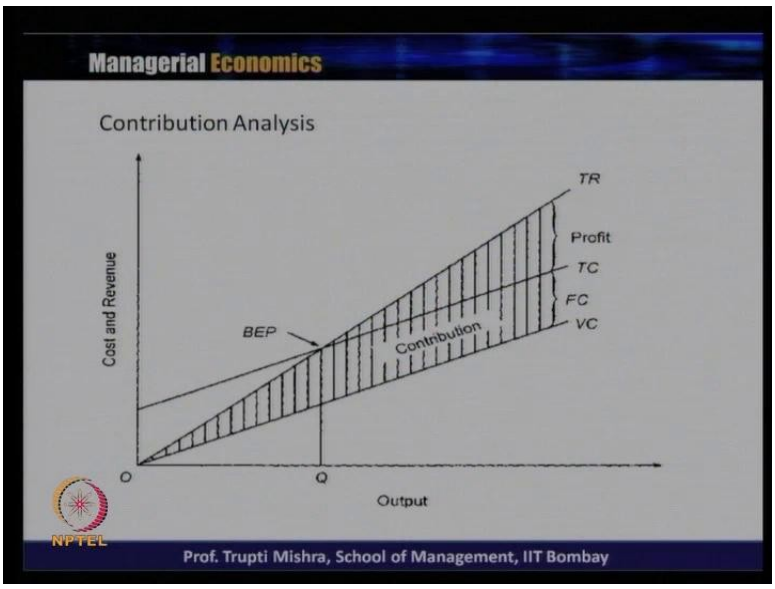

So, this is how the contribution analysis if you look at the graph, the total revenue curve is TR which starts from the origin. Total cost is the summation of the variable cost and the fixed cost that is starting at a point in the Y axis, which includes the fixed cost variable cost is starting from the origin. The total cost and the difference between the total cost and variable cost gives us the fixed cost and which is alternatively also known as the, may be, the difference between the total fixed cost and the total variable cost and total cost.

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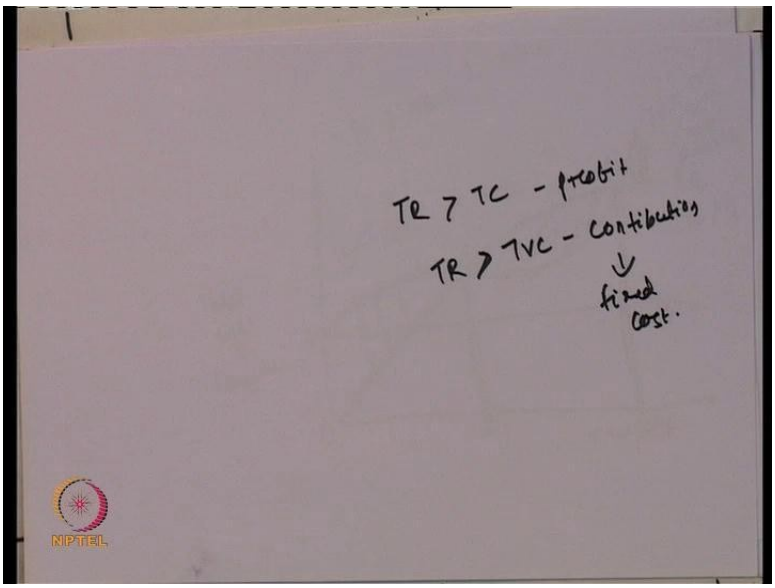


The difference between the total revenue and total cost is profit. And the difference between the total revenue and total cost is profit. And the difference between the total revenue and the total variable cost is known as contribution. This contribution is nothing, but also the fixed cost and the breakeven level. So, the breakeven level is corresponding to, if you look at the graph breakeven level is corresponding to the point q, but total revenue is equal to the total cost and the variable cost is VC and the difference between the total revenue and the total variable cost, gives us the contribution and the difference between the total revenue and total cost gives us the profit.

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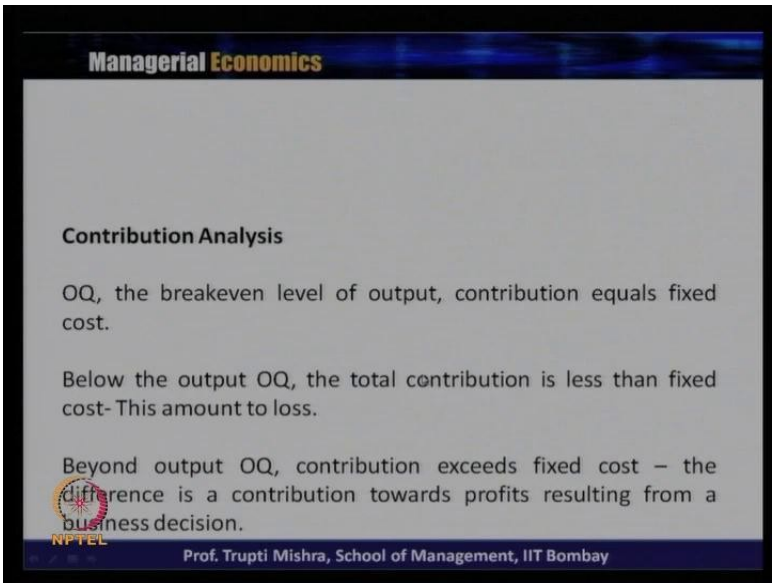


So, if you look at this graph previously *OQ* is the breakeven level of output and the contribution equals to the fixed cost below the output *OQ* to the total contribution is less than the fixed cost. That is amount of loss below this the contribution is less than fixed cost. That is the reason this is the amount of the loss and beyond this point the contribution is more than the fixed cost. And that is the reason if you look at this the case of the profit that is the contribution exceeds fixed cost. And the difference is the contribution towards the profit resulting from the business decision. So, beyond the before the breakeven level of output total contribution is less than fixed cost. So, this is the amount to loss and beyond the output *OQ* that is beyond the breakeven level of output contribution exceed the fixed cost and this is the difference in the contribution towards the profit resulting from the business decision.

So, one is before breakeven level of output. The contribution is less than fixed cost. That is the reason this leads to loss and the other point is beyond the breakeven level of output which exceeds the fixed cost. The contribution exceeds the fixed cost and this is the difference in the contribution towards the profit resulting from the business decision.

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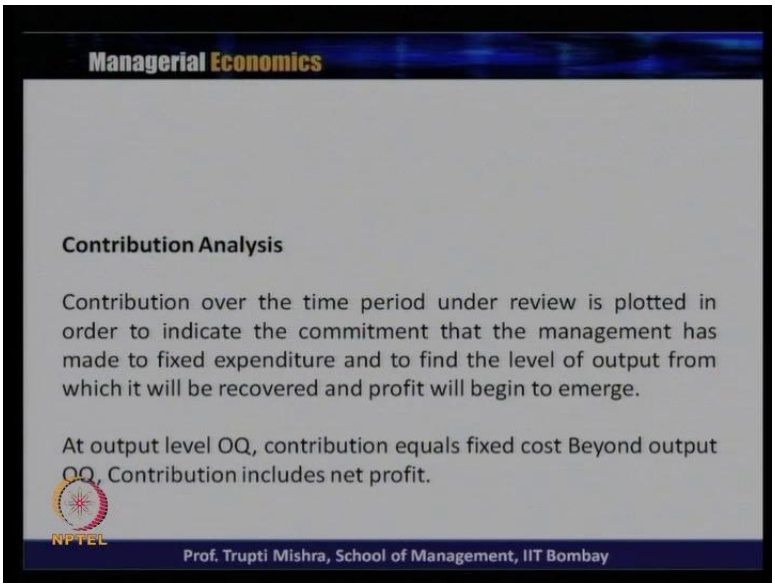


But, if you look at the contribution overtime period under the review is plotted in order to indicate to the commitment that the management has made to fixed the expenditure. Because there is a commitment, even the output leads to profitable output and not still they have to incur a certain amount of the expenditure. And to find the level of output from which it will be recover and profit will begin to immerge back will look from the contribution.

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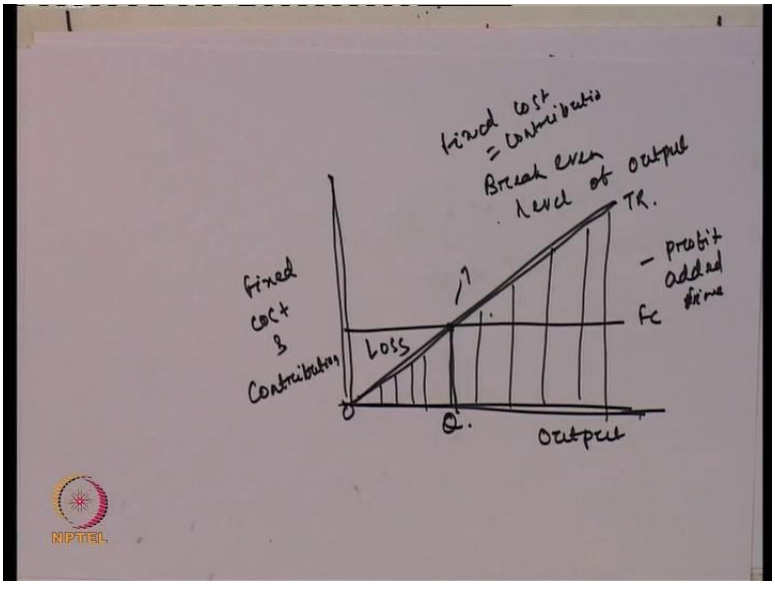

So, if you look at the graph here. So, will just draw a graph that how the contribution immerge when there is a commitment. When the management decides to or management has the commitment to made to the fixed expenditure and there we need to find the level of output from which level of output the fixed cost whatever, the contributed before that can we recover and the new level of profit can be generated.

So, we will take a total revenue curve here as a straight line. This is the fixed cost to make it simplify, we are not adding the variable cost. Here this is fixed cost and contribution on the Y axis and output and the X axis. So, this is Q and this is the contribution, but beyond the breakeven level since Q is the breakeven level of output, breakeven level of output OQ is the breakeven level of output. This is the loss because the contribution is less than the fixed cost and at the point OQ the fixed cost is equal to the contribution. And beyond this the fixed cost is less than the less than the contribution that is why this is the net profit added to the firm beyond the breakeven level of output.

So, the output level of OQ contribution equals to fixed cost before this the contribution is less than the fixed cost. That is why the firm is incurring loss and beyond this point the contribution is more than the fixed cost and that is the reason the firm is getting the profit.

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