Conservation Economics
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Module 9
Industrial organisation and Conservation
Lecture 1
The costs of production

Namaste! Today we begin a new module which is Industrial Organisation and Conservation. This module will have 3 lectures: The Cost of Production, competition and monopoly. So, let us begin with the cost of production. Now, in economics we say that people do rational decision making which means that people take into account all sorts of information that they can have access to and process that information to maximize their benefits, that brings us to the topic of cost benefit analysis.

Rational decision making is based on cost benefit analysis which means a study that compares the cost and benefit of providing a good or service. So, essentially what it says is that, everybody tries to maximize the benefits that they have while reducing the cost as far as possible. If you have maximum benefits at the lowest cost, then that is the most relational decision that can be taken.

This is the cost benefit analysis, a study that compares the cost and benefits of providing a good or a service, but herein lies a problem. When we say that the benefits need to be maximized and the costs need to be reduced as far as possible in a number of cases this reduction in cost may also have severe environmental considerations.

And we have observed a number of environmental disasters that have occurred because of cost cutting. Common example is the Bhopal gas tragedy. We shall explore the Bhopal gas tragedy in more detail in a later module but in short what was happening was that the union carbide plant was working at only 20 percent of its capacity because the insecticide that it was manufactured called 7 it was not selling at that fast phase.

And so, the plant management decided to go for fast cutting because they were having a huge stockpile of insecticide that they were accumulating. Now, this cost cutting involved things such as making of the gas methyl isocyanate, it was stored in a liquid form, but this compound was made in large quantities.

It was stored which was against the norms of the company. Then it was stored in tanks that had to be around 50 percent full of mech and the rest of the space had to be kept empty, but they were filled above the capacity. The refrigeration system was shut down to cut cost and the plant was very yield maintained because of which water entered inside the tank and it started a run-away exothermic reaction.

In a normal plant there were a number of measures that could have stopped this gas from coming out. So, if there was any gas leak then it would have led to the sounding of alarms, but then the plant in Bhopal it was not computerized did not have those sensors. Then if the gas still leaked away, then there were options of neutralizing the gas using chemicals, but then those towers were not working.

If the gas was able to pass those chemicals, then any amount that remained should have got burned in a flare tower. In a flare tower there is a flame that is kept on so that any gas that passes through it gets burned, but then this flare tower itself was not working again because of a cost cutting measure.

Because of several cost cutting measures the locals were untrained, they did not have the equipment, they did not have the resources to tackle any gas leakage. So, because of a huge number of cost cuttings the disaster occurred. The gas leaked in 1984. So, this is one environmental disaster that can be linked to cost cutting and the tragedy still continues.

There are a number of disabled people in Bhopal because of this and this was heavily documented. Another environmental disaster due to cost cutting is the love canal tragedy. In this case there was a firm that took the chemicals that were untreated industrial waste and they just dumped them into the love canal.

So, this canal was converted into a dump site and later on this site was handed over to the civil authorities for the construction of a school and so, a school was constructed on top of a dump site that was having a very huge quantity of untreated industrial effluents and a lot number of children got exposed to those chemicals. Now here again the company was only interested in doing the cost cutting, but even 35 years later it is still losing poison.

Another example is the Minamata disease. In which case the Chisso Corporation in Japan dumped the untreated methyl containing catalyst into the oceans into the seas. The fishes started to die off, the animals started to show neurological symptoms and in a short while people also started to show a large number of neurological symptoms and disabilities.

Here again the company could have installed equipment to treat the waste, but it was not done for cost cutting. Cost cutting leads to a very significant influence on the environment sacrificing health to corporate profits. Itai Itai victims settling with the mining operation release of large quantities of dioxin from this plant in severe soil or in recent past cost cutting leading to the Gulf of Mexico oil spill.

BP's cost cutting was blamed for the avoidable deep water horizon oil spill. So, in all these cases what we are observing is that cutting of cost by firms can lead to a large number of environmental disasters. But then the firms are doing this cost cutting because they seem to be racial decisions for these firms.

Because in economics we assume that everybody is a rational decision maker and in a number of cases this cost cutting does appear to be rational. This is rationality in the short term: in the long term it can have very tremendous consequences, but then in the short term people do think that these are rational decisions.

Now, because cost cutting has such huge impacts on conservation, it is prudent that we should understand what is cost, what is the cost of production and why do companies go for a cost cut-

ting. So, the firms go for a cost cutting because the firm's cost determines the profit and in this context we can define the total revenue, total cost and the profit. Total revenue is the amount a firm receives for the sale of its output - when a firm is selling something the amount that it receives for the sale of this output. When it is selling something, the total amount that it receives is the total revenue and total cost is the market value of the inputs a firm uses in production. So, to take an example let us say that there is a firm that is manufacturing some of us.

Now suppose in a day the firm sells samosas worth rupees 1,000. Now this sale has broadened a revenue to the firm which is rupees 1,000. So, they have sold samosas that have worth 1,000 rupees, but then this 1,000 rupees is not the profit of the firm because there are several costs involved.

You have the cost of the raw materials, you have the cost of electricity, you may have the cost of the workers, wages, you may have a rental cost because there is a space that has been rented to make these samosas. You can have n number of costs and suppose all these costs add up to rupees 750. So, in this case we will say that this is the cost of production and the difference between the revenue of 1,000 rupees and the cost of rupees 750 will give us the profit.

The profit is 1,000 minus 750 is rupees 250 for this particular day. So, total revenue is the amount a firm receives for the sale of its output, in this case 1000 rupees total cost is the market value of the inputs a firm uses in production. Now we are emphasizing market value because we will not say in the case of raw materials, we will just say that the raw materials is 150. We will not say in this case that the raw material is maida or it is water or it is salt, but what we are doing is that we are taking the market value of all of these and we are saying that raw material is in total 150 rupees. So, the total cost is the market value of the inputs a firm uses in production and profit is total revenue minus total cost.

Now, when we talk about the cost there are explicit costs and implicit costs. Explicit costs are input costs that require an outlay of money by the firm. The important thing here is the outlay of money such as wages to workers cost to cost of raw materials. So, in the case of explicit costs we are asking the question what are the inputs for which the firm is paying money.

The firm is paying money to buy maida, the firm is paying money to buy potatoes, the firm is paying money to get salt, the firm is paying money to workers, the firm is paying money for say electricity, fuel, rent and so on. Now, all those things for which the firm requires an outlay of money are known as explicit costs. Implicit costs are input costs that do not require an outlay of money by the firm.

So, these still are costs, but they do not require an outlay of money. Example the opportunity cost of foregone income from other sources, the opportunity cost of capital that could otherwise have earned interest. An example of this opportunity cost is say there is a person who was working in a software industry and was earning say 60,000 rupees in a month.

Now, this person leaves his job and starts a startup company to say uh manufacture spectacles. Now when the person is making spectacles in this startup, he is not earning the 60,000 rupees that he was earning in the software firm in his earlier job. Now this 60,000 rupees is something that this person has given up to start the startup.

This 60,000 rupees is an opportunity cost that has been given up and so, we will count this as an

implicit cost in making of the spectacles. So, this is an input cost that does not require an outlay of money by the firm. So, the spectacles firm will not say that we have forgone this 60,000, but then this is a cost for this person. Another example is the opportunity cost of capital that could otherwise have earned interest.

Suppose this person, to make his spectacles factory, spends say 20 lakhs of rupees to get the space and to get certain equipment. Now this 20 lakhs of rupees had he not invested it in making of uh this startup firm could have been say put into a bank and in that bank this money would have earned certain interest.

When this money is being used for the startup firm, then the person is losing out on that interest that this capital would have earned otherwise. So, this again is an implicit cost. So, this is a cost that this person is paying, but this is not a cost for which the firm will put up an outlay of money. So, this is an implicit cost.

Depending on whether we include the expense, the implicit cost or not in the computation we have two different kinds of profit. Now economic profit is defined as total revenue minus total cost including both the explicit cost and the implicit cost.

Which means that, if the person who is starting this startup, suppose in the first month the earnings or the revenue is rupees 1 lakh and the cost of inputs that is the cost of the raw materials, electricity, payment of wages and so on is rupees 30,000. So, this is the explicit cost. Now, let us look at the implicit cost. This includes the 60,000 rupees that he otherwise would have earned in the software firm plus say 20,000 rupees that he would have earned as an interest.

In this case we will say that the implicit cost in total is 80,000 rupees. Now when we talk about the economic profit, we are saying total revenue minus total cost which is in this case the total revenue is 1 lakhs of rupees, total cost is 30,000 plus 80,000. So, in this case the total cost is rupees 1.1 lakh.

Now, this is the total cost and this is the total revenue 1 lakh. In this case we will say that the economic profit is rupees 1 lakh minus rupees 1.1 lakh is minus 0.1 lakh rupees. In this case what we have computed is that, the economic profit is minus 0.1 lakh which means that this person is at an economic loss because the profit is negative whereas, the accounting profit is total revenue minus total explicit cost.

Total revenue is 1 lakh of rupees. This is the total revenue total explicit cost is 30,000 rupees and so, we will say that the accounting profit is 1 lakh minus 30,000 rupees is 70,000 rupees. So, this person is earning an accounting profit of 70,000 rupees, but an economic profit of minus 10,000 rupees. So, there is a big difference between the profit or loss that a person would feel when there is a computation being done on an accounting basis or on the economic basis.

In this case the accountant might say that ok this person every month is earning 70,000 of rupees. So, this person should continue to be in this startup, but the economist would say that no this person is actually suffering a loss of 10,000 rupees every month because had he not set up this startup, probably he would have been working in the old company earning 60,000 rupees from there and getting 20,000 rupees out of the interest income from the money that he kept in the bank which now he has spent in making of the startup.

And so, in that case he would have earned more in the previous position as he is earning in the

current position. And so, there is a big difference between economic profit and accounting profit. That is when we are taking an economic versus accounting view, if we talk about the total revenue. So, in both the cases total revenue remains the same, explicit cost remains the same, but when we take an economic view of a firm, we also deduct the implicit cost from the total revenue to get an economic profit.

Whereas, in the case of an accounting firm they do not incorporate the implicit cost and so, the accounting profit in a number of cases is much greater than the economic profit. Now this distinction between economic view and accounting view has a very big bearing for conservation because say a company or a firm that is manufacturing goods and is polluting the environment. Now how would this uh the accountant and the economist view such a firm?

Now let us say that the net revenues of this firm are rupees 10 lakhs and the explicit cost is say rupees 3 lakh, but then when the firm say does not install a device to control the pollution, it also harms the environment because of pollution and the harm to the environment is say rupees 5 lakhs. Now the economist would say that this harm to the environment is leading to an implicit cost because if the environment was not harmed, then probably this 5 lakhs would have been accrued to the society.

This is an implicit cost. Now this harm to the environment could probably have been removed by installing a pollution controlling device, which would have caused the company 1 lakh of rupees. Now let us look at the view of this firm from an accounting point of view. From an accounting point of view the accountant would say that the net revenues are 10 lakhs, the explicit cost is 10 lakhs, but if we install this device then the explicit cost would be 3 lakhs plus 1 lakh is 4 lakhs.

The explicit cost increases when the pollution controlling device is installed and currently the profit is 10 minus 3 lakhs is 7 lakhs, but if this device gets installed then because there is an extra explicit cost then the profit will come down to 6 lakhs and in this case the accountant would say that oh this company should not install this device whereas, the economist would say that currently the total cost which is the explicit cost plus the implicit cost is 8 lakhs.

If the device gets an explicit cost, we will forego this implicit cost. So, when once the device gets installed then the total cost would be 3 lakhs of the explicit cost today plus 1 lakh is 4 lakhs, but we will be saving on this 5 lakhs and so, the profit would be 10 lakh minus 4 lakh is 6 lakhs, but currently the without the the device the total cost is 8 lakhs of rupees and so, the net profit is 10 minus 8 is 2 lakhs.

Currently the profit is 2 lakhs with the device it will increase to 6 lakhs. So, the economist would say that the firm should install this pollution controlling device. Now in both of these cases we are doing rational decision making, we are doing a cost benefit analysis, but when we incorporate all the explicit and all the implicit costs then we have a much better picture of what the firm is doing to the society and in that case our decisions will be much better.

When we look at things from the accountant point of view, we do not incorporate the implicit costs and in such a scenario in a number of cases it is possible that we will take a decision that will not be in the best interest to ourselves or to our society. Now, similar to the example of the person who left his software job and started a startup, in that case the accountant will say that this person is earning a profit and so, he should continue in this startup whereas, the economist

might say that no he was in a much better position earlier.
Similarly, in this case the accountant will say that this device should never be installed because it will bring down the accounting profit because it will increase the explicit cost by 1 lakhs of rupees. But the economist would say that by increasing the explicit cost by 1 lakh we are saving 5 lakhs in the implicit cost. So, there is a net saving of 4 lakhs of rupees which is much better. So, this is why we need to understand the difference between the economic view and the accounting view.
Now, when we are doing this cost benefit analysis another thing that we need to keep in mind is the marginal product. Marginal product is the increase in output that arises from an additional unit of input. So, now, what we are trying to do is, we are asking how much of things should be produced. So, there is a cost of production we have implicit cost we have explicit cost there is a profit.
Now, the thing is, should we make more and more of this stuff or is there a limit to which we should be making this stuff? How do we decide that? So, for that we are now getting into how much to produce. So, in this context we can talk about a marginal product which is the increase in output that arises from an additional unit of input.
A good example is this firm that is making samosas. Now if the number of workers is 0 in that case the total output is 0 because there is nothing that is being made, but in this case there will be certain fixed cost because even when you are not producing this the samosas even then you have installed the machines you are paying the rent for the land and so, there are certain fixed costs. So, the fixed cost remains the same whether you make the product or not.
Now, if the firm employs 1 worker and the output of samosas now becomes 50. Now the marginal product would ask the question: how much is the increase in the output because of one additional unit of input? In this case the input is the labour. So, the marginal product of labour in this case is 50 minus 0 is 50.
If the firm employs two workers and the samosa output increases from 50 to 90, then the marginal product will be the increase in the output that is 90 minus 50 because of an additional unit of input. The marginal product in this case becomes 90 minus 50 is 40 and so on. With each additional input of a worker there is a change in the output marginal product is asking the question how much is this change.
So, the marginal product is the increase in output that arises from an additional unit of input. Now this input can be anything, this input can be in terms of the workers that are employed, this input can be in the terms of raw materials, it can be in terms of the number of machines that are installed in the factory and so on.
But for any input when we increase the input by 1 unit what is the net increase in the output is what marginal product is asking. And in the case of marginal product we normally observe a diminishing marginal product which is the property whereby the marginal product of an input declines as the quantity of input increases. What we are saying here is that when the number of workers is increasing from 0 to 6, the marginal product is reduced in each case.
That is when you increase the number of workers from 0 to 1, you get a much greater increase in the marginal product than when you increase it from 5 to 6. So, in this case from 0 to 1 you are

getting a marginal product of 50 whereas, when you increase it from 5 to 6 you are getting a marginal product of only 5. So, this is the law of diminishing marginal product.

The property whereby the marginal product of an input declines as the quantity of the input increases. That is when we plot the number of workers on the x axis and the marginal product on the y axis, the marginal product with increasing number of workers goes down and there are several reasons for this. One is that there can be crowding in the factory.

Earlier each worker was getting sufficient space to work, but now because of the overcrowding people are not getting sufficient space to work, sufficient space to move. That would reduce the efficiency of every worker because earlier the worker could move from point a to point b say in 30 seconds, but now because there are 5 people standing between point a and point b and this worker has to negotiate the path.

In place of 30 seconds now he is taking say 2 minutes and so, the output per unit time will go down. Another reason could be insufficient access to equipment. So, probably there is only a single mixer in this factory and so, when there was only 1 worker, this worker was having 100 percent access to the equipment.

But now what is happening is that when this worker - when you have 6 workers and when 1 worker is going to that equipment he finds out that there are two people already in the queue. So, now, he does not have sufficient access to the equipment. At the same time another reason could be things like chit chats.

With more people there is more chit chatting and so, the people are not putting up that much amount of output as they were doing without the chit chats. So, there is a certain amount of social loafing. But the thing to remember is that we have a law of diminishing marginal product. As you increase the amount of input the marginal output of or the marginal product of the input would go down.

Another concept here is the production function which is the relationship between the quantity of inputs used to make the good and the quantity of output of that good. That is what we are asking here is that when the input increases like this. How does the output increase? So, here we have it in the form of a table, but we can plot it in the form of a production function.

The production function is telling us that as the number of workers increases, the output increases from 0 to say around 160, but the shape of the curve is telling us that earlier when the number of workers was increasing the output increases at a much faster pace, but later on it is now getting more and more leveled which is another way of showing the law of diminishing marginal product.

The increase in the output at this point because of an additional worker is much less than the increase that we were getting at this point. So, typically the production function looks like this. Earlier we have a large increase in the output when the input is increased, but later on it becomes more and more flat enough and we can also plot the total cost curve now total cost.

If the output increases there will also be a change in the total cost. Why? Because in any firm we have a certain fixed cost now fixed cost will remain the same for any amount of output. So, even when the output is increasing from 0 to 155, the fixed cost remains the same, but then to increase this output we are also employing certain labour, certain workers.

The cost of these workers will go on increasing with the number of workers because, say the wage rate is 10 units of money per worker. So, if only 1 worker is employed then the cost of the worker is 10, if 2 workers are there then the cost is 20, 6 workers are there the cost is 60.

This is a variable cost that we have. So, we have fixed cost here variable cost and the sum of the fixed cost and the variable cost will give us the total cost. So, when no worker is being employed then the fixed cost is 30 rupees, the variable cost is 0 rupees and so, the total cost becomes 30 when 1 worker is employed then fixed cost plus 30, the variable cost is 10, and so, the total cost increases to 40 and so on.

In this particular example we are not talking about the cost of the other inputs because we are looking at only one input. So, the total cost increases as the output increases and with this we can plot the total cost curve. Now here on the x axis we have the output. It increases from 0 to close to around 160 and we have the total cost.

As the output increases the cost also increases mainly because of the variable cost because the fixed cost remains the same, but the variable cost increases, but in the case of the total cost curve we will observe that the curve starts in a flatter manner and then it starts to increase at a very fast rate. Because here again what we are observing is that because of the law of diminishing marginal product to increase the output from 140 to 160 we will require a very great amount of input.

Because now the inputs are not working that hard, they are not giving that high an output whereas, when we increase the output from 0 to say 50, the costs involved are really less because the inputs are putting up a very large amount of output.

As the inputs are increased their marginal product decreases because of which for any additional amount of output we will need to put up a very large amount of input which would also mean that we would have to spend a very large amount of money. So, the total cost increases, it increases more gradually in the beginning, but later on it increases at a very fast pace. So, this is the total cost.

And total cost includes the fixed cost and the variable cost. Fixed costs are costs that do not vary with the quantity of output produced such as the cost of rent, the cost of security and so on. Whether the firm produces 0 samosas or whether it produces 150 samosas in an hour the rental cost of land will remain the same.

The cost of security will remain the same because even when the production is going up you do not have to employ a larger number of security guards, but even when you are not doing any production, you will still require the security guards to protect the equipment to protect the premises.

The cost of security is a fixed cost. Then we have variable costs. Costs that vary with the quantity of output produced such as the cost of raw materials, the cost of wages and so on. So, if the firm is producing less number of samosas it requires less number of potatoes, it requires a lesser quantity of maida, it requires lesser number of workers, it requires lesser amount of electricity, but when it is producing a larger quantity of samosa, then it requires a larger quantity of all of these.

This is a variable cost: a cost that varies with the quantity of output that is produced. Total cost is

fixed cost plus marginal plus variable cost and marginal cost is the increase in total cost that arises from an extra unit of production. So, what we are asking in the case of marginal cost is that, if you increase the output by 1 unit if you want to increase the output by 1 unit what is the cost involved to increase that? Now the cost in this case is smaller and the cost to increase 1 unit of production in this case is much larger.

The marginal cost in this case is increasing with the output. So, marginal cost is the increase in the total cost that arises from an extra unit of production. Now we take a firm example. Let us look at the cost of a firm that is making coffee and in this case when the number of coffee cups per hour increases from 0 to 10 the fixed costs remain the same, the variable cost goes on increasing and the total cost is given as fixed cost plus variable cost.

In this case for 0 cups of coffee we have a fixed cost of 3, variable cost of 0. So, total is 3 for 1 cup of coffee, the fixed cost is 3, the variable cost is 0.3. So, the total cost is 3.3 for 2 cups of coffee that becomes 3.8 and so on. This is the total cost. The marginal cost is the cost of increasing 1 unit of the output. From 0 to 1 when the number of coffee is increased from 0 to 1 the total cost increases from 3 to 3.3.

And so, the marginal cost of 1 cup of coffee in this case is 0.3. 3.3 minus 3 is 0.3, but when it increases from 1 to 2 then the total cost increases from 3.3 to 3.8 which means a marginal cost of 0.5 when you subtract 3.3 from 3.8 you get 0.5. So, here the marginal cost is 0.5. The cost of making an additional cup from 2 to 3 is 0.7. So, here we are observing that the marginal cost is increasing.

If we plot these costs we will find that the fixed cost remains the same, say 3 rupees, whether the firm is making 0 cups of coffee or it is making 10 cups of coffee. So, the fixed cost remains the same; it is a flat line. The variable cost shown in green increases with the number of cups because with more cups you require more sugar, more water, more milk, more coffee.

The variable cost goes on increasing. If you look at the total cost then total cost because it is the sum of the fixed cost and the variable cost it will also increase because fixed cost is the same variable cost is increasing and so, total cost will also increase. And when we look at marginal cost we are asking the question: what is the difference from this point to this point in terms of cost?

What is the difference from this point to this point in terms of cost? And in this case we are observing that the marginal cost is increasing. To make an additional unit of coffee an additional cup of coffee the costs are increasing. Earlier we required a lesser cost to make a cup of coffee or to increase the production of coffee by 1 unit, but later on we require much more money to make an additional cup of coffee.

Now, this is because of the law of diminishing marginal product because our inputs that we are buying from uh the cost they will not be giving out that large an output. So, these are the costs. Now we can also look at the average cost. So, we have the average fixed cost which is the fixed cost divided by the quantity of output.

In this case the fixed cost is the quantity of output when it increases we can find out the average fixed cost, another one is average variable cost which is the variable cost divided by the quantity of output. The third is the average total cost which is the total cost divided by the quantity of out-

put and the fourth cost is the marginal cost which is the change in the total cost divided by the change in the quantity of output.

In this case we have a fixed fixed cost, we have an increasing variable cost and so, the total cost is also increasing. Now in finding out this uh average cost, for average fixed cost we do 3 divided by 1 is 3 in the next line we have 3 divided by 2 is 1.5. So, the fixed cost is remaining the same. So, in this case the numerator remains the same fixed cost, but the denominator is increasing.

And so, the average fixed cost rate goes on decreasing. What about the variable cost? The variable cost for making 1 cup of coffee is 0.3. So, the average is 0.3 to make 2 cups of coffee it is 0.8. So, the average variable cost is 0.8 divided by 2 is 0.4, to make 3 cups of coffee the variable cost is 1.5. So, the average is 1.5 divided by 3 is 0.5 and so on.

And here we are observing that the average variable cost is increasing. Now the average variable cost is increasing because of the law of diminishing marginal product. Now if we look at the average total cost. So, we have this total cost divided by the number of cups of coffee. So, 3.3 divided by 1 is 3.3 1.5 3.8 divided by 2 is 1.9, 4.5 divided by 3 is 1.5 and so on.

Average total cost is the total cost in that particular row divided by the number of cups of coffee and that would give us the average total cost. Marginal cost is an increase in the total cost divided by the increase in the number of cups of coffee. So, for each increase for each additional cup of coffee what is the cost involved?

Here we can find out the marginal cost by dividing the value in this row by the value in the previous row. So, 3.3 minus 3 is 0.3 3.8 minus 3.3 is 0.5 4.5 minus 3.8 is 0.7 and so on. So, in this case we can find out the average fixed cost, the average variable cost, average total cost and the marginal cost.

This is how it looks when we plot them. The red curve is showing us the average fixed cost. Now the average fixed cost goes on decreasing. The average fixed cost decreases from 3 to 1.5 to 1.1 and so on. It is going to decrease, which is what we are observing here. The average fixed cost is going on decreasing, but earlier the decrease is very large and later on the decrease is much lesser.

Now, this is because in the case of the average fixed cost is the fixed cost divided by the amount of output. Now earlier what we are seeing is 3 divided by 1 or it is 3 divided by 2 and 3 divided by means 3, 3 divided by 2 is 1.5. So, there is a large change from 3 to 1.5, but when we do say 3 divided by 9 and 3 divided by 10. So, 3 divided by 9 is 1 by 3 is 0.33 and 3 divided by 10 is 0.3.

Here the change is very less the the change is the only 0.03 whereas, here the change was much larger it was 1.5, which is what we are observing here in this curve that earlier the fixed cost it decreased by a very large amount, but later on the change is very less because the denominator is increasing the numerator is kept fixed the denominator is increasing and the impact of this increase in denominator will be much built in the beginning than at the later stages.

The average fixed cost goes on decreasing. The average variable cost and the marginal cost go on increasing with the number of cups of coffee per hour because of the law of diminishing marginal product. Now to make each additional cup of coffee we require more of the inputs because now the inputs are not working that hard and that would increase both the marginal cost and also

the variable cost.
The variable cost and the marginal cost go on increasing. The average total cost decreases in the beginning and later on it increases. Now the decrease in the beginning is because of the decrease in the average fixed cost. Now what we are observing here is that the total cost is equal to the fixed cost plus the variable cost.
The average total cost is the total cost divided by the output. So, if we divide the whole of the additives also by output we will get this. Now TC by Q is the average total cost is equal to the fixed cost by Q is the average fixed cost plus the VC by 2 is the average variable cost. So, the average total cost is equal to the average fixed cost plus the average variable cost.
As the number of cups of coffee increases we find earlier a very great decrease in the average fixed cost. The average fixed cost decreases very quickly, but at later stages it will decrease at a very less amount. So, we can say that after a while it will tend to become constant, but earlier it decreases very fast.
But the second component is the average variable cost. Now the average variable cost goes on increasing. Now in the beginning when we look at the average total cost the average fixed cost is very high the average variable cost is very less. So, in the beginning what we are observing is that in the beginning the average fixed cost is very much greater than the average variable cost.
The average fixed cost shown in rate is very much greater than the average variable cost and so, the average total cost is roughly equal to the average fixed cost because in this case we can neglect the average variable cost. But later on what happens, the average variable cost becomes very much greater than the average fixed cost which is what we are observing here.
The average variable cost because the average variable cost has been increasing with more cups of coffee, it has increased to a large value whereas, the average fixed cost has continued to decline in its value. So, later on the average fixed cost is less, the average variable cost is very high and so, we can write that the average total cost is approximately equal to the average variable cost.
Because later on we can say that we can neglect the average fixed cost because the average variable cost is very high. So, we can neglect the average fixed cost.
Now, in the beginning what is this telling us, if we look at the curve in the beginning the average total cost is roughly equal to the average fixed cost which means that when the average fixed cost decreases then the average total cost also decreases because it is roughly equal. So, the average total cost is roughly equal to the average fixed cost because we can neglect the average variable because they are very less.
In this case when the average fixed cost will decrease the average total cost will also decrease, but later on the average variable cost are high and the average fixed cost are less and so, the average total cost is roughly equal to the average variable cost which means that, when the average variable cost increases the average total cost will also increase.
In this case we can see that in the beginning the average total cost shows a decreasing trend, but later on it shows an increasing trend which is what we are observing here the average total cost earlier it shows a decreasing trend, but later on it shows an increase in trend which means that there is some point somewhere that is the minimum of the average total cost. Because before this

point we are observing that it is going down. After this point it is increasing which means that there should be a minimum.

What we can see here is that the marginal cost rises because of the diminishing marginal product, the average fixed cost decreases because of fixed cost by increasing the quantity of output, the average variable cost rises because more inputs are required for the output, but the average total cost is U-shaped because earlier it lowers because of reducing average fixed cost and later on it rises because of the increasing average variable cost.

And the point where we have the minimum of the average total cost that gives us the efficient scale. Efficient scale is the quantity of output that minimizes the average total cost which means that when you look at this curve, then this point. So, at this point the average total cost is minimum.

This quantity, which is 6 cups of coffee, we will say that this is the efficient scale because this quantity of output minimizes the average total cost. So, the average total cost is the least at 6 cups of coffee, but then how do we reach this lowest value? Is there any correlation between all of these costs?

So, we can find out that the relationship between the marginal cost and the average total cost is that the marginal cost curve cuts the average total cost curve at the efficient scale where the average total cost is the minimum. Now why is that so? When we talk about the marginal cost, the marginal cost is the cost of producing an extra unit of coffee, the increase in cost for making one more cup of coffee. Now in this case before this point say. So, to the left of this point the marginal cost is less than the average total cost which means that if one more cup of coffee is produced then the average total cost will further reduce.

Whereas, to a point to the right of this the marginal cost is more than the average total cost. So, when the marginal cost is more it means that to make an extra cup of coffee it will now cost more than the average total cost which means that at this point to the right of this efficient scale, we will find that the average cost will increase.

It is decreasing here, it is increasing here. At this point where both of these curves are, it should be the minimum of the ATC line. So, the marginal cost curve cuts the average total cost curve at the efficient scale where the average total cost is the minimum because to the left of this point the marginal cost is less than ATC and the ATC is falling to the right of this point because it has cut here.

To the left it is less than ATC, to the right it is more than ATC. To the right of this point the marginal cost is greater than ATC and the ATC is rising. To the left it is falling to the right it is rising. So, the point has to be the minimum. This is the relationship between the marginal cost and the average total cost curve, that the marginal cost curve cuts the average total cost curve at the efficient scale.

And this also brings us to the economies and diseconomies of scale. Economies of scale is the property whereby the long run average total cost falls as the quantity of output increases which means that when we talk about economies of scale it makes more sense for the company for the firm to produce more output because when the output is more the long run average total cost falls a good reason is because of specialization.

So, different components that are required to make the product are brought together and so, the output increases. Diseconomies of scale is the property whereby the long run average total cost rises as the quantity of output increases because of problems in coordination and a constant return to scale is the property, whereby the long run average total cost stays the same as the quantity of output changes.

What we are saying here is that, in the case of certain firms which show economies of scale, what happens is that with more production, more and more specialization is brought in which increases efficiency because of which the average cost further reduces. So, the larger the firm, the lesser the average cost in the case of diseconomies of scale the larger the firm the larger is the problem of coordinating different units and so, the larger it becomes the more the cost will rise.

So, different firms will show different tendencies, some will show the economies of scale, some will show diseconomies of scale and some others will show a constant rate return to scale.

To summarize, costs determine the levels of profits. At the market equilibrium the firm with the lowest cost will have the largest profits and will be a winner in the competition between different firms which is why every firm wants to be a winner and so, it tries to lower the cost.

And this is the reason why firms try to cut the cost even at the risk of environmental damage.

That is all for today. Thank you for your attention. Jai Hind!

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Module 9
Industrial organisation and Conservation
Lecture 2
Competition

Namaste! We move forward with our discussion on Industrial Organization and Conservation and in this lecture, we shall have a look at Competition. So, we will begin with a recall. Rational decision making is based on cost benefit analysis which is a study that compares the cost and benefit of providing a good or a service.

What we are saying here is that rational decision making, which is the basic assumption that we make in the case of theoretical economics, it says that the rational decision making is based on a cost benefit analysis; what is the cost of doing something and what is the benefit that we are going to receive by doing that activity.

This brings us to the concept of profit and profit is defined as total revenue minus total cost. For a firm the profit is the benefit. When the firm is making a decision which is a rational decision, then it bases its decision on the amount of profit that it is going to receive.

We also had a look at a competitive market. Competitive market is a market in which there are many buyers and many sellers so that each has a negligible impact on the market price. Essentially what happens in the case of a competitive market is that there are so many buyers.

And so many sellers that any one buyer or a group of buyers or any one seller or a small group of sellers is not able to make a big change in the market prices. Which means that, these people are price takers, that is the buyer will have to take the price that is being offered in the market and the seller will have to sell at the price that is being offered by the market.

We also had to look at the characteristics of perfectly competitive markets 1 - goods offered for sale are exactly the same. 2 - there are so many buyers and sellers that no single buyer or seller has any influence over the market price; all buyers and sellers are price takers.

This is a very important statement that you should remember that in a competitive market all the buyers and sellers are price takers. At the market price, the buyers can buy all they want and the sellers can sell all they want and this is because there are so many buyers and sellers that if a buyer is ready to procure the goods at the market price.

Then there are so many sellers that he can buy an indefinite amount of goods and similarly if there is a seller who is ready to sell things at the market price, then there are so many buyers that he can sell as many things as he wants. Then another characteristic is perfect information transfer regarding prices which means that the buyers and the sellers know at all times what the prevail-

ing market prices are.
Now, this is very important because the buyer is not spending time and energy and effort in finding out at what rate different sellers are selling the things. So, he gets this information in an instant. So, this is an assumption that we make in the case of a competitive market. Similarly, the seller knows at an instant what is the price at which different buyers are ready to buy the goods.
When that happens the biggest thing is that the seller can sell the goods to the buyer who wants to pay or who is ready to pay the maximum amount. And, because this thing can happen in an instant so, if there is any buyer who wishes to buy at a price that is greater than the market price, then so many sellers will be ready to supply him the goods that it will bring his price down.
Which means that, suppose, I go into the market in a fairly competitive market, and I see that there is this pen that is being offered. Now, I am ready to pay as much as 20 rupees for this pen, but the prevailing market price is 15 rupees.
If I say that I want to purchase 20 pens for 20 rupees each. What will happen is that there will be so many sellers who will be ready to supply me these pens at 20 rupees that I will start to think that ok if 20 probably I am offering them a bit too high a price. So, let me offer them 19 rupees because at 20 rupees there are so many sellers.
So, basically I can have say lakhs and lakhs of pens for 20 rupees and remember that the goods that are being offered are the same, that is they have the same quality. So, when I am offering 20 rupees there are a very large number of sellers and I have so many pens that I can purchase.
Similarly, at 19 rupees, a few sellers would go away because their cost of production is greater than 19 rupees. So, in that case those sellers will go away, but still I have a very large number of sellers and then I will bring my cost down to 18 rupees, then 17, then 16, then 15, and even at 15 rupees I am finding that there are so many sellers who are ready to sell me the product.
But, then when I bring it to a value that is less than 50, less than the market price say I say that I am going to pay 14 rupees and 99 paise and that case I will find that there is no seller who is ready to offer me this pen for 14 rupees and 99 paise and why is that so?
Because there are so many different buyers that there will be some buyers who will be ready to pay 15 rupees. So, the seller in that instant will shift away from me and offer the goods to the other buyer. That is, at any price that is less than the market price or the market equilibrium price, there is no seller who is ready to give me the goods.
And, at any price that is equal to or greater than the market price I can have as many goods as I want and so, the equilibrium is reached very fairly quickly because there is a free flow of information in an instant. So, if I offer anything more than 15 rupees there will be so many sellers that I will think because here again I am a rational decision maker.
Every buyer and every seller is said to make the decisions on a rational basis. So, when I am offering 16 rupees and there are so many sellers I will start with this question that ok can I bring my welfare up? Because the consumer surplus is determined by the price that the buyer is going to pay if I am paying a higher price, then my consumer surplus is less.
So, I will try to bring down the price to increase my consumer surplus and so, I will move from 20 rupees to 19, 18, 17, 16 and 15. But, then at any price that is less than 15 rupees I will find no sellers because they will be offering their goods with the other buyers and in that case in a very

quick instant I am able to reach the market price and, similarly in the case of a seller.
Now, if there is a seller who is ready to sell the pen at the market price that is 15 rupees he or she will find n number of buyers. If the seller is ready to sell the product at 14 rupees, then he will have so many buyers that again with the rational thinking the seller would start to think ok can I increase my producer surplus.
And, the producer surplus of the seller would increase when the price goes up. So, at 14 rupees the seller would say that ok there are so many buyers, let me offer them 14 rupees 50 paise. He will still find so many buyers, then he will slowly and steadily bring the price up to 15 rupees and even at 15 rupees there are so many buyers.
But when he increases it from 15 rupees to 15 rupees 1 paise, suddenly there are no buyers because all the buyers are ready to buy the product from the other sellers because remember there are so many buyers and so many sellers. And, so, this criterion of a very fast moment of information ensures that the competitive market works properly.
So, this is again a very important criteria. A perfect information transfer regarding the prices and when we say perfect it is not just accurate, but it is a keep information transfer and a fast information transfer. Then there has to be well defined property rights. Free entry and exit into and from the market.
Because if there are buyers who find that the prices are too high, then they can go out; if there are buyers who are ready to buy at this price, they can enter into the market there is no restriction. Similarly, the sellers who find that their costs are less than the market prices so, they can earn a profit they will enter into the market.
Those sellers whose cost of production is very high will exit from the market. So, in the case of a competitive market because we have a very large number of buyers and sellers and we want to maintain that condition. So, there is also a free entry and exit from the market. Then there is rationality: both buyers and sellers try to maximize their utility and there are zero transaction costs.
And, when we say zero transaction cost it means that as a buyer if I go from one seller to another seller it should not be the situation that one seller is near to me and another seller lives 10 kilometres away. Because in that case the cost of moving from point A to point B will also enter into the computation.
And, so, when we are making the model of a competitive market we say that there are no transaction costs. The buyer and the seller are able to reach each other; make all their negotiations in an instant without paying any amount for it.
So, there are no transaction costs, no cost of moving from one place to another and no cost of getting the information or transmitting the information. This is what a competitive market or a theoretical competitive market on a model of competitive market will look like. So, these are the characteristics.
And, we also saw that competition is beneficial because it permits everyone to specialize in what they have the highest comparative advantage in. And, comparative advantage is the ability to produce a good at a lower opportunity cost than another producer.
Now, when people are doing a specialization and they are producing things in a way that they have the highest comparative advantage in effect it brings down the prices. So, it increases the

efficiency because different people have a comparative advantage in doing different things and through the specialization people do what they have the highest comparative advantage. So, in effect it brings down the prices for everybody.

Second, competition increases efficiency or the property of the society getting the most it can from the scarce resources. Now, this is because people are doing what they have the highest comparative advantage in which means that they are doing everything very efficiently and so, the cost of producing anything is very less.

So, the resources that the society has are able to generate the largest quantity of goods and services. So, which is beneficial to the society and specialization and efficiency reduce prices which also benefits the consumers.

Now, let us talk about how a firm is going to decide how much to produce, at what rate to produce and how to produce. Now, we have seen before that whenever a firm is doing production, they do it through rational decision making looking to maximize their profits.

That is they want to sell at the highest prices and make things at the lowest possible prices maximizing their profits and profit is total revenue minus the total cost of production. Now, total revenue is given as TR or total revenue is equal to P into Q, where P is the price at which the goods are sold and Q is the quantity of goods that are sold.

Essentially if there are say 100 pens that are sold at 20 rupees each, then we will have that 100 pens is Q and 20 rupees is P and the total revenue is given by P into Q which is 20 into 100 is 2000 rupees. So, this is how we find the total revenue. Total revenue is P into Q.

Average revenue is defined as average revenue is total revenue divided by the quantity of goods sold, AR is TR divided by Q. Now, average revenue is more used when we are talking about a situation when goods are sold at different prices.

Basically if we say that out of these 100 pens we had say 90 pens that were sold at 15 rupees and if we say that we have 10 pens that were sold at 20 rupees. In that case total revenue would be 15 into 90 plus 20 into 10. This would be total revenue and average revenue would be given as total revenue divided by the quantity.

In our case what we are saying is that the price is constant. So, in this case when we write the total revenue is P into Q. And, average revenue is total revenue divided by Q, then we will find the total revenue divided by 2 is P into 2 divided by 2 which is P.

So, the average revenue is the price at which the goods are being sold. Now, this is something that is applicable in the case of a competitive market because the price is constant. But, in the case of other markets we will have an average revenue that is different from the price.

Then we also have marginal revenue, the change in the total revenue from an additional unit sold. In this case, the question that is being asked is that the seller is selling 100 pens at 20 rupees each. Now, if the seller in place of selling 100 pens is now selling 101 pens, and suppose, the 101 pens are sold at 21 rupees.

In that case the marginal revenue will be given by difference in the total revenue divided by difference in the quantity. In this case, this. What we are saying here is that the total revenue earlier, let us say that we are writing TR one is 100 into 20 is 2000.

Total revenue 2 is when the seller is selling 100 pens for 20 rupees and 1 pen for 21 rupees. So,

the total is 2021 rupees. Now, in this case delta TR will be given by TR 2 minus TR 1 is 2021 minus 2000 is 21 rupees. So, the change in the revenue is 21 rupees and the change in the quantity is 101 pens minus 100 pens which is 1.

In this case the marginal revenue will be given by 21 rupees. Now, this is a theoretical construct, but when we are talking about a perfectly competitive market in that market everybody is a price taker. The seller is a price taker.

The buyer is also a price taker which would mean that the 101 pens will also be sold for 20 rupees and in that case the marginal revenue will also be 20 rupees which is equal to the price. So, marginal revenue is the change in the total revenue from an additional unit sold delta TR divided by delta Q.

In the case of a perfectly competitive firm we will have average revenue is equal to marginal revenue is equal to the price. Because in this case what will happen is that average revenue is total revenue divided by quantity is P into Q divided by Q is equal to P.

And the marginal revenue is delta TR divided by delta Q is equal to TR for selling n plus 1th item minus TR for selling nth item divided by n plus 1 minus n. So, delta TR is the total revenue for selling the larger number of quantities minus total revenue for selling the smaller number of quantities.

And, in this case we are talking about the change in the revenue by selling one extra item. So, earlier the seller had sold n items and now, he is selling n plus 1 items, which is why we are having TR n plus 1 minus TR n.

In this case total revenue for selling n plus 1 items will be P into quantity which is here n plus 1 minus TR for n items is P into n divided by n plus 1 minus n is 1 which in turn becomes. So, this now becomes P n plus P minus P n divided by 1. Now, P n and P n get cancelled is equal to P.

What we are finding is that AR is equal to P and MR is also equal to P. So, in total what we can write is that AR is equal to MR is equal to P. Average revenue is the same as the marginal revenue which is equal to the price at which the goods are being bought and sold.

This is one example. In the first column we have the number of samosas that are being sold and the price of each samosa is 6 rupees. Now, when we have this chart the total revenue given by TR is equal to P into Q.

When Q is one then total revenue is 1 into 6 is 6 ; when 2 samosas are sold then total revenue is 2 into 6 is 12 ; when 3 samosas are sold then it is 3 into 6 is 18 and so on. So, in this column we have the total revenue. The average revenue is given by TR divided by Q.

So, here we have TR divided by Q 6 divided by 1 is 6, 12 divided by 2 is 6, 18 divided by 3 is 6 and so, we are finding that average revenue is equal to 6 rupees in each case which is equal to P. So, P here is 6 rupees and here we are finding that this all is also equal to P.

In the case of marginal revenue it is delta TR divided by delta Q. So, delta TR is the difference between this TR and this TR 12 minus 6 is 6 divided by delta Q is an increase of 1. So, 12 minus 6 is 6 18 minus 12 is 6 24 minus 18 is 6.

And so, here we are also observing that in each of these the MR is equal to the price. So, for a competitive firm that is a price taker the average revenue is equal to the marginal revenue is equal to the equilibrium price in the market at which the goods are being sold.

Now, the thing is that when a firm is making the goods and is telling the goods the aim of the firm is the maximization of the profit. So, we saw this in the case of the cost benefit analysis. The benefit to the firm is the profit and the firm is trying to maximize the benefit. So, how can the profit maximization be done?

Now, when we talk about profit maximization we need to remember that marginal revenue is fixed which is given by the price. So, here we have observed that the marginal revenue is equal to price, but when more and more quantities of goods are being produced the marginal cost increases.

And, we have observed that the marginal cost increases because of the law of diminishing marginal product which means that for every additional unit of item that is being produced, the inputs do not work that hard. The efficiency goes down.

So, the marginal cost increases when more and more products are being manufactured whereas, the marginal revenue will remain the same as P. Now, in such a scenario here we are observing that in this column we have the number of samosas that are sold.

This is the price, this is the total revenue and the marginal revenue is 6 in each case, but the marginal cost increases. So, let us say that the marginal cost increases like this 2 3 4 5 6 7 8 9. So, this is the marginal cost. Now, we can also talk about the total cost and total cost is equal to the fixed cost and the variable cost.

What we are saying here is that total cost is equal to the fixed cost plus the variable cost. But, we can also write that total cost is equal to say at stage n plus 1 is equal to total cost at stage n plus the marginal cost for n plus 1.

This means that at every step of computing the total cost we can use the total cost in the previous step and the marginal cost. Now, marginal cost as we have seen it goes on increasing. So, in this table we are observing that the marginal cost is increasing and the total cost.

So, the total cost for selling 0 items would be the fixed cost which in this case is 3 rupees. And, for every step we can do a computation by adding marginal cost to the total cost in the previous step that we had seen here.

The total cost at any stage say that nth nth stage is the total cost in the previous stage plus the marginal cost at that particular stage. So, if the total cost for this point is 2 plus 3 is 5, for this cell it will be 3 plus 5 is 8, for this cell it is 4 plus 8 is 12, for this cell it is 5 plus 12 is 7 teen and so on. So, this is the column for the total cost.

Now, profit is defined as total revenue minus total cost. So, we are taking this total revenue minus total cost. So, 0 minus 3 is minus 3 rupees, 6 minus 5 is 1, 12 minus 8 is 4, 18 minus 12 is 6 and so on. Now, in this case we can observe that the profit when 0 items are sold is negative.

Because the total revenue in this case is 0 because no items are being sold, but still the fixed costs need to be paid. So, in this case the profit is negative. Then the profit increases reaches a maximum and then starts to decrease and we are observing the change in the profit which is given as marginal revenue minus marginal cost.

Now, in the case of change in profit what we are asking is if one more item is being produced and sold, what is the change in the profit? So, when one more item is sold, the revenue that the firm will be getting is the marginal revenue.

But the cost of producing it will be the marginal cost for that particular item. What we are asking is the firm has already sold n items and it wants to sell now n plus 1 items. So, for this one item that the firm wants to sell, what is the marginal revenue? What is the marginal cost? Now, the difference will give us the change in the profits.

The marginal revenue minus marginal cost: here you have marginal revenue, here we have the marginal cost. Marginal revenue is fixed, marginal cost is increasing. So, when we subtract marginal cost from marginal revenue we start from a large value.

But this value goes on decreasing because MC is increasing whereas MR is constant. Here we are observing that the change in the profit is reducing, that is when the firm is producing larger and larger amounts of products, then after a while the change in the profit will become negative which means the profits will start to decrease.

If we plot these values we will find a curve like this. So, the first thing is the price which is shown here at this blue line and the price in this case is constant. It is fixed at 6 rupees. So, this is what we are talking about: the price is fixed and so, we are getting a straight line, this straight blue line is the price line.

The total revenue is proportional to the quantity that is shown because total revenue is given as total revenue is P into Q. Now, because P is constant it is a straight line so, total revenue is proportional to the quantity of goods that have been sold and which is what we are observing here.

In the case of this green line the more is the quantity the more is the total revenue and it is a straight line because it is proportional to Q and the proportionality is a fixed constant. Then the total cost increases with the rising marginal cost.

The total cost is shown here in the red curve. So, the total cost is increasing, but then the rate of increase also goes on increasing, which means that earlier there is a very small change in the total cost with more and more items that are being produced the change is much larger and this is because of the law of diminishing marginal product.

Now, with more and more quantities that are being made the efficiency of the inputs reduces which means that for producing an extra quantity of the good more cost needs to be put in. And, so, we are observing a curve that increases like this.

Now, the total cost curve shown in red does not start from 0, but it starts from a finite value and that finite value is the fixed cost. So, when 0 quantities of things are being produced and sold, even then there are certain fixed costs and those fixed costs will show themselves in the total cost.

Next we can have a look at the profits. Now, profit increases reaches a maximum value and then starts to decrease which is this black line. Now, the profit is given by total revenue minus total cost. The difference between both of these is the profit.

Where both of these are roughly the same we will have a profit of 0 or near to 0 when the difference is large, then we will have a larger amount of profit. So, profit goes to a maximum and then it goes on decreasing and profit is maximum where the price is equal to the marginal cost. So, what we are saying here is that if you plot the profit.

This is the profit and the profit reaches a maximum and the profit reaches the maximum where the price is equal to the marginal cost. Now, the marginal cost is shown here. So, this is marginal

cost and it is increasing and at the point where it touches the price curve and price is a straight line which is equal to marginal revenue. So, at this point the profit is maximum. Now, why is that?

The thing is to any point to the left of this point this is our point that we are interested in and at any point to the left we have a situation where the marginal revenue which is given by the price is greater than the marginal cost.

What we are saying here is that at points on the left, the marginal revenue which is equal to price is greater than the marginal cost. Now, if the marginal revenue is greater than the marginal cost it means that if one more item is produced, then the cost of producing that item is less.

But, the increase in the revenue that we will get will be greater which means that the production of any extra item will add to the profit. Because or for all of these points the margin and revenue is greater than the marginal cost. So, if one more item is produced we will get a larger amount of revenue, but the increase in cost will be lesser.

So, for any such point it makes sense to produce more items. So, it makes sense to move to the right. So, for all the points to the left of this point, it makes sense to move to the right. But, for any point to the right of this fixed point ; so, we are talking about this point.

At any point to the right, what is the situation? We have a situation where the marginal cost is greater than the marginal revenue which means that when any further item is produced, then it costs more to produce that item than the increase in the revenue that we will get by selling that item.

Which means that the more the items that are produced the less the profits will become which means that it does not make any rational sense to make that item. So, at any point to the right of this point we will come to the conclusion that no, we are already making a bit too much and we should be making a bit less.

All these points will try to move to the left, all these points will try to move to the right and they will reach to this point. So, for all the points to the left what we are saying is that if we increase the number of items, then we can increase the profit for all the points on the right.

We are saying that we are already making a bit too much. We should reduce the quantity and so, this will be the quantity at which the profit will be maximized. So, profit is maximum where P is equal to MC which is the price is equal to the marginal cost of production.

We can also say that profit is maximum where MR minus MC is equal to 0 because marginal revenue minus marginal cost is equal to 0 that is this is the marginal revenue line which is the price line and this is the marginal cost line. And, we are saying that profit is maximum where the difference is 0.

That is, if this is the difference then and if you take another point, say this point so, we are taking these two points. Now, at this point there is a certain amount of profit because the margin and revenue is greater than the marginal cost, but if more items are produced here again we are getting a profit because the marginal revenue at this point also is greater than the marginal cost of production and similarly at this point.

For all of these points, the marginal revenue is greater than the marginal cost, but once we cross this point we will reach a point where the marginal cost of production is greater than the mar-

ginal revenue that we will get. After this point we should stop producing any more items because if we cross this point.

Then we will reach a stage where it costs more to produce the goods and we will get a lesser amount of revenue in return, that is, the profit will go down. So, the profit is maximum at the point where this difference is 0 because if this difference is greater than 0.

Then there is still a scope to produce more items and get more profit. Whereas, if this difference is negative then it means that we are already producing a bit too much. So, the point at which this difference is 0 is the point of the maximum profit which is what we are observing here.

So, this is the point of the maximum profit. Next we can also say that profit is maximum at the peak of the profit curve which is very obvious because when we are reaching the peak of the profit curve that is the maximum profit after that the profit will decrease.

Now, the next thing is that we can have a maximum profitability, but how do we maintain that profitability for a long period of time? That is the next question that we need to analyse. So, if you look at this chart we have the number of samosas that are sold, the price and the price is fixed.

The marginal cost increases; the total cost also increases; the fixed cost is fixed and fixed cost is given by the total cost for 0 production which is 3 rupees. Now, the difference between the total cost and the fixed cost will give us the variable cost.

For 0 items it is 3 minus 3, 0; for 1 item it is 5 minus 3 is 2; for 2 items it is 8 minus 3 is equal to 5. So, we can compute the variable cost and the variable cost is equal to total cost minus the fixed cost and this is because total cost is fixed cost plus variable cost.

We can compute the variable cost in this manner. Now, with this we can also compute the average total cost and the average variable cost. Average total cost is total cost which is this value divided by the quantity that is sold.

Total cost here is 5 divided by 1 is 5, for this value it is 8 by 2 is 4, then 12 by 3 is 4, then 17 by 4 is 4.25 and so on. So, this is the average total cost. We also have the average variable cost which is variable cost divided by the quantity sold.

Here it is 2 by 1 is 2, then 5 by 2 is 2.5, then 9 by 3 is 3, then 14 by 4 is 3.5 and so on. So, we can compute the average total cost and the average variable cost. Now, the thing is when we plot these values together.

We have a fixed price which is equal to the marginal revenue, we have a marginal cost that goes on increasing and we have observed that the firm earns the maximum profit where the marginal cost is equal to the price which is what we have seen before.

Profit is maximum where P is equal to MC in this case when P is equal to MC we are getting the maximum profit. Now, if you look at the average total cost it decreases and then it increases. And, we have observed this before because when we look at the total cost.

Now total cost is fixed cost plus variable cost. Now, the average total cost will be given by total cost by Q is equal to FC by Q plus VC by Q. Now, in this case, the FC is a fixed value because this is a fixed cost whereas, the variable cost goes on increasing.

Now, if we look at our chart the average total cost reduces and then it increases whereas, the average variable cost goes on increasing. Now, why does the average total cost reduce first because

the average total cost is this value plus this value.
Now, in the beginning when we have a very low quantity of goods that are being produced then we have a substantial amount of fixed cost, but the variable cost is very close to 0 because we are not producing anything. So, what we get here is that in the beginning the fixed cost is very much greater than the variable cost which means that FC by Q is very much greater than VC by Q.
And, in this case, we can say that the average total cost is approximately equal to FC by Q because FC is very much greater than VC. So, we can neglect this term and we can say that average total cost is roughly equal to FC by Q. Now, FC is fixed because this is a fixed cost, Q when it goes on increasing the average total cost will go on decreasing.
So, in the beginning what we observe is that the average total cost, it goes on decreasing. Because here the fixed cost is more, the variable cost is very small and with increasing quantity of goods the average fixed cost goes on decreasing. But, then at a later stage we will find that average total cost is total cost by Q is fixed cost by Q plus variable cost by Q.
So, later we will find that the variable cost has increased and so, the variable cost is now greater than the fixed cost. When that happens, we can write that TC by Q or the average total cost is approximately equal to VC by Q because in this case we can neglect this term because this is now very much less than VC by Q.
So, average total cost in this case is approximately equal to VC by Q which is equal to the average variable cost and what we have observed here is that the average variable cost goes on increasing. So, in the later stages we will find that the average total cost also goes on increasing and this black line is showing us the average variable cost which is increasing. So, we have observed that this is the point of the maximum profitability.
But, then we can also talk about profitability in the long run. Now, in the long run what we are saying is that if this is the average total cost and if this is the price that we get as long as the price is greater than the average total cost we should be producing the goods.
Which means that, the cost of production is less, the selling price is more, so, there is some profit. It may not be a very large profit, but there is some profit. And, so, we should continue the production in the long run if the price is greater than the average total cost.
We will continue to produce goods till this point where the price is greater than the average total cost. After this point the price is less and the average total cost has increased. Now, we are moving into a point of loss and so, we should not cross this point, but this is the point for long term profitability.
In the long run a firm should shut down if the revenue is not able to meet the total cost of running because here again the firm is making decisions based on rational decision making and if the revenue is not able to meet the cost of production then the firm should shut down.
In this case what we are saying is that the firm should shut down when the total revenue is less than the total cost or TR is less than TC. So, if you divide both sides by Q we will get TR by Q is less than TC by Q. Now, TR by Q this term is equal to price.
Price, because we have seen that the total revenue is equal to P into Q and so, TR by Q is equal to P into Q by Q is equal to P. So, what we are seeing here is that P is less than TC by Q and TC by Q is the average total cost. So, a firm should shut down.

When P is less than ATC that is price is less than ATC then the firm should shut down. And, if the price is greater than ATC then in the long term a firm should enter the market. Now, remember that in the case of a competitive market we had said that there is a free entry and exit and what we are saying here is that if the price is less than the average total cost of production.

Then the firm should shut its operations and it should move out of the market. But, if the price is greater than the average total cost of production, then a firm should enter into the market and start production. So, this is in the long run.

What we are saying is if we do the supply curve in the long run we will see that this is the average total cost and we saw that the average total cost decreases then it increases. So, the average total cost and the marginal cost curve will cut the ATC at this point, the point of the minima, which is what we have observed before.

Now, above the ATC the MC curve or the marginal cost curve becomes the supply curve because the supply curve is given by the cost of producing things and so, above this price this is the supply curve. But, below this price the firm will not supply according to the marginal cost, but the firm will shut its operations and supply zero quantity.

So, when the price is this or the price is this or the price is this the firm should produce zero quantity of goods: it should not be producing at all. But, once the price has increased above the minima of the ATC, then this curve which is the MC curve, the marginal cost curve, becomes the supply curve. Now, this is in the long run.

In the short-run, the firm will have a different profitability. Now, this is because the firm will ask the question that if the total cost is not being met, are we at least able to meet the variable cost, the cost of maintenance of the firm? Now, that is the variable cost.

In the short run what we say is that the firm should continue its operations and the short run till this point where the average variable cost is less than the price which means that it is at least able to meet the cost of running. Because, there is always a sunk cost in all the operations.

A sunk cost is a cost that has already been committed and cannot be recovered which means that if there is a hotel, then there is the cost of land, there is the cost of construction and if you shut the operations you will not be able to recover this cost. So, this is already money that has been put inside.

Now, if we forget this money, if we forget that we had put so much of investment, what is now the cost of at least running the operation is what the firm is interested in knowing in the short run. So, in the short run the firm should shut down.

If the revenue is not even able to meet the variable cost of running which is like the variable cost of paying the wages of those workers that are involved in cleaning of the premises or making and serving the food. Now, in the off-season in the off-tourism season.

We should have at least that much amount of profitability that we should be able to meet the cost of these people, the variable cost of the firm. So, in the short run the firm should shut down if the revenue is not even able to meet the variable cost of running which means that the total revenue is less than the variable cost.

Now, if TR is less than VC, then dividing both sides by Q we will get PR by Q which is equal to P is less than VC by Q which is the average variable cost. So, the firm should shut operations

when the price is less than the average variable cost.
And, so, in the short run the supply curve will look like this. So, if this is the average total cost, if this is the average variable cost, then above this point above the minimum of the AVC we should have the MC or the marginal cost which gives the supply curve.
But, below the average variable cost, the firm should shut operations. So, if P is less than average variable cost there should be no supply at all, the firm should completely shut down. If the P is greater than the average variable cost, then in the short run the firm should be supplying things.
But only in the short run. In the long run the firm should only be supplying if the price is greater than the average total cost. Now, in this context we can look at the profit and loss of the firms.
Now, if this is the average total cost curve, if this is the price and this is the marginal cost.
Now, why is that so? We had observed that in the long run this is the supply curve of one firm. It says that if the price is less than the ATC then the firm should shut operations, but if the price is more than the ATC then this is the supply curve.
If the price is greater than ATC, then one firm will enter into the market. Now, in the case of a competitive market where the firms have a free entry and exit, we will have the situation that whenever the price is greater than ATC there will be some firm that will get inside.
Whereas, when the price is less than ATC, then there will be some firm that will be going down.
In essence the long term market supply curve will be given by this price curve. At this price any amount of any quantity of things can be bought or sold.
Because of the free entry and exit there will be at least some firms who will be supplying the goods at this price. In the long run, the market supply becomes a straight line. At this price any quantity of goods can be bought or sold because the firms are entering and exiting from the market.
Now, the question arises at this price point the profit of the firm is 0 because the profit is given by this one; the profit is given by P minus ATC into Q. Now, in this case when P is equal to ATC, then you have P minus ATC is equal to 0.
So, 0 into Q is also equal to 0. So, the firm is not earning any profit, but still it is supplying. Now, why would we have such a situation? The answer is, because the profit is given by total revenue minus total cost and total cost also includes the opportunity cost.
Now, this is why we make a distinction between accounting profit and economic profit. Now, accounting profit is given as total revenue minus the explicit cost which is the cost for which a firm is outlying money that is the cost of say land, the cost of the inputs, the raw materials, the cost of wages and so on.
Whereas, when we talk about the economic profit we talk about total revenue minus total cost and total cost is explicit cost and the implicit cost. Now, the implicit cost is those costs for which the firm is not making an outlay of money things such as opportunity cost.
For instance, there is a person who is setting up a firm at an opportunity cost of say 1 lakh rupees because if this person was not running this firm, he would be earning a profit earning an income of 1 lakh of rupees from some other source, probably he was working somewhere and he left his job to set up this firm.
Now, when we talk about the economic profit, we include this 1 lakh of rupees which is the op-

portunity cost of running this curve. So, what we are saying here is that the economic profit is the total revenue minus total cost.

And because total cost is equal to the explicit cost plus the implicit cost. Now, in this case the implicit cost is rupees 1 lakh. Now, because we are subtracting that from the total revenue and when we say that the firm will go on supplying till the economic profit is 0 rupees.

It means that 0 is equal to TR minus EC minus IC which means that IC is equal to TR minus EC. So, we have an implicit cost of 1 lakh of rupees which is given by TR minus EC. Now, because TR minus EC is a positive value, it is 1 lakhs of rupees it means that TR is greater than the explicit cost.

What we are saying here is that because this is a positive value of 1 lakh, it means that TR is very much greater than the explicit cost. The total revenue is very much greater than the amount of money that has to be outlaid by the firm for running of things.

So, when we say that the firm continues to produce at a profit of 0 rupees, it is not the accounting profit we are talking about the economic profit and in this case the TR or the total revenue minus the explicit cost it is still giving the person 1 lakh of rupees of the implicit cost.

Which means that, if the person left this firm, if the person shut down his operations and if he went back to his original job, then he would be earning 1 lakh of rupees. But, when he is running this firm and not earning 1 lakh of rupees from there he is still earning that 1 lakh of rupees from his new firm.

Which means that, when we talk about an economic profit of 0 rupees, it is still giving the person at least that amount of money in profit that he would have earned otherwise. So, the person is still having a substantial sum of money as income.

It is not the income from the wages that he was earning in his previous occupation, but this is the profit that he is earning and which is why the firms are able to work at a profit of 0 rupees. So, in this lecture we had a look at how profit is computed and how firms maximize the profit and continue to maintain profitability both in the long run and the short run. And, because the running of the firm is also related to quite a number of problems of conservation, so, it is important for us to understand what keeps a firm running.

That is all for today. Thank you for your attention. Jai Hind!

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Module 9
Industrial organisation and Conservation
Lecture 3
Monopoly

Namaste! We carry forward our discussion on industrial organization and conservation and in this lecture we shall explore Monopoly. A monopoly is defined as a firm that is the sole seller of a product without any close substitutes. So, this is a firm that is the sole seller.

It means that it is the only seller, only seller of a product without any close substitutes. Now, what does that mean? When we look at things such as rice, now in the case of rice you have different varieties that are available. And if there is a seller who is the only seller of a particular variety.

In that case we will not call that seller to be a monopolist because the variety can be replaced or substituted by certain other varieties usually. However, if there is a variety of price that is the only rice that can be used for say a religious function.

In that case if this rice variety cannot be substituted by any other variety then the person who is the sole seller would be called a monopolist because in that case that would be the only person who would be selling that particular variety of rice. Now, this becomes important because we have observed that yeah in the case of a competitive market.

Everybody is a price taker, but in the case of a monopoly because this is the only person who can provide this particular variety of rice. So, he can charge as much as he wants. So, in this case in the case of a monopoly the monopolist is not a price taker, he is a price maker that is he decides what will be the price of the produce. And because he is the only seller, whatever price he wishes to charge he is in a powerful position to charge that price.

A monopoly is a firm that is the sole seller of a product without any close substitutes. Examples include a firm that is selling a patented medicine. Now, if there is a firm that has developed a medicine for a certain disease, and suppose that is the most effective medicine, that is the medicine that everybody wants to have, so that they can be cured of the disease.

In that case because the firm holds a patent on this medicine it would mean that the firm would be the only seller of the medicine for at least 20 years. In this period of 20 years we will say that this firm will be a monopoly because this firm is the only seller of something that is so unique that it has no alternatives. An example is the owner of the only well in a village.

This owner can charge any amount of money that he wants. Other good examples include things like patents and copyrights. So, when we talk about a copyright, the author who is holding the

copyright is the only provider of that particular book or if the publisher holds the copyright the publisher is the only provider or the only seller of that particular book.

If it is a book that everybody wants to read, say a new installment in the Harry Potter series. Now, this is something that all the fans of Harry Potter would like to read. Now, if they do not get this book they cannot read any other book and say that that book becomes a part of the Harry Potter series.

Because this book by the same author in the Harry Potter series it cannot be substituted by any other book. And in this case we will say that the author or the publisher will be a monopoly because they will be the sole sellers of a product without any close substitutes.

Now, the question is why do we have monopolies? Well, we have monopolies because of 3 main reasons: one is monopoly resources. A key resource that is required for the production is owned by a single firm. In that case we will say that we have a monopoly because of a monopoly over the resources.

And a good example is, say, mine. Say, when we talk about the diamond mines, the De Beers company holds the largest share greater than 80 percent in the whole world because they own the mines they are operating the mines from which the largest chunk of diamonds comes out.

And so, in this case the De Beers firm will be a monopoly because they are the sole sellers, they are the sole suppliers of diamonds because they own these resources. They have a monopoly over the resources. Similarly, for things such as tanzanites.

Now, tanzanites are mined from very few mines and so, the owner of this particular mine can become the sole supplier of tanzanite. So, we can have monopolies because of a monopoly over resources.

In certain other cases we can have monopolies because of a government regulation. In this case the government grants the exclusive rights to produce and sell something and examples include copyrights and patents. Now, why does the government grant exclusive rights to anybody?

In the olden days what used to happen was that if the king had a close friend then to favor his or his friend the king used to grant a monopoly over a certain trade. So, we can have monopolies as a way of favoritism, but these days we have monopolies because monopolies can provide a social good and a social well being.

Now, this is because a number of things such as inventions are extremely time consuming, resource intensive and effort influencing. And so, whenever somebody makes a new product, if the market was made open for all the competition then what would happen is that other people would just copy that product.

Now, making the product for the first time requires the greatest amount of inputs, the greatest amount of effort, but copying the product might not require that much amount of input. And so, if the market was let open for everybody then we would have a situation where nobody would want to make any new products.

Because there is no financial incentive and as we have seen incentives are very important tools to make people do something because people respond to incentives. So, if the government wants that we should have a society in which new things are coming up in which we are able to manufacture new technologies.

New technologies are important because they overall increase the efficiency and reduce the cost because of which the welfare of the whole society would increase. Now, to incentivize people to make these new technologies the government grants them exclusive rights over whatever they make.

Typically the government grants them patents through which they will have an exclusive right on selling that product for the next 20 years. Similarly, when we talk about books or means of art then we have copyrights. Now, copyrights ensure that the people who are doing this creative work in the form of writing a book.

Making a movie or say singing a song these people retain the rights of selling these creations. So, there is an incentive to make these creative things. And so, we can have a government regulation through which exclusive right to produce and sell a certain product is granted to somebody and when we have such a situation we will have a monopoly. And a third reason is that of the natural monopolies. In the case of natural monopolies the cost of production for a single firm is much lesser than the cost of production for competitive firms.

What happens in the case of natural monopolies is that in the case of certain sectors it so happens that if one person provides or if one firm provides the services they would incur a certain cost, but if you have a competitive situation where multiple firms supply the same goods the cost increases. A good example is that of water pipes.

If we have a town and there is a company that is supplying water from a river then this company will have to make a pipeline probably have distribution pipelines that will provide water to the whole of the society and then they can also have the smaller pipelines

The cost of laying the pipelines is very high and so, when this pipeline system has been made then the residents would have to pay a certain price for this water. Now, the price that they will be paying to the firm will be used to recuperate the cost of dig of earth moving, laying of these pipes and providing water

Suppose the per capita cost is coming to be say rupees 10 per liter. Now, this is when one firm is supplied. Now, suppose there is another firm that also comes up and says ok we are also going to supply. Now, what will happen? Now, the second firm that will also have to lay this a very similar pipeline probably next to it because it is supplying to the same locality. And so, it will have to do all this to work and provide for all these smaller pipes as well.

What is happening in this case is that the cost of laying the pipe has now doubled because while one pipe would have provided water now we have two pipes for each of the areas. But, what happens also is that now the water that is being supplied by any one firm is reduced because half of the customers are now being supplied by firm A and half of the customers are now being supplied by firm B.

In that case because of a reduced market share they will each of these firms will not be getting that high an amount because the quantity has gone down. What will they do? They have to recuperate the cost of the earth work and digging of the pipes. So, probably when this second firm comes up then both of the firms start to charge 15 rupees a litre.

So, what we are observing here is that when we have two firms that are supplying the same thing then even though there is a situation of competition, what is happening is that the cost for every

person has gone up. So, now people have to pay more money to get the same amount of water and this is a situation of a natural monopoly.

Natural monopolies arise when the cost of production for a single firm is much lesser than the cost of production for the competitive firms because the more the number of firms that are there the more is the amount of input that they have to put in. Another example is laying off roads.

If we have two roads that are running right next to each other in that case the efficiency of operation will go down or things such as electricity lines or things like railway lines. Now, a large number of these services are natural monopolies, which means that if there is a single firm then the products will be made available at a much cheaper price to the people or to the public as compared to when we have more than one firm.

What we observe here is that the economies of scale that result because a single firm is acting that also results in a natural monopoly. So, what we are observing here is that on the y axis we have the cost, on the x axis we have the quantity and here we are plotting the average total cost.

If a lesser quantity of the thing is sold, say in that case with a lesser quantity the cost increases. So, everybody will have to pay a larger cost. Whereas, if the quantity that is being supplied is large in that case people will have to pay lesser costs.

Now, when we have a situation like this, when there is more quantity that is supplied the average total cost reduces, which means that when more and more of the quantity of the goods is being supplied then the firms are able to supply at a lesser cost. Then such sectors become natural monopolies because when we have a lesser quantity of goods that are being supplied because there are more sellers.

What we are observing here is that at this point there are more sellers and at this point there is a single seller because of which a larger quantity can be provided by the single seller. So, the single seller is much more efficient and so, the economies of scale normally result in natural monopolies.

Now, a monopolist market is very different from a competitive market. Because in a competitive market everybody is a price speaker, which means that the price is fixed by the market. And in the case of a competitive market at the set price the firm can sell as much as it wants.

Because there are so many buyers that the firm can sell as much as it wants, but it cannot change the price. The price has been determined by the market. So, in this case the demand curve that the competitive firm faces is a straight line that is at the price that is fixed by the market it can supply any quantity. So, this is the demand curve that the competitive firm faces because it is a price taker.

In the case of a monopoly the demand curve is the market's demand because there is no fixed price. So, what happens is that in the case of the demand curve we have observed that as the price increases the quantity demanded reduces. Now, when this is the demand curve for the market then the monopolist can pick any price.

And so, if the monopolist says that I am going to sell my product at this price then in that case this is the quantity that the monopolist will be able to supply to the market. If the monopolist says that no, I will sell my products at this price. So, at that price this is the quantity that will be sold by the firm

In the case of a monopolist firm, the firm decides the prices and at those prices the demand curve of the market will tell how much is the quantity that will be or that should be made by the firm. Because that is the quantity that is being demanded at that particular price point and so that will be the quantity that will be supplied to the market.

There is this major difference between a competitive firm's demand curve which is a straight line that is parallel to the x axis and a monopolist firms demand curve that is actually facing downwards. Now, we have observed that or we have assumed that in economics people are relational decision makers.

When the monopoly firm is providing this good, it is providing this good to earn a profit to increase its welfare. Now, the question is if it supplies the goods at a higher price lesser quantity is sold and if it supplies at a lower price then higher quantity is sold, but then the amount of revenue that it will earn will be given by the price at which the goods are being sold multiplied by the quantity of the good that is sold.

When the firm is trying to maximize its profit it would also want to maximize the revenue or probably go for an optimum level of revenue. But, what we are observing here is that if price increases then the quantity decreases and if the price decreases then the quantity increases.

In such a scenario how should the monopolist firm decide how much of the price should be kept and how much of the quantity should be produced for the market? So, that is a question that the monopolist firm faces. And the monopolist firm is free to make the prices, it is free to decide the prices.

But because of the market's demand curve the revenue that it earns it will depend on its choice, but it will not have a complete control. Because when it increases the price the quantity that will be supplied to the market will also go down. So, let us now understand how the monopolist firm maximizes its profit.

So, we are taking the example of a monopolist who is holding the only well in a village and everybody in the village has to come to this well to get water. Now, if the price is less, then people would demand more and this is because people will use water for say recreational activities or they will not be using water that stringently, but if the price of water increases then people will try to cut down on the amount of water that they will consume.

Probably people will go for a shorter bath or probably people will shift to crops that do not require that much amount of water or probably people will stop watering the plants. So, this is a scenario in which we will have a market demand curve that will be sloping downwards, but then we also have this monopolist who holds access or ownership of the only well and so, he can decide the prices.

Let us say that the monopolist has decided these prices. So, it can be as high as 11 or as low as 3. And what is the quantity that is being sold in the market when this price has been decided? So, the quantity that has been sold is given here. So, in this case what we are observing is that when the price is less when the price is 3 rupees per liter then 8 liters of water are being sold.

Let us assume that this quantity is given on a per hour basis, that is if the price is 3 rupees then 8 liters of water are being sold per hour. Now, if the monopolist increases the price, so, from 3 if he increases it to 4 then a lesser quantity of water is getting sold. When he increases it to 5, 6, 7,

8, 9, then we are observing that progressively less quantity of water is getting sold. Now, this is because of the market demand curve.

In the case of a monopolist the monopoly firm faces the market demand curve as the demand curve according to which it will have to supply because the price is not fixed. So, when the monopolist is increasing the price, a lesser quantity of water is getting sold. Now, the total revenue TR is given as P into Q. So, when the price is 11 then the revenue is 11 into 0 is 0 rupees. When the price is 10 rupees only 1 liter is being sold. 10 into 1 is 10 rupees is the total revenue.

When the price is 9 rupees then 9 into two is 18 and so on. So, this column is telling us the total revenue. Now, from the total revenue we can compute the average revenue and average revenue is given as average revenue is total revenue divided by the quantity sold. So, at this price point of 10 rupees the total revenue is 10 divided by Q which is 1 and you get 10.

At this price point of 9 rupees the total revenue is 18, 18 divided by 2 is 9. Here 24 divided by 3 is 8. So, what we are observing here is that the average revenue in this case is what is the price So, average revenue and price are the same. What about the marginal revenue?

Now, the marginal revenue is given by change in our total revenue divided by change in the quantity that is when this monopolist is moving from 0 to 1 then the change is 0 to 10

So, in this case the marginal revenue will be given as the change in the total revenue which is 10 minus 0 is 10 divided by the change in the quantity which is 1 minus 0 is 1 or the marginal revenue will be 10 rupees. The when the price is 9 rupees, so, when the price has has decreased from 10 to 9 rupees the quantity has increased from 1 to 2 and the total revenue has increased from 10 to 18

In this case the marginal revenue will be given by delta TR is 18 minus 10 is 8. So, here we have 8 divided by delta Q which is 2 minus 1 is 1. So, 8 by 1 is 8. So, this is how we compute the marginal revenue. Now, this marginal revenue is for a change from 0 to 1 or a change from 1 to 2 and so on.

When the seller is trying to increase the price or when the seller is trying to change the quantity that is being supplied then we are observing that there is a change in the total revenue and the total revenue it increases reaches to a maximum and then starts to decrease.

So, it has increased from 0 to 30. There is an increase, but then it decreases from 30 to 20 4 and so on. Now, this is because when we write TR is equal to P into Q then there are two impacts that are happening. One is the output effect. So, if Q increases then TR increases, but then there is also the price effect because when Q increases P decreases and when P decreases then TR also decreases.

Because of the output effect the TR is increasing because of the price effect that TR is decreasing when Q is getting increased and which is what we are observing here. When the quantity increases then we can have a situation where the PR may go down or it may go up or it may go down.

If we plot the average revenue and the marginal revenue. So, in this case this is the average revenue and the average revenue is actually equal to the price and so, we can plot that it is going like this. So, it is going like this. This is the average revenue, but the marginal revenue.

Now, remember that this value of 10 is for a change between 0 to 1. So, when we are talking

about the value of 0, the marginal revenue will be a bit greater than 10. So, what we do is we plot it from the same beginning. So, we plot it from a point of 11 and here we are observing that between 0 to 1 that is at a point of 0.5, we have a marginal revenue of 10.

At a point of 0.5 we have a marginal revenue of 10. At a point of between 1 and 2 that is 1.5, it has become 8. So, at this point at this point the value is 8 and so on. So, what we are observing here is that the marginal revenue is less than the average revenue.

This is marginal revenue in the red line and this is the average revenue in the blue line. And what we have observed is that the average revenue is given by the price or it is also given by the demand curve.

But what we are observing here is that the marginal revenue is always less than the average revenue. Now, why is that so? When the firm tries to increase the output by a certain amount then the price goes down because we have a demand curve in this market. This is the demand curve that the firm is facing.

When it increases the quantity the price goes down. Now, when the price goes down it does not go down for only the next item the price goes down for all the preceding items as well because the firm can set up a price, but when it sets up a price. So, let us say that the firm has set a price to be this.

So, in this case this quantity is being sold, but then all of this quantity will be sold at this price. So, when that happens with each increasing amount of goods that is being sold in the market the price of everything goes down and so, the marginal revenue has to be less than the average revenue.

Because whenever we have an increase in the quantity that is being sold the price reduces by so much that the price of everything goes down. And So, the marginal revenue has to be less than the average revenue, which is what we are observing here. So, the marginal revenue is less than average revenue, but average revenue is equal to the demand or the price.

When that happens how does the firm maximize its profits? Now, we have observed before that the quantity to be supplied in the market is given by the point of crossing of these two curves; the marginal cost and the marginal revenue because if the firm is supplying anything to the left of this point.

This is our point of intersection which gives us a quantity Q, which is the optimum quantity. If the firm decides that we should supply a quantity that is less than this, that is we should supply only this much of quantity. Now, in that case we have a situation where the marginal revenue is greater than the marginal cost.

When the marginal revenue is greater than the marginal cost, it means that for every item that is being sold from this point onwards we will have more revenue and less will be the cost of manufacturing this item which means that if the firm produces a single more item then it will only add to its profits because at any stage to the left of our equilibrium point we have a situation where the marginal revenue is greater than the marginal cost.

And so, for every item that is being sold we have a marginal profit and because of this marginal profit the company will decide to sell a bit more. Because remember that we have begun with an assumption that the monopolist is also a rational thinker. So, because the monopolist is getting

some more profit, it would say why not and.
For any point that is to the left of this point of equilibrium because this situation holds true that the feeling of one more item will lead to a marginal profit then the firm will try to move towards the right that is towards this equilibrium. But what happens after it has crossed the equilibrium point? So, let us take a point to the right. Let us take this point.
At this point the firm finds out that the marginal cost of producing is greater than the marginal revenue, which means that for the item that we have just sold we were requiring more inputs or more money to make that item, but we were getting lesser returns.
Which means that we were at a net loss, a net marginal loss, which also means that the firm would think that ok, probably we have manufactured a bit two more because if we did not manufacture this item because the marginal cost is greater than the marginal revenue, if we did not manufacture this item we would have reduced our losses.
And so, for any point to the right of this equilibrium point the firm will try to move towards the left. And so, to a point to the left it moves towards the equilibrium any point to the right it moves towards the equilibrium and so, this is the point that has to be the equilibrium point.
This is the point at which the firm will be earning the maximum profit. Now, at this point we are getting the quantity and we also get the price. Now, this price is determined by the point where this vertical line cuts the demand curve. So, this is the point. So, this will give us the price.
This is the situation in the market for a monopoly format and here as well we have a to an average total cost of making the goods and the marginal cost curve will cut the average total cost at the lowest value. So, this is something that we have observed in the case of a competitive firm and this will hold here instead.
The marginal cost curve cuts the average total cost curve at the minimum. So, that holds true here. But, the only difference here is that the point of cutting off the marginal revenue and the marginal cost will only give the quantity, it will not give the price. The price will be given by this vertical where it cuts the demand curve that will give us the price.
What we are observing here is that while in the case of a competitive firm we were observing that P is equal to MR is equal to MC. So, the price was fixed and this price was the marginal revenue because for each item it will be sold at this price only. So, P is equal to MR and the maximization of profit happened, where MR is equal to MC that is marginal revenue is equal to marginal cost and where it was cutting we were getting the price. So, that was the maximization of the profit, but the price was fixed.
This only gives us the quantity. In this case also we have MR is equal to MC which is giving us the quantity. But what we are observing here is that this MR curve is lower than the demand curve, the demand curve is always upper and so, we will have a price that will be always greater than this point.
So, P is greater than the marginal revenue and the marginal cost at the point of profit maximization. This point P is greater than this point where MR is equal to MC. So, this is the situation for a monopolist firm. This is the situation of the maximum profit.
In such a situation we can compute the profit. Profit is total revenue minus total cost, so, TR minus TC. Now, we can divide this whole portion by Q and multiply it by Q. So, that will mean the

same thing because Q and Q will get cancelled out. So, this is what we are writing here, TR by Q minus TC by Q into Q.

Now, total revenue divided by the quantity, total quantity that is Q is equal to the price because we had observed that the total revenue is given by price into the quantity. And so, if you divide both the sides by Q, in that case this Q and this Q will get cancelled out and so, we have P is equal to TR by Q.

Here we have TR by Q is equal to P or the price minus TC by Q. Now, TC by Q is telling us the total cost divided by the quantity sold, which is the average total cost. And remember that here we were drawing this curve the average total cost curve and the marginal cost curve was cutting it at the minimum and here in the equation also we are coming to the same thing.

Profit is equal to price minus the average total cost multiplied by the quantity that is being sold in the market. Now, the firm has an option. It can either choose Q or it can choose the price at which it will be sold. It will be selling the things and that would determine the other object. Now, profit is price minus average total cost into the quantity.

This is what we are marking here in the curve. The price is given by this point which will tell us the quantity where the marginal cost and the margin revenue are the same. So, this is giving us the quantity, drawing the vertical where it cuts the demand curve and gives us the price. So, this is the price.

And the average total cost for this quantity is given by the point where this vertical line is cutting the average total cost curve, which is this point. This is P, this is ATC and so, this length is P minus ATC, this one P minus ATC. This much is the quantity Q. So, this portion of this rectangle is the quantity Q.

And so, the area of this rectangle is given by A is area is P minus ATC which is the height multiplied by Q which is the base or in other words we can say that this area shown in green represents the profit of the monopolist firm

To recap, how did we come to this point? We first of all computed Q which is given by the crossing of the MR and the MC curve. So, this is the point of profit maximization and this will give us the Q.

Now, for this Q we draw a vertical and this vertical will cut the demand curve at the price point of P and it will cut the ATC curve to give the the average total cost for this quantity and so, this side or the height of the rectangle is P minus ATC, this point minus this point. The side of the rectangle is given by Q.

This is the quantity that we have found out by this point and so, the area of this rectangle is the profit of the monopolist firm. Now, this is different from what we were observing in the case of a competitive firm. Now, in the case of a competitive firm, the marginal cost is the same as the price. So, we had observed here that in the case of a competitive firm marginal cost is the same as price.

And because a competitive firm is a price taker, the price is fixed which means that the marginal cost also is fixed. And so, we are drawing it like this that the marginal cost is fixed at the price which is also the competitive price. So, this is P competitive and this is the marginal cost curve.

This is the demand curve of the market and the point where this demand curve cuts the MC

curve. Now, the MC curve is also the supply curve of the firm because we are talking about not the accounting costing, but the economic costing. So, it includes all the opportunity cost.
And we had observed that a firm will be able to supply goods, a competitive firm will be able to supply goods at its marginal cost and so, this is the supply curve. And the point where the supply and the demand are meeting each other this will give us the quantity that is supplied by a competitive firm.
Suppose that for the monopolist curve firm, we also have the same marginal cost. In that case the quantity supplied by the monopolist firm will be given by this point, where the MR and the MC are cutting each other. This gives us the quantity supplied by the monopolist firm.
When we draw the vertical the point where it cuts the demand curve gives us the monopoly price. Now, two things are important here. One is that the quantity that is supplied by the monopolist firm is less than the quantity that is supplied by the competitive firm.
Here it is important to know that the quantity that is being supplied by the competitive firm is the most efficient quantity because that is the quantity at which the surplus of the society is maximized. The second thing to note is that the monopolist firm supplies at a price that is greater than the competitive firm's price.
These are two things that we need to remember that the monopolist will supply a lesser quantity of the good and at a higher price than a competitive one. Now, that would result in deadweight losses because we have observed that when we talk about a competitive firm the point where the the demand and the supply curve meet each other that gives the point of maximization of the total surplus.
That is if we talk about these curves, so, this is the marginal revenue, this is the marginal cost. So, marginal cost is the supply curve for a competitive firm, this is the demand curve of the market and this point it gives the efficient quantity and the efficient price which is the equilibrium quantity and the and the equilibrium price and we call it as efficient because it maximizes the total surplus.
But for the monopoly firm we have a situation that the quantity is given by this point where the marginal revenue is cutting the marginal cost and we get this quantity and the price is given by this point where this vertical cuts the the demand curve and so, we get this price.
Now, the situation is if we take any point between the monopoly quantity and the efficient quantity and if we draw a vertical then what happens? For this quantity let us say that this is quantity Q. So, for this quantity we have a situation that it cuts the marginal cost curve at this point and it cuts the demand curve at this point, which means that the cost of providing the goods to the market for the firm is this much.
So, this is the cost and the value that somebody in the market is putting on this is this which means that there is some person who is willing to pay this much amount to this company or to this firm and this amount is greater than the cost of producing the good which would mean that if a transaction happened between this person and this firm we will have a situation that the person will be happy because he or she will be able to have this product at any price between this V and C.
If that is a price that is decided then there is a consumer surplus because this price will be less

than V and there will also be a producer surplus because this price is greater than C. So, both are having a profit, but the thing is this transaction does not happen because the monopolist firm only sells this much quantity, it does not sell this quantity Q.

And so, there is a situation where there is a deadweight loss because there is somebody who is putting a higher value to the product and the firm can manufacture it at a lower cost, but still it is not selling it because it would reduce the total profit for the firm.

In the quest to increase the profit for the firm we are creating a situation where the society is getting hampered and so, this is a deadweight loss. And so, this triangle shown in green represents the amount of deadweight loss that will be there because of the action of the monopolist firm. Because the firm supplies this quantity to maximize its profit and it does not supply the efficient quantity that actually the society or the market demands.

We need to remember that there is a deadweight loss. Now, the next thing is is there something that the monopolist firm can do to reduce the deadweight loss while ensuring that it also earns the maximum profit. Now, this is something that most firms actually are doing. So, let us now understand how that works.

So, now, the firm is trying to reduce the deadweight loss and the firm is trying to reduce this deadweight loss because it wants to sell a bit more. It wants to earn this profit that was being left out because it was not selling that quantity. But it wants to do that in a manner that will not reduce the price of the good.

Because if it produces more quantity the price goes down which will affect all the goods that it is selling. So, it wants to find out a way in which the firm can sell more quantity while not reducing the cost for everything. And this brings us to the topic of price discrimination.

And let us understand price discrimination with an example. Suppose there is a publisher of a book and this publisher is publishing an ebook. Now, in the case of an ebook the cost of publishing is next to 0, but the publisher is not writing the book. There is an author that is doing the writing and the publisher needs to pay a royalty to the author.

And suppose they have decided that the royalty to be paid is 20,00,000 of rupees. Now, when the publisher looks at the market the publisher finds out that there are two markets. The first market is that of the diehard fans of the author. So, these people who have read the earlier books of the author are ready to pay a higher price because there are fans of the author.

And so, here we have 1,00,000 people who are ready to pay as high as 30 rupees to get a copy of this book, but then there are also certain other people in the market who have not read this author or probably who are not fond of this author. So, these people will buy this book if they can get it cheaply, but they will not pay 30 rupees for this book.

So, the publisher has found out that they will be ready to pay say 5 rupees per copy and in this case the number of people is 4,00,000. Now, the publisher has to decide what price it should sell the book at. Now, suppose the publisher decides that ok I should sell it for 30 rupees.

Because 30 rupees is the maximum that it can charge to these people. Now, when that happens, these 1,00,000 people will buy the book at 30 rupees. So, the firm will get a revenue of 30,00,000 of rupees, but none of these 4,00,000 people will buy the book. So, the revenue from this segment of the market is 0 rupees.

The total revenue is 30,00,000 and out of this 30,00,000 the firm will pay 20,00,000 to the author and make a net profit of 10,00,000 rupees. Now, this is one scenario when the publisher is choosing the largest price. If the publisher chose the second price, if the publisher chose a price of 5 rupees,.

Now in the case of a normal monopoly market. What happens is that when the price reduces that is the price for all the goods. So, even these 1,00,000 people who are able and willing to pay 30 rupees will get this book for 5 rupees because that is the price that the publisher has set.

And from these people the revenue will be 5,00,000 rupees and from these people these 4,00,000 people now because they are able and willing to pay 5 rupees. So, they will purchase the book and the publisher will get 20,00,000 of rupees.

So, total is 25,00,000 of the revenue out of which 20,00,000 has to be paid to the author and so, the profit is 5,00,000 rupees. So, what we are observing here is that in the first case when the publisher chose the higher price 30 rupees it was making a profit of 10,00,000 rupees.

In the second case when it chose the lower price looking at the second market segment it made a profit of 5,00,000 rupees. The question now is can the publisher do something to increase the amount of profits that it can make. Now, suppose the publisher chooses to release the book at 30 rupees and when this book is released then all the diehard fans of the author go and purchase this book.

After they have bought this book now at a later point of time the publisher reduces the price and sells it for 5 rupees. Now, what will happen? The people who wanted or who were ready to pay 30 rupees because they were diehard fans they bought the book immediately. So, that market is now saturated and after they have bought the book the publisher sells it for 5 rupees.

If that happens, the publisher would be making 30,00,000 rupees from the first segment and 20,00,000 rupees from the second segment. So, the total revenue becomes 50,00,000 out of which 20,00,000 has to be paid to the author and so, the profit has become now 30,00,000. So, price discrimination or selling the same good at two or more different prices is a strategy that the monopolist can use to maximize its properties.

What is happening in this case is that earlier because here the marginal cost is the same it is 0 rupees. The point where the marginal revenue was cutting this curve gave the monopoly quantity and the point where it was cutting the demand curve it was giving the monopoly price.

When we had this situation this was the profit given by the green rectangle and these people who were putting a higher value, but were able to get the product at this price they were getting a surplus. So, this was the consumer surplus. And these people who were ready to pay a price that was smaller than the monopoly price, but was still greater than the marginal cost they were not getting anything and so, we had a deadweight loss here.

In the case of price discrimination what the what the publisher is doing is that it is selling a particular quantity at this price another quantity at this price another quantity at this price and so on. So, now what the publisher can do is to have multiple prices.

And when we have multiple prices the profit gets maximized because in the case of a perfect price discrimination we have innumerable number of prices. So, everybody gets the product at the value that they are putting in the product.

When that happens then the consumer surplus for every person is 0 rupees because they are getting the product at the same price that was their value for the product. So, the consumer surplus is 0 rupees, but the profit is maximized because you are selling each product to each person at the maximum possible price that they were willing to take it for.

And so, the profit increases and the deadweight loss becomes 0 because in that case every person, whatever value this person is putting if it is greater than the marginal cost the publisher will sell them. So, this is perfect price discrimination and in this case all the surplus goes to the producer. So, we have a good amount of producer surplus of profit. The consumer surplus is 0, but at least everybody is getting the product.

And examples of price discrimination include things like paperback edition versus library edition. So, when the book is released a number of publishers just released the library edition. So, it will be a hard bound book at a very high price meant for libraries, but all the diehard fans will buy this book. And once they have bought this book then at a later point of time the publisher will release say a lower price paperback edition.

In that case the publisher is able to do a price discrimination it is able to cater to the needs of the diehard fans and also to the needs of those people who put a lower value to this product. Another is economy class versus business class in the case of aeroplanes. In this case the airlines are selling the same product that is the service of transporting people from point A to point B at two different prices or another example is discount coupons.

Those people who can pay less can always cut these discount coupons from newspapers and magazines and bring them to the shop and in that case they will get a discount. But those people who are not ready to cut these discount coupons or collect these discount coupons are probably very busy people or they are very rich people. So, they just do not give a thought about getting a discount.

In that case those people will not collect these discount coupons and when they go to the market they will get the same product at a higher price. So, these are all different examples of price discrimination. Now, because monopolies have a deadweight loss, we have different public policies towards monopolies.

In certain cases the government says that no, monopoly is bad for the society and so, we should have an increased amount of competition and the government makes use of antitrust laws to break down the monopolies. That is one large firm will be broken down into two or more smaller firms so that the amount of competition increases.

Another policy is price control. So, the government might say that no the monopoly is selling the things at too high a price and so, we put a price ceiling that nobody can sell above this price. Or the government may go for a public ownership or nationalization.

In a number of countries things like roads or railways are natural monopolies they are nationalized. The government is the only one who provides for these and another option is doing nothing. Because here again we have observed that markets are a good way of organizing economic activity and certain governments might say that let the market do what they want to do.

Whereas certain other governments might say that the governments can sometimes improve the market outcomes and so, it is our duty to improve the market outcomes and we will do that. The

choice is dependent on the society that we live in.
That is all for today. Thank you for your attention. Jai Hind!