Managerial Economics
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Lecture – 6

Then we will move to our next topic and that is basic tools of economic analysis and optimization technique.

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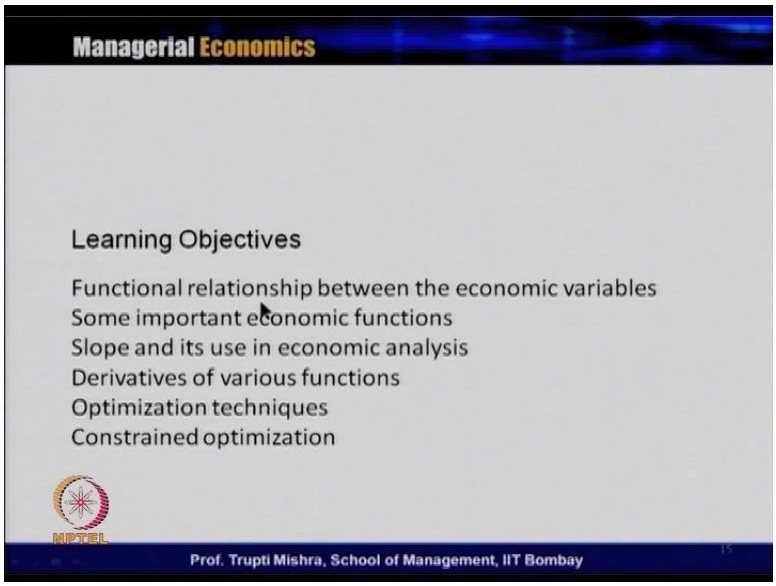

Now, what is the learning objective or session outlines of this topic? We will first look at what is the functional relationship between the economic variables and then we will discuss some important economic functions. Then we will see slope and its use in the economic analysis and derivatives of various functions, optimization techniques and finally, how we do optimization with a constant.

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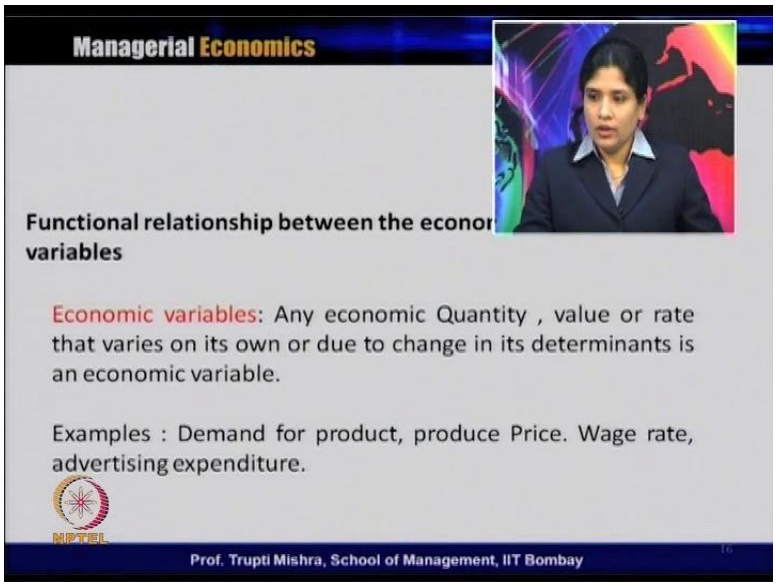

So, now coming to the relationship between economic variables. Now, what we consider as an economic variable? Any economic quantity, value or rate that varies on its own or

due to change in its determinants is an economic variable. Any economic quantity or value or the rate, the variables rate, any variable whether its value or rate that changes due to its own or due to change in the determinants of each is an economic variable.

So, when the variable changes the value due to its own value or due to some other factors, those are considered as economic variables. We can take the example as demand for a product whether it is 10 units or 12 units or 13 units, every time it is changing a value. The demand is not constant. So, this is an economic variable.

Price of the product, wage rate, and advertising expenditure these are few more examples of the economic variable, where the value get changed either due to own factors or due to change in the determinants, that is the factors affecting the demand for the product.

Suppose you take an example like why there is a change in the product price or why the price of goods increases, when the cost of production increases. Suppose you take the case of this marker, the cost of production is 10 rupees. So, price is on the basis of 10 rupees. When you add a normal profit and a tax with this, it becomes the market price for

this marker. Suppose the market price of this marker is 13 rupees and out of this, cost of production is 10.

So, what is the determinant of this price of this marker? The cost of production. Now, on what basis there will be an increase in the market price of this marker? When there will be an increase in the cost of production. Suppose, the increase in the cost of production has become from 10 rupees to 11 rupees. So, the market price given all other factors, the value of all other factors remains constant, and the market price of this marker will go up by 1 rupee. So, if it is 13 rupees, now it is 14 rupees. So, product price in this case, the product price is changing due to change in the value of its determinants. So, this is one example of the economic variable.

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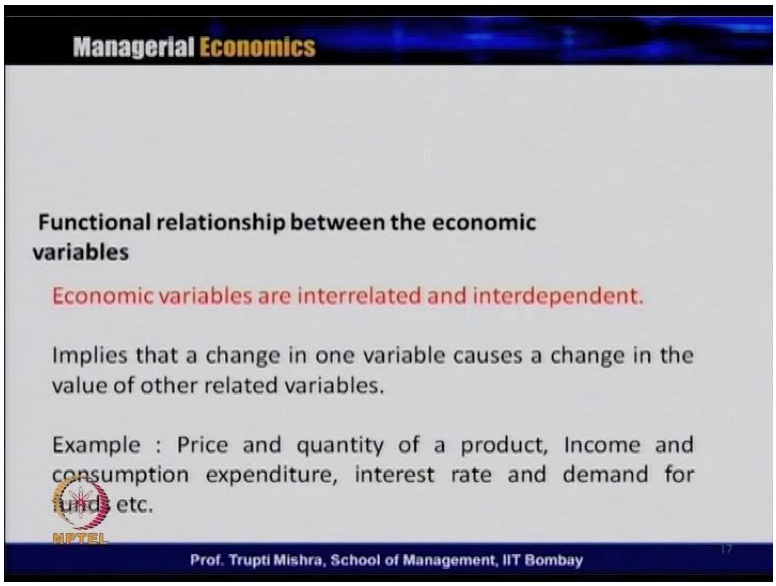

Now, all these economic variables are interrelated and interdependent. All economic variables they are not independent but they are interdependent and they are interrelated. This implies that a change in one variable cause a change in the value of other related variables. If they are interrelated or interdependent, when value of one variable changes, generally that leads to change in the other variable.

Suppose, we take an example of price and quantity of a product. If you take the same example, that is price of marker, earlier the price of marker was 13 rupees. Due to change

in the cost of production, the price of marker is 15 rupees. Now, price and quantity of product, they are interrelated. The price is more. Now, if it is from 13 to 15 rupees, few customers who cannot afford to pay 15 rupees for that, they will not buy this product. So, this increasing price affects the quantity of the product what is getting sold in the market.

So, price increases leads to decrease in some quantity of product that is getting sold in the market. So, if we look at price and quantity of product, they are interrelated. Because of that, when there is a change in the price or when there is a change in the value of one variable, that leads to change in the value of the other variable.

In this case, typically the price of marker gets changed and that leads to change in the quantity of the products getting sold in the market. Similarly, income and consumption expenditure. Suppose, if your income is more, you consume more and you spend more.

If income is less, you spend less. So, if you look at income and consumption expenditure, they are interrelated. So, value of one gets changed, due to change in the value of the others.

Similarly, interest rate and demand fund. If the interest rate is less, more people go for loan. If the interest rate is high, there is at least decrease in the demand for loans because the interest rates are on the higher side. So, economic variables are interrelated and they are interdependent. When there is a change in the value of one variable, that leads to change in the value of other variables because both of them are interdependent and interrelated.

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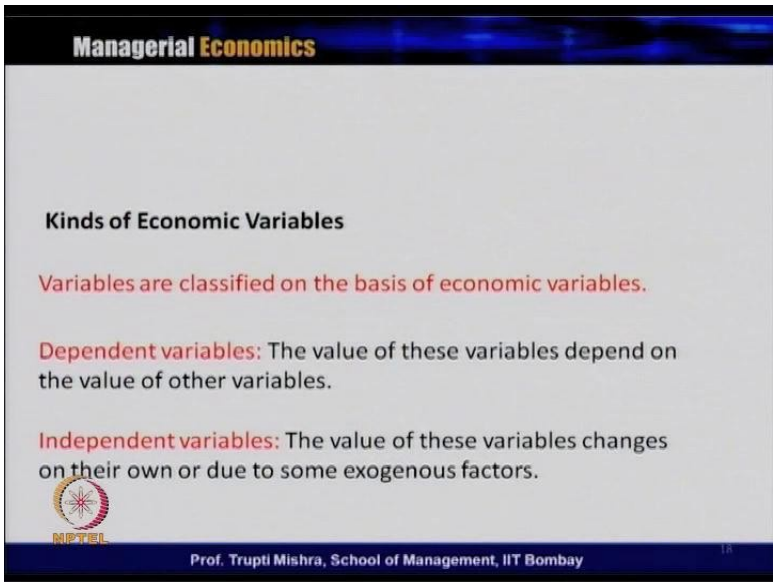

Now, what are the different kinds of economic variable? Variables are classified on the basis of economic variables. So, the first category is dependent and independent variables. The value of this variable depends on the value of other variable in case of dependent variable. Independent variables are those where the value of these variables changes on their own or due to some exogenous factors.

So, dependent variable is one where the value of this variable is always dependent on the value of the other variable. Independent value is the value of this variable changes due to their own or may be due to some exogenous factors, but not due to change in some other variable.

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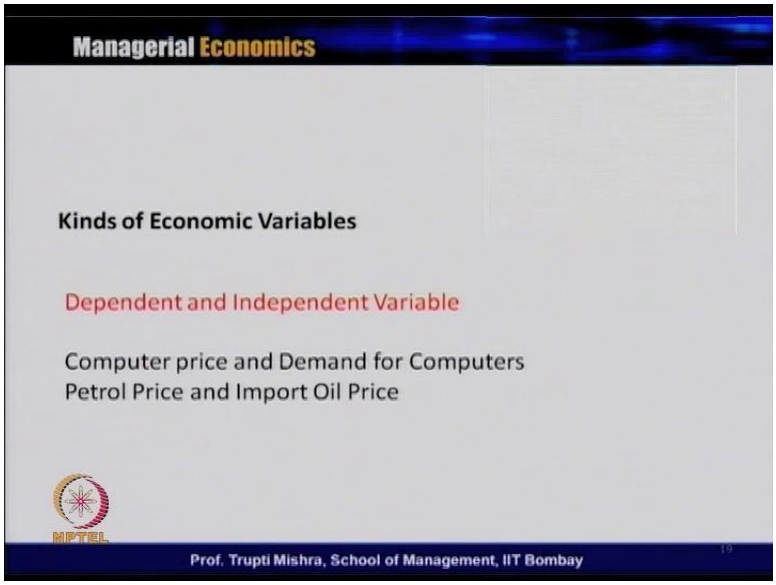

So, if you take the example of computer price and demand for computers. Here, demand for computers is dependent, computer price is independent because demand for computers is dependent on the computer price. When there is an increase in the computer

price, it leads to decrease in the demand for computers. When there is a decrease in the computer price, that leads to increase in the demand for computers.

So, in this typical case, the computer price is the independent variable and demand for computer is the dependent variable. Similarly, there is an increase in the petrol price. If you look at nowadays, there is an increase in the petrol price. Why there is an increase in the petrol price because there is a hike in the import oil price.

So, in this case, which one is dependent and which one is independent? Petrol price is a dependent variable, because petrol price is related with the value of the import oil price. Whenever there is a change in the import oil price, either increase or decrease in the import oil price, and that leads to change in the value of petrol price. So, if there is an increase in the import oil price, that leads to increase in the petrol price. If there is a decrease in the import oil price, that leads to decrease in the petrol price. So, in this case, petrol price is dependent and input oil price is the independent variable. So, dependent variable is one where the value of that variable is dependent on the other variables. Independent variable is one where it is not dependent on any other variable for its value, rather the value changes due to own or due to the exogenous factor.

The second kind of economic variable is endogenous and exogenous variable. Now, what is endogenous variable? Endogenous variables are those where the value of these variables is determined within the framework of the analysis model. So, if there is a model between price and quantity, the endogenous variable is one where the value of price or value of quantity has to be determined within this specific framework or specific model. Exogenous variables are what the value of these variables are determined outside the framework of the analysis model. So, any exogenous factor or any external factor will decide what is the value of this exogenous variable.

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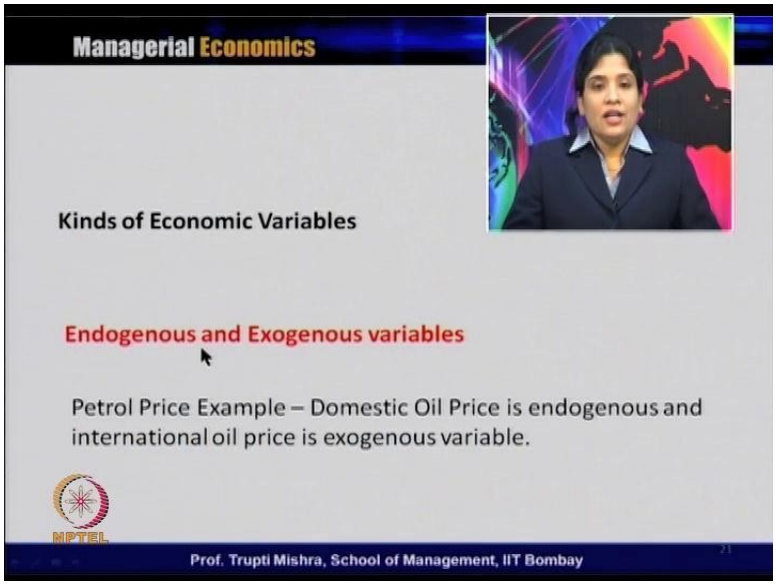

Now, we will take the example of the endogenous and exogenous variable. If you are going to the same petrol price example, domestic oil price is endogenous and international oil price is exogenous variable. So, domestic oil price is dependent on the import oil price. So, in this case, the value of the domestic oil price is decided within the

framework from the import oil price. However, exogenous variable is international oil price. International oil price is not strictly on the basis of the import oil price. It has some other factors and the value, those other factors also decide whatever is the international oil price. So, in this case, domestic oil price is the endogenous variable, whose value is determined within the framework and international oil price is the exogenous variable, whose value is decided on the basis of the external factors.

Now, when we analyze the relationship between the variables, we can analyze this or we can present the relationship between these variables through three methods. One is tabular method, second one is functional method and third one is the graphical method.

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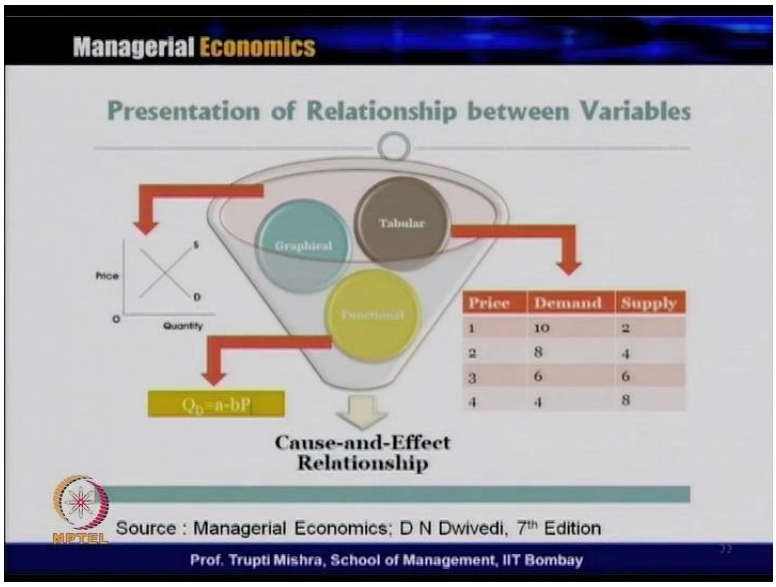

So, if we are taking the example of price, demand and supply. Suppose, there are three variables. This relationship between price, demand and supply can be presented through a graphical analysis. That is, through a supply curve, and through a demand curve taking quantity in the right axis and price in the left axis. We can do a tabular, where we can find out what is the demand and supply when the price is 1 rupee, 2 rupees, 3 rupees and 4 rupees. So, this is the tabular representation of the relationship between the variables and this is the graphical relationship between these variables and third one is functional, which deals with the cause and effect relationship, which we analyze or which we present through a functional form.

So, in this typical example, when we are deciding the relationship between demand and price, it will take a functional form, which is equal to Q d which is equals to a minus b P, where a and b are constant and P is the price of the product and Q is the quantity demanded for this product. So, relationship between these three variables can be presented through graphical method, through tabular method or through the functional method.

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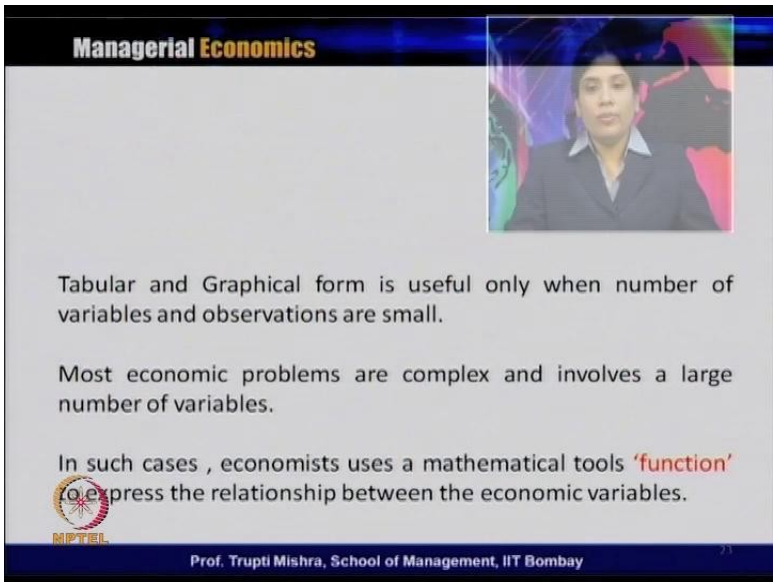

So, tabular and graphical form is useful when number of variables and observations are small. If it is two or three variables, then tabular and graphical form can be used. But if the number of variables is more, specifically in case of economic analysis, all the economic variables are interrelated and interdependent.

So, the number of variables and the number of observations are more. So, in this case, it is always good to use the functional form in order to represent the relationship between these variables. So, most economic problems are complex. It involves large number of variables because they are interrelated and interdependent. In such cases, the economist uses a mathematical tool known as function to express the relationship between the economic variables. So, the tool is functional and we generally call it as a functional representation of relationship between the economic variables. Economic analysis is more useful because there are large numbers of variables. Next, we will see what is a

function because function is used to represent the relationship between different economic variables.

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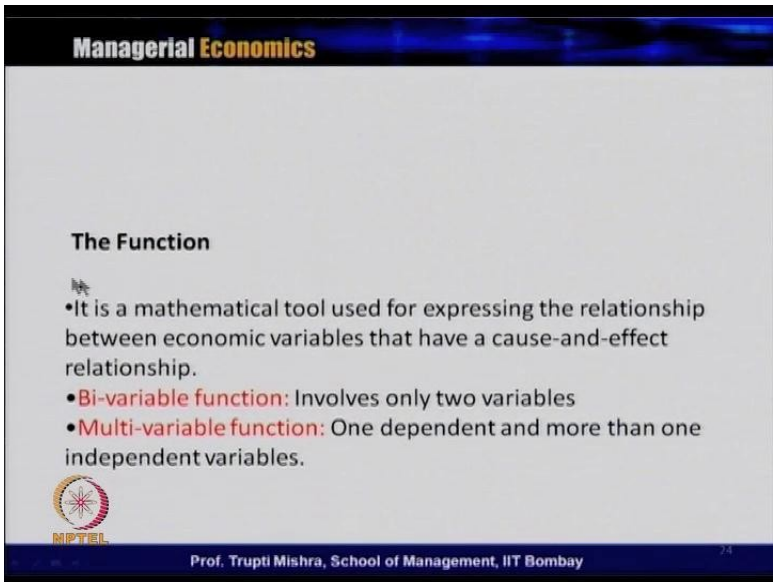

So, it is a mathematical tool used for expressing the relationship between economic variable that have a cause and effect relationship. When they are interrelated, if one is cause and other is effect and it is the relationship between different economic variables. It is a mathematical tool. Function is a mathematical tool used for expressing the relationship between the economic variables.

There are two types of functions. One is bi-variable function and second one is the multi-variable function. Bi-variable function involves only two variables and multi-variable function has one dependent and more than one independent variable. In case of bi-variable function, it has only two variables. One is dependent and another is independent. In case of multi-variable function, there is only one dependent and more than one independent variable.

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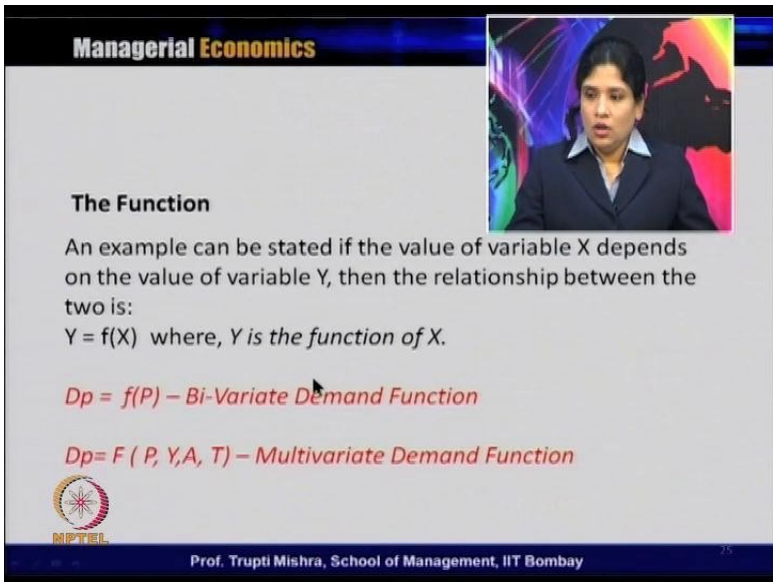

Now, we will take an example to understand this bi-variate function and multivariate function. If the value of variable X depends on value of variable Y, then the relationship between the two is, Y is a function of X, where Y is the dependent variable and X is the independent variable. So, this is a typical function, which expresses the relationship between Y and X, where Y is the dependent variable and X is the independent variable and Y is the function of X.

Now, taking the example of a demand function. If you consider P is the price of the product and d P as the demand for the product, the demand for the product is always dependent on the price for the product. So, in case of your bi-variate demand function, we are taking that there is only one dependent variable and one independent variable. In this case, we use this function d P, f is a function of P and this is a bi-variate demand function, where the demand for the product is dependent only on price.

Now, suppose we assume that demand for the product is not only dependent on the price. It is also dependent on the income, which is represented through Y, dependent on A, that is advertising expenditure and also depending on the taste and preference of the consumer.

So, in this case, how we represent the relationship between the variable price, demand for the product, income, advertising expenditure, and taste and preference of the consumer through a function. We know that demand for a product is dependent on price

for the product, income for the product, advertising for the product and taste and preference for the product. So, demand for the product is a function of price, income, advertising expenditure and taste and preference.

So, this is the example of a multivariate demand function, where there are four independent variables and one dependent variable. Here, the dependent variable is d P and it is dependent on four independent variables. That is, P ,Y ,where P is the price of the product, Y is the income of the product, A is the advertising expenditure associated with the product and T is the taste and preference of the consumer for the product.

So, there are two types of functions. One is bi-variate and the other is multivariate. Bi-variate essentially deals with two variables and multivariate deals with one dependent variable and number of independent variables.

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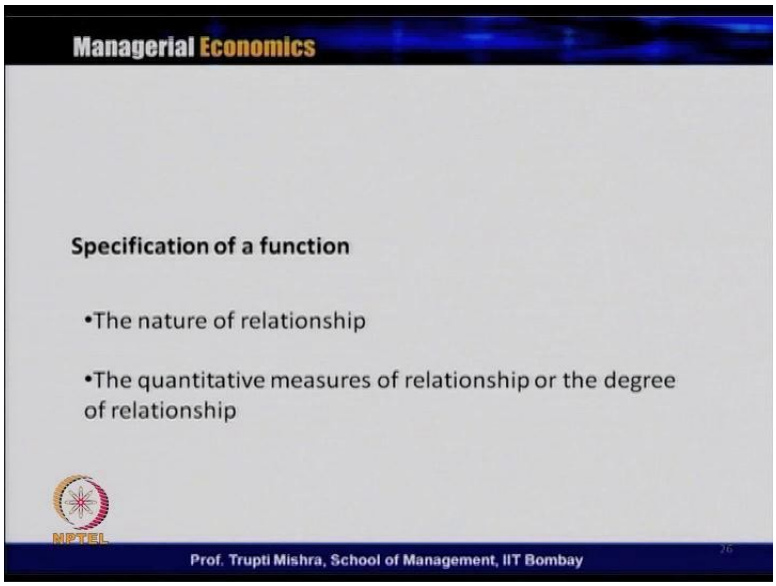

Now, how do we specify a function? on the basis of the nature of the relationship. How both of them are related? Whether they are positively related or whether they are negatively related? Second is on the basis of quantitative measure of the relationship or the degree of relationship, if they are positive. If they are negative, up to what extent. How we can quantify the degree of relationship? That is, on that basis we can specify a function.

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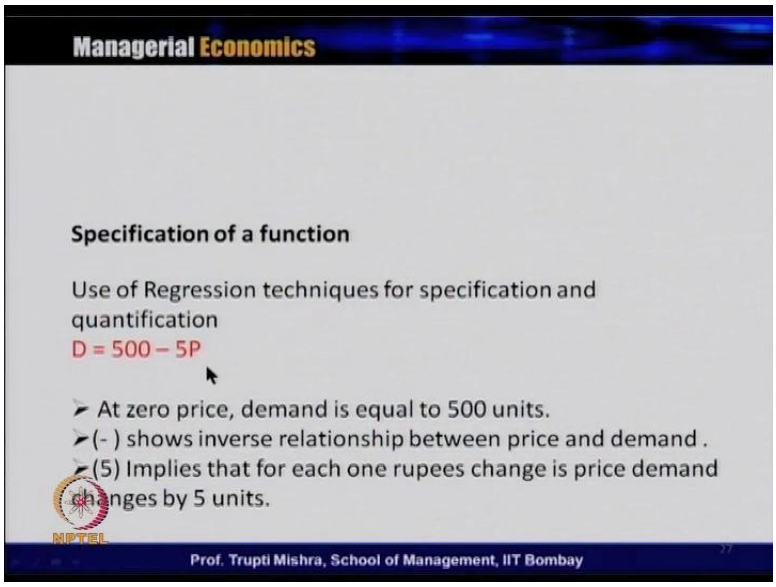

Generally, we use a regression technique for specification and quantification. Now, look at this example. Suppose, we take a demand function, which is 500 – 5P. What are the different implications of this demand function or how we can analyze this demand function? When the price is 0 and demand is equal to 500 units because the intercept value is 500. So, the first implication is at 0 price and demand is equal to 500 units. There is a negative 5P. So, negative source. There is an inverse relationship between price and demand.

This nature of relationship between price and demand is inverse. The value 5 implies that, for each 1 rupee change in the price, demand changes by 5 units. So, 1 rupee change in the price leads to 5 units change in the demand. So, this is the degree of relationship between the price and quantity demanded.

So, at 0 price, demand is equal to 500 units. So, when you get the product for free, the demand is 500 units. What is the significance of this minus? This shows the nature of the relationship between two variables. Nature of relationship is inverse. There is an inverse relationship between the price and the demand and 5 implies that, for each 1 rupee change in the price, the demand change is by 5 units. So, if you look at it, there is 5 times change in quantity demanded, when there is a onetime change in the price. This is the quantification of the relationship or the degree of the relationship.

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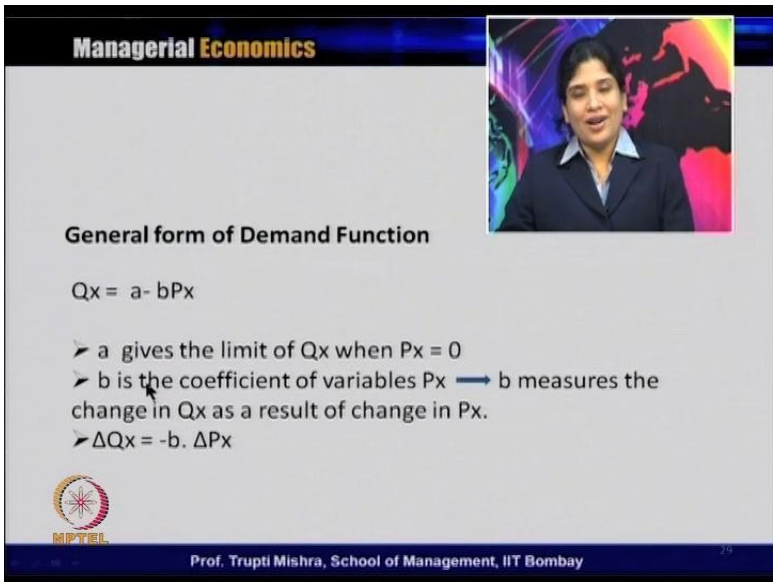

Now, what is the general form of a demand function? The general form of a demand function is Q x is equal to a minus b P x where Q x is the quantity of X, P is the price of X and a and b are the constant. So, constants in a function are called the parameters of the function. What is the role of these parameters? The parameters of the function specify the extent of relationship between the dependent and independent variable.

So, this a and b, they will specify what is the extent of relationship between the dependent and independent variable. They will talk about the nature of the relationship and the degree of relationship between dependent and independent variable.

So, taking this demand function, Q X is equal to a minus b P X, here constant a gives the limit of Q X, when P X is equal to 0 and b is the coefficient of variable P X, which measures the change in the Q X as a result of change in the P x. So, this is basically the change in the Q X, which is equal to minus b and the change in the P x.

So, in the previous example, if you remember, d was equal to 500 minus 5 P. So, 500 was the value of a, which gives the limit of Q X, when P X is equal to 0. So, when price was equal to 0, 500 was the quantity demanded and b is the coefficient of the variable P x. So, if you look at it, in the previous example 5 P. So, 5 P is the value of b, which is the coefficient of variable P X, which measures the change in the Q X as a result of change in the P X. which was 5 times because the change in the Q X was 5, which we can get through the value of b and change in the P X is 1. So, in the previous

example, when there is a onetime change in the price that leads to five times change in the quantity demanded.

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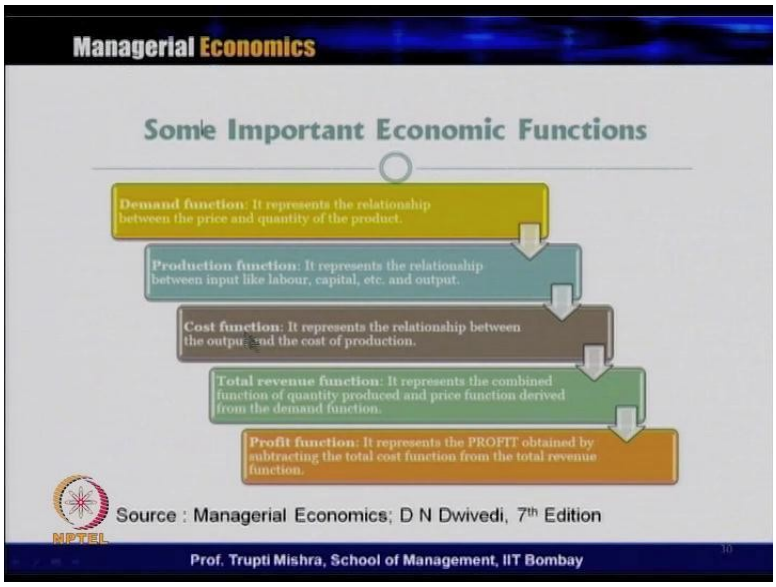

So, there are few other functions like demand function and other thing, like production cost function, that we will discuss in the next session. And for this specific part like basic optimization technique in basic economic analysis, we followed this Managerial Economics by D. N. Dwivedi, 7th edition. Thank you.