Econometric Modelling.

Prof. Rudra P. Pradhan

Department of Management

Indian Institute of Technology, Kharagpur

Module No. # 01

Lecture No. # 02

Structure of Econometric Modelling

Good afternoon and welcome to nptel project on econometric modelling. This is rudra pradhan here, today we will discuss this structure of econometric modelling so before we know about structure of econometric modelling it is better to know its agenda so the agenda of econometric modelling is to enter into future so that means it is all about forecasting.

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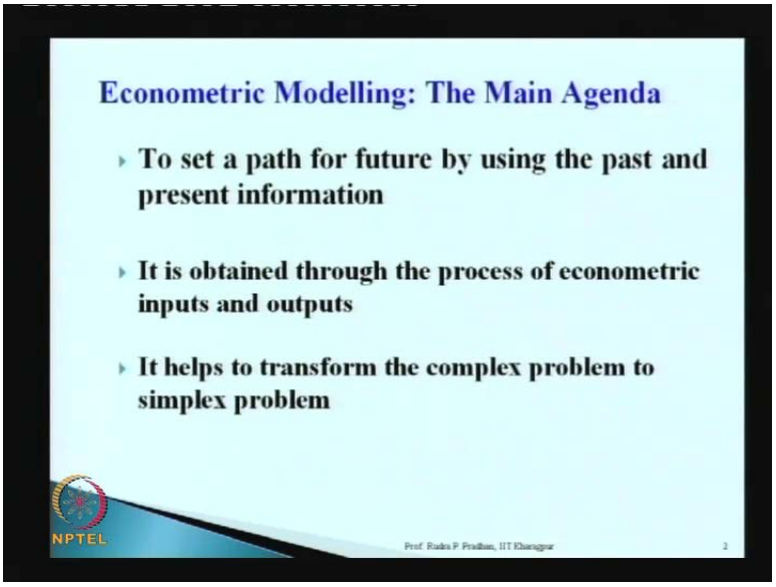

Forecasting is a process of entering into future by using past and present information that is with respect to econometric inputs and econometric outputs. Econometric inputs includes the theory basic theory the problems, mathematical theory, statistical theory,

information what we call data stast statistical tools like softwares computing methodology and knowledge interpretation etcetera.

In the output sides so it includes estimation, inference, forecasting, evaluations and assessment. So, now so forecasting is all about to integrate the econometric inputs and econometric outputs. So, now so how you have to do this things?

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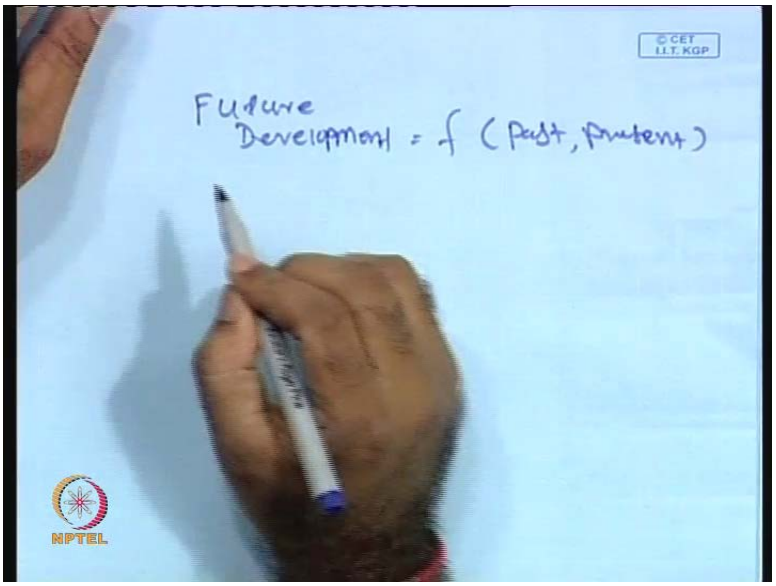

So, it is basically basically the question of entering into the futures or future development. So, future development basically function of past informations and present informations ok.

So, now so it is the question of solving complex problem into simplex problems. Now the question is how? So, there are there are various ways we have to do there are many you can say criteria you have to you have to designs now I will give you the indication how econometric model can help to solve this particular you can say issue?

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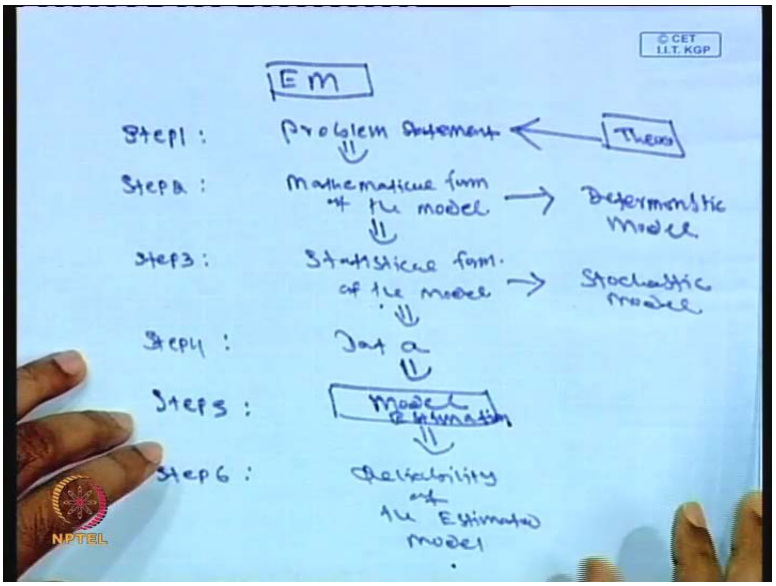

So, econometric modelling basically based on certain steps through which we can solve any particular problems so now the structure of econometric modelling starts with the the problems statement ok.

So, this step 1 step 1 process is problem statement which basically derives from existing theory so problem statement we have to derive from theory.

Then step 2 in the step 2 we have to transfer the problem into mathematical form of this models mathematical form of the form of the models ok.

So, now what is all above mathematical form of the model it is just the transformation of row information into certain mathematical equation so it is the theoretical a transformation of theoretical information into quantity information so basically it is an indication of deterministic models it is an indication of deterministic model ok.

So, now once you have mathematical form of the model then it has to be transfer into statistical form of the model so this step 3 process step 3 process is nothing but, statistical statistical form of the form of the model now once you have statistical form of the model it is nothing but, stochastic model it is nothing but, stochastic model alright.

So, now we move to step 4 the step 4 process is that you need to have informations which we call it into data so data has to be they are to investigate the statistical models so that means the whole idea is we have to bring a problem from the existing theory then

that problem has to be transfer into mathematical form of the model then that mathematical form of the model can transfer into statistical form of the model.

So, now our objective is to investigate this statistical form of the models so that means we have to verify the edge existing theory and existing problems. So, now to do that we must have a informations so that is what we call it data now once you have a data then you have to process it properly.

So, now in the step 5 in the step 5 we the data has to be you can process through some econometric technique so then we have we have we have the component called as a estimated models ok or model estimations or model estimations model estimations.

Now, once you have estimated model then next step is is the reliability of the models a step 6 we have reliability reliability of the estimated model reliability of the estimated model now the step 5 is very crucial here because before this a step there are certain procedures and after this step there are certain procedures so it is the middle between this a econometric structures. So, now what is all about the model reliability model reliability basically deals with certains you can procedures.

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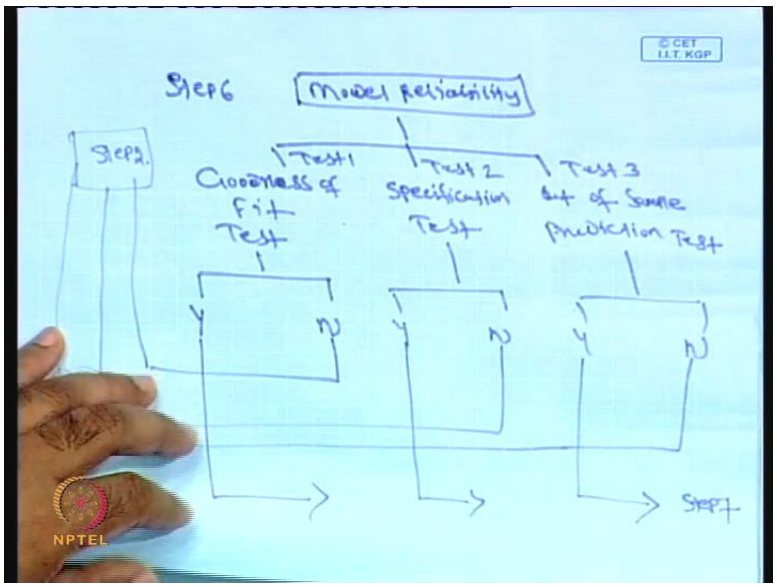

Let's once again I write it here step 6 this is what it is is called as a model reliability which is derive through model estimations so model reliability is basically basically three three components one is called as a goodness of fit test goodness of fit test then

second is a specific as an test specification test then third is called as a out of sample prediction test out of sample prediction test.

So, that means that means once you have estimated models. So, next step is model reliability so model reliability deals with 3 tests so test 1, test 2, and test 3; so, test 1 deals with goodness of fit; test 2 deals with specification test; and test 3 deals with out of sample prediction test.

So, now once you go through all these test so we had two different answers yes and no yes and no then again yes and no alright now if it is every case if it is no then then we have to proceed further we have to proceed further to step called as a you can go to step 2 so that means if the mod estimated modal is not reliable we have to go back to step 2 that is what is called as a mathematical form of the models.

So, now the mathematical form of the model again transfer into statistical form of the model and again that is to be verified through available information then again you have to process it, get this estimated model then again you have to go for reliability check again you have to continue with yes no situation then if again know you have to go back to again step 2. However, if it is yes if it is yes then you have to proceed to step 7 so every times if it is yes, yes, yes then you have to go for step 7 you have to go to step 7.

So now the question is what is step sevens so let me explain here what is what is step 7

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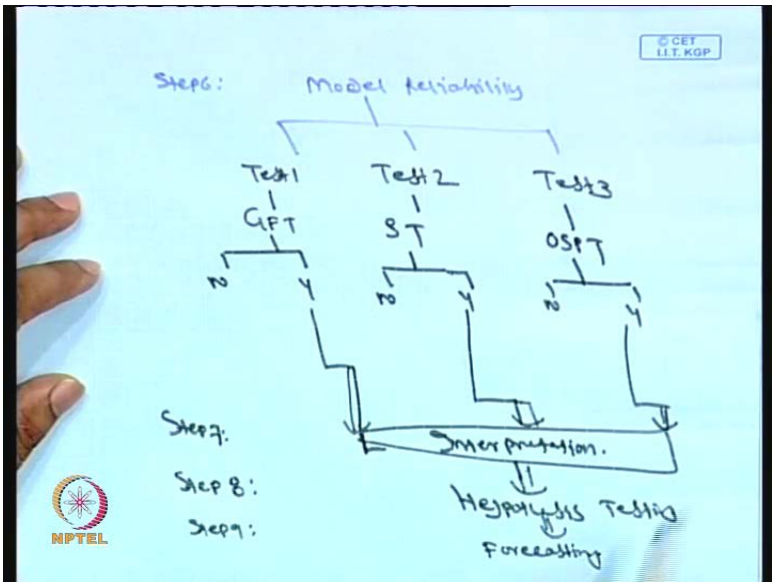

Here now the model step 6 here step 6 this is model reliability model reliability now this is this is test 1 this is test 2 this is test 3 this is nothing but, goodness of fit test this is nothing but, specification test and this is out of sample prediction test so obliviously it is no situation yes situation obviously it is no situation and yes situation obviously it is no situation and yes situation.

So, now you have a in every test gives no, no, no then obviously you have to go to step 6 this step 2 now if it is a yes, if it is yes, if it is yes ok so then you have to go for step 7 now this will be give you step 7 power view .

So, what is step 7? Now step 7 is basically deal with a interpretations interpretation of the existing estimated models now once you interpret then next step give to proceed for hypothesis testing hypothesis hypothesis testings hypothesis testings right this is a ste 8 step 8 information is a hypothesis testings now this is for we have to derive from you can say specification test ok.

So, now so per as a interpretation is concerned we have to go for hypothesis testings then we have to move to step 9 step 9 step 9 is a nothing but, forecasting step 9 is nothing but, forecasting now this forecasting for casting has to be go to step 10.

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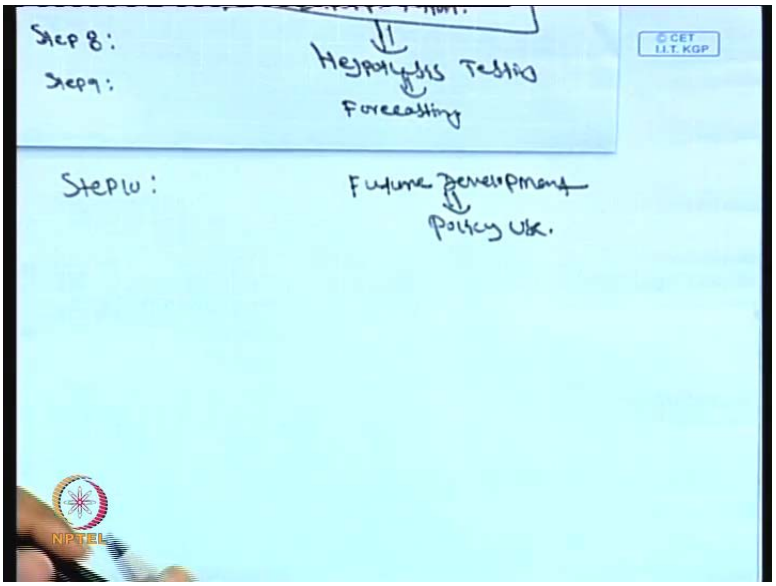

So, now this step 10 process is go for future future development future development which is otherwise called as a policy use. This is what the complete process of econometric structures so basically econometric structures starts with existing theory within that theory we have to find out the problem that problem has to transfer into mathematical form of the models; then mathematical form of the model has to be transfer to statistical form of the model then our objective based to investigate that theory to proper econometric tools.

So, now to verify that theory or to apply that econometric model or that problems so we need to we need informations now once you have information you get the estimated models now that estimated model has to be checked that is nothing but, a reliability cal part so reliability part is basically a three specifications that is three different tests so one is called as a goodness of a fit test specification test then out of sample prediction test.

So, now every test will give yes no results now if it is a no answer is no then we have to go to step 2 again so that is nothing but, mathematical form of the model again this system will continue like statistical form of the model data then estimated model then again you have to go for reliability check so again you you have an search yes no so if it is again then again you have to step 2.

So, now if it is yes then you have to interpret the estimated models so the moment will interpreted esti estimated model so you have to go for hypothesis testing which which we have basically derive through existing statement or problems what is all about hypothesis hypothesis basically checkmate which is a not verified which has to be verified so that means for verification we need to have a information we have tools then you have to process it have the estimated model then you have to go for testing.

So, now the moment you have a test the results then you can apply that model for forecasting so that means if the estimated model is a reliable then obviously a it has to be gone through testing a hypothesis now if the hypothesis testing is a you can say feasible one or it is you can say considerable one then obviously we have consider that model for forecasting.

So, now once you have forecasting then it will be give you the direction or for future development so that means that model can be utilized for any policy per policy use. So,

this is what the complete structure of you can say econometric model. Let me let me a explain the details with a very beautiful examples let us take case of it is take case study.

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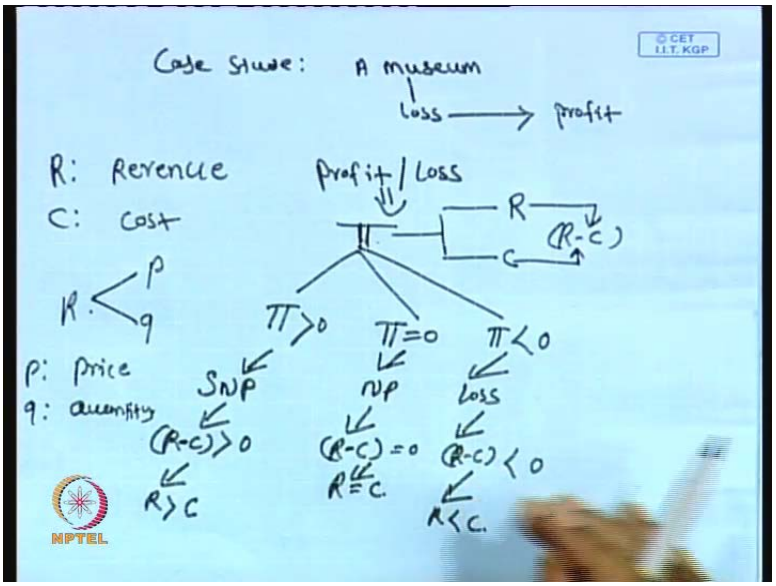

So, now the case study is a museum the museum which is running in loss the museum is a running in loss; and here assignment is to transfer this loss making unit to profit making unit so this is the typical problem which we have receives from from a particular department.

So, now the problem is very clear here is the museum which is running in loss here assignment is to transfer this loss making unit into profit making unit alright. Now how to do that? There are several setups or structure which we can transfer this loss making unit profits profit making unit but, here our agenda is whether econometric model can be use to transfer this loss making unit to profit making unit. If you ask me question obviously the answer is very much yes.

So, now the question is how? Before we apply econometric model to this particular problem let us first go through the existing setup or theory what is all about this problem the problem is that for any particular business this status of business difference of one its low profit and loss account so this status of particular business difference upon profit and loss account alright.

So, now profit and loss usually represents the indicator of or performance of a business so in business environment profit is a represented as the component called as a pi so pi is the value which can determine the position of the business so whether it is profit step or loss steps this pi has a three different structures one is called as a pi greater than 0, pi less than 0, equal to 0 and pi less than 0. Now if I greater than 0 this business store is called as a super normal profit ok.

So, now if pi equal to 0 it will give indication normal profit it will give indication to normal profit. if it is less than 0 it will give indication to loss. Now so, what is super normal profit what is normal profit and what is loss.

So. let me a first highlight what is a pi pi is the profit function which basically difference upon two components one is called as a r component another is called as a c component; r represents revenue and c represent cost so that means the problem is a very clear here we like to know what is this step of this particular business the step of particular business depends upon profit function and profit of a particular business unit difference upon it is earnings which we call it revenue and its cost which equality expenditures.

So, now the different betweens earnings and expenditure will give you the step of the business now once I do have a revenue another side we have cost now the difference will give you indication about the size of profit are minus c so r minus c will give you indication about the step of the profit.

So, now if will as super number profit then it is nothing but, r minus c, r minus c should be greater than 0 now for normal profit the structure of r minus c must be equal to 0 and a for for this loss situation this r minus c must be less than 0. Now if r minus c greater than 0 so it is an indication that r should be greater than c now if r minus c less equal to 0 then it is nothing but, r equal to c.

So, now for this it is an indication of r must be less than c alright now the question is what is r r is basically r is basically revenue and it depends upon it depends upon two components price component and quantity components; that means p represents price of this business or product then q represents quantity of this particular business so this is the entire structure of you can say profit and loss account of this particular business accounts.

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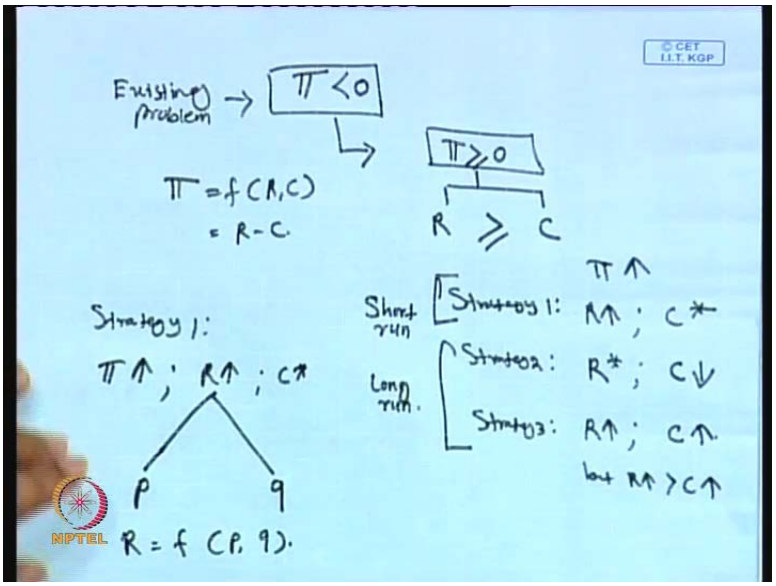

So, now for this particular problem now for this particular problems we are in the position of pi less than 0. Now when we see the loss making organization or loss making business then obviously y is less than 0 so that means the existing problem that means the existing problem is pi less than 0 but, our assignment is two transfer this existing problem in to profits f.

So, that means we need to transfer pi should be greater than equal to 0 pi should be greater than to 0 that means so what is pi here is now pi greater than 0 means we must have a revenue and we must have cost that means the transformation rule should be r greater than equal to c.

So, now how to do that so we need to have pi so that means if I will put it in mathematical for than obviously pi is function of r and c so that is nothing but, r minus c now we have three different strategy all together so what is the strategy so strategy 1 now strategy 1 pi can increase means pi increase depends upon various strategy strategy 1 first r will increase provided c remain constant then strategy 2 r can be constant provided c must be decrease ok.

So, now strategy three here r can be increase in the same time c can b also increase but, r increase must be greater than to c increase so we have three different strategy all together

to transfer loss making unit two profit making unit now the first strategy is very effective in the short run short run in the short run but, strategy 2 strategy strategy three is the long run in part ok.

So, now in the mean times for this particular problem we have to take one strategy let us start with a strategy 1 what is strategy 1 strategy 1 is a pi as to be increase provided r has to be increase and c has to be constant now what is all about r increased so r increase means it is the question of p and q moment because revenue is a function of price and quantity price and quantity now how to do that because I will come come here again.

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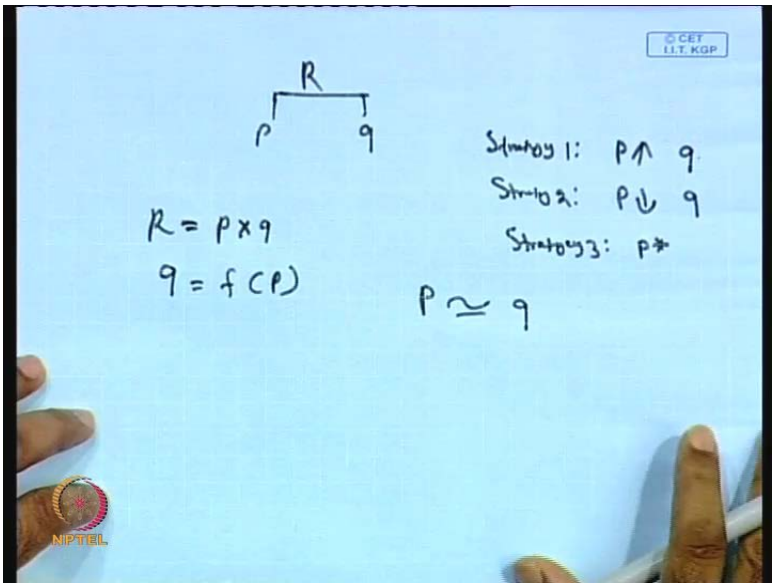

Now, this R R depends upon price and quantity so now how to that so now again we have three different strategy again we have three different strategy in fact first strategy strategy 1 p increase q q as usual remain constant; strategy 2 p decrease or as usual q is an normal then; strategy strategy 3 p remain constant but, if we remain constant then q remain constant so that means strategy three cannot be possible however first strategy and second strategy can be very effective tool for solving this particular issue.

So, now whether you will go for price increase or price decrease because price increase and quantity increase cannot be go simultaneously because the if will go by you can say market principals then obviously the structure is something different for instants so the structure is a revenue equal to price into quantity but, you know if will go by market model then q equal to function of price ok.

So, that means it is the p which influence q so that means here whatever items we have mention here they remains silent its increase decrease difference upon the moment of p p increase p decrease now whether will go for p increase and p decrease it has to be certain procedure it has to be certain procedures now whether you have to go for p increase or p decrease so we have to proceed further for it is a you can say structures.

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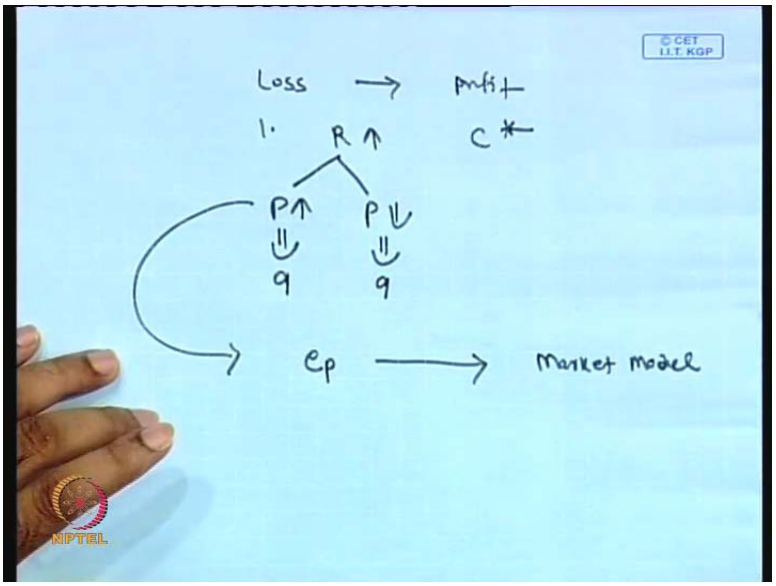

So, now for loss making organization loss making to profit making organizations so we have to use revenue increase strategy where cost remain constant and within the revenue increase strategy we have p increase strategy and p decrease strategy so obviously q I will change accordingly obviously q I will change accordingly now whether you will go for p increase or p decrease now it difference upon the concept called as a if the price elasticity which is usually derive through market models market models so that is by theory usually place fantastic rules so in the elder concept I have mentioned revenue equal to price into quantity and the difference the difference of revenue minus cost will you give you the profit structure this is the complete market model and which we have derive from the existing information or theory.

So, now to transfer this loss making unit to profit making unit then obviously we have certain procedures or you can structures so that we have to follow and apply accordingly the business strategy can be you can say a implemented now what is all about this a you can say a price elasticity now price elasticity basically let me explain here price elasticity.

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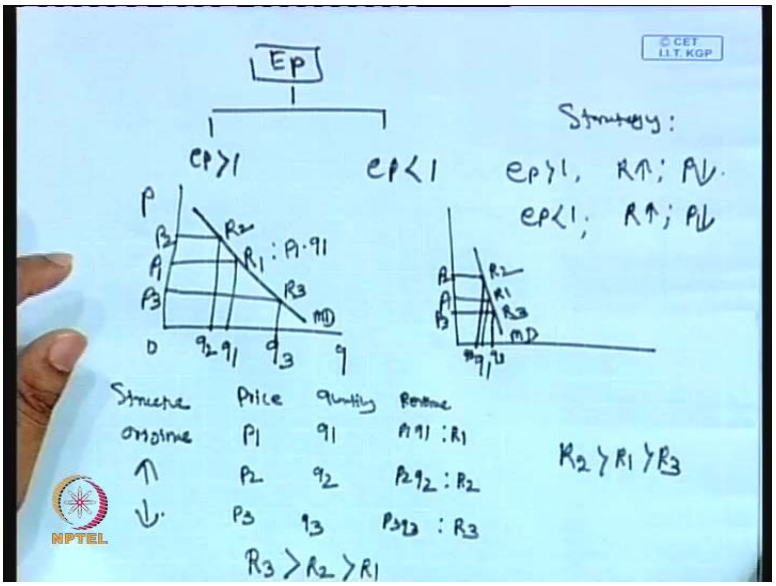

So, price elasticity basically here difference upon two things if we greater than one and if we less than one alright. Now before I explain this concept if we greater than one and if we less than one let me high let one thing here what is all about price elasticity price elasticity represent the degree of responsiveness of change in quantity with respect to its determinants and price is one of the determinant of this problems now the moment of price will affect the moment of quantity now so we have to target price then obviously quntil quantity will be quantity will be get affected.

So, now what we have to do here so the moment when if we greater than one then the structure of the relationship between pri if we means it is the relationship between price and quantity keeping other things remain constant now this idea will measure quantity in this side a I will measure price then obviously the existing setup with respect e p greater than one is like this alright.

So, now this is called as a market demand curve and another set when e p less than one this structure of demand curve is a like this this is also market demand curve this is for e p greater than one this is for a e p less than one it is derive through again the existing theory that is market informations.

So, now oh now we have to see what is the safe and structure of price and quantity now let us take a case here is this is the position original position say p p 1 and this is q 1

alright now we have to take here also one one situation then this is p 1 this is q 1 and corresponding revenue is a r 1 so r 1 is a nothing but, p 1 into q 1 alright.

So, now the moment you will get r 2 one so this is the existing current situation of revenue which is noth which is multiplied by price into quantity now I will make a change one increase price and another decrease price now this is p 2 and this is p 3 corresponding p 2 the quantity information is q 2 revenue information is r 2 then corresponding p 3 quantity information q 3 and revenue information is r 3 alright.

So, now the structure is like this way so this is what the existing structure so structure original position then increasing situation and decreasing situation this is price component this is quantity component so original position is p 1 then p 2 then p 3 and quantity information is q 1 q 2 and q 3 alright.

So, now if will make a comparative analysis the corresponding revenue is a corresponding revenue is a p 1 q 1 p 2 q 2 and p 3 q 3 which will quality r 1 which will quality r 2 which is quality r 3. Now if will make a look here is then obviously the conclusion is that if will order it properly with respect to ascending and descending then obviously r 3 is the greater than to r 2 greater than two r 1 alright.

So, now you come down to this particular component against now here if will increase price then the quantity decrease accordingly so this is p 2 this is q 2 now again you go for price decrease so this is p 3 and q 3 now this is r 2 this is r 3 and this is r one.

So, now you make a look here this side and this sides here a small increase of price will decrease the quantity very low rate again if will decrease the price it increase quantity at a larger what in this particular situation if will go for high increase your price then the a decrease quantity very less what it will decrease price then increase quantities you also very less so that means so here the structure is that if will go by same strategy then this sequence will be yes r 2 greater than r 1 greater than r 3 so that means when if we greater than one then we come down to now strategy now you come down to strategy for if we greater than one then to get r more you need to have p decrease policy now for if we less than one you need to have policy for r increase a you must have a p decrease policy if we decrease policy.

So, now what you to do so for this existing problem so we have to check whether if we greater than one or if we less than one if we greater than one then our assignment to transfer loss making to profit making we need to have we increase policy but, if your situation is e p less than one in two transfer this loss making to profit making organized unit you have to go for price increase so price easier tool here to transfer this loss making organization to profit making organization.

So, now in order to go; in order to decide whether you have to go for price increase or you have to go for price decrease so elasticity demand or priceless demand pressure fantastic rules so the pricelist demand basically elastic in nature or in elastic in nature if it is elastic then obviously the value of if we greater than two one if price is in annalistic then the value of p must be less than one.

So, now when if you greater than one then obviously decrease price is the best solution to have more and more revenue now if we less than one an obviously the price increase will have more and more revenue now according to this situation we have to apply price increase policy and price decrease policy ultimately it will increase the the revenue component the moment it will be increase the revenue component then profit can be incase subsequent because we have applied the strategy where c remain constant.

So, now having c remain constant then you have to fine how do the situation how price increase can be a applied or price decrease can be applied to transfer this loss making unit two profit making a unit.

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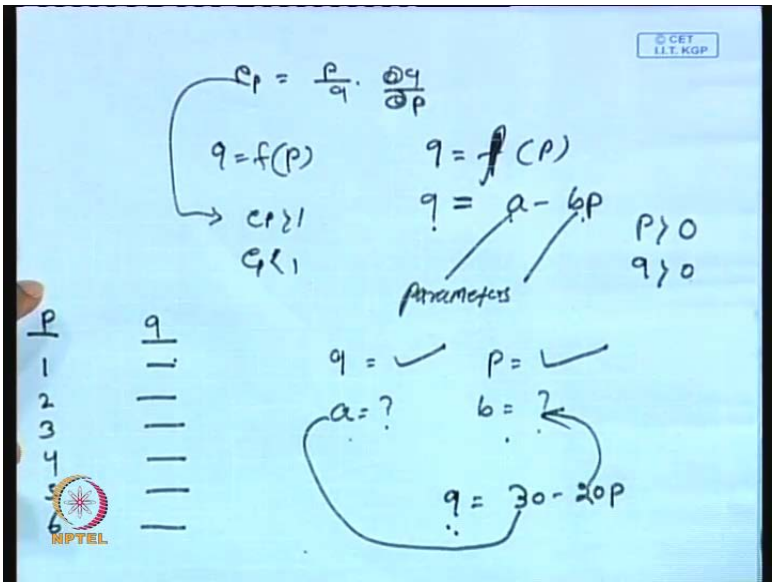

now the interest thing is interesting thing is the price elasticity component now what whatever concept to have discussed still now this all about business funda so that means we have identify the problem the problem is that it is loss making unit and we have to transfer into profit making you have this is this in full problem there is straight forward but, how to do that so for that we need a need to have a complete information that is nothing but, the market information the problem information the existing theory existing setup.

So, what we have done so we just collect the information so what is all about this loss and profit funda so the loss profit funda depends upon the pivello which depends upon revenue cost structures now pi can be increase depending upon moment of r and c since it is loss making organization then obviously r is less than to c so our task is to have more are with respect to c so for that we have to know the price and quantity structures.

So, now there is simp principal very simples because r depends upon p and q but, p q has a mathematical relationship because we have a market theory so the relationship between p q depends upon the structures so the relationship between p and q is a like this so every time this q is a function of function of p so that means to have to have more and more revenue so p has to be instrumental.

So, now either p can increase or p can decrease depending upon the situation of price elasticity now the question is what is all about this price elasticity I have already explain

the physical interpretation it is simply represented as the degree of responsibilities of change in quantity demand with respect to it is a price.

So, now if value put it in mathematical not then it is nothing but, p by q d q by d p now this is what we call its simply mathematics now how to get this value here is how to get this value whether e p greater than one or e p less than one theoretical we explain if it is e p greater than one what is the situation what should be done and e p is less than one what is this situation and what is two be done but, the question is how to now whether if we greater than one or if we less than one further we have to again go for this existing market theory.

So, market information or market module will give you information about the price elasticity now depending upon the calculated will (( )) b p we can get a conclusion or we can get a solutions for this particular problem now the existing theory is that q is every time function of p but, it is in implicitly format if will put it implicitly format an q is not thing what represented as a it is nothing but, function of of p and which is nothing but, a minus b p say ok.

So, p is every time positive q is a every time positive because of price of price of particular product cannot be 0 cannot be negative so quantity of particular product cannot be 0 cannot be negative if it is 0 that means there is no business at all so obviously price must be positive quantity must be positive now with this particular equation q equal to a minus b p so there are two indicators here a and b so this are called as a parameters this here called as a parameters a b r parameters and q p r price and quantity.

So, now for this particular problem you most have you most have q information and we must have a p informations but, u may not have a information u may not have a b information now econometric modelling place a rule here it it place base very very classic rule.

So, what is that no here econometric model is employed to know the value of this two parameters that it is a and b so that means once you get to know what is a and what is b then you can get to know what is the value of e p m d because the adjusting problem will give information like this for every p there is q for instants a p g one p g two p g three p four p five p six then corresponding p now obviously you must have a q information you

have q information you have q information you have q information you have q information and you have q information.

So, now corresponding p you have q information now so p is their q is their but, a minus b p is not with you so we have to past now what is a value what is b value for instants if lets a p equal to one then you cannot get q because we have no idea about a and b so if I derived the equation so q equal to thirty minus twenty we then obviously if v equal to one then can able to calculate q q if we equal to to you can able to calculate the value of q.

So, now the question is what is a a and what is b for this equation a can be thirty and b can be twenty what you cannot arbitrary (( )) this value thirty and twenty it has to be obtained certain process and stationed structure and to have that accurate value of a and b econometric model is means usually play place verify very very fantastic rules.

So, now how econometric modelling you can say very beautiful for this existing situation what you remember one thing whatever we have discussed you will now it is all about the bivariate frame work of this econometric modelling because every time we are handling q and p what the game is very interesting when you will go for multivariate models what is all about this multivariate model in that case the q may not be function of p only it can be something else for instance like this.

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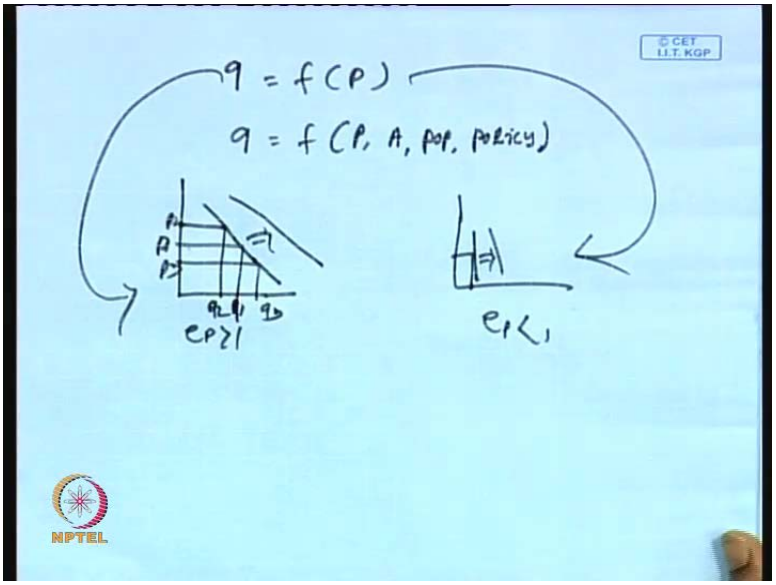

So q q is a function of p only now q can be function of so many other for other components p advertising of that particular product or you can say for this museum museum problem you people have a no idea about that museum then people may not compared because museum business depends upon how many costumers entering to that museum so obviously you need to a you can say awareness so you to create a awareness among the people so that is y advertisement place a fantastic rules population of that c t also another effector which can influence the quantity effector then policy of that particular area also for instants if there is a earthquake policy for there is some external factor like terrorist attack or something else then obviously that effector also have a impact on quantity for instants take a case of you can say north east states like you can say Asam, Arunachal pradesh etcetera. And you take another case Jammu and Kashmir. So, the it tourist particular place depends upon the a economic environment their business environment their political environment their if this factors are not stable not positive or you can say you not in a positive set an obviously a the quantity of the means the costumer to that tourist area will be very less.

So, only the pricing of that particular product or particular based may not be a one criteria but, it depends upon so many other criteria that means when will go for long run strategy transfer this loss making unit to profit making unit then obviously you have to apply multivariate models but, we have to start with the first bivariate then you will integrate with the multivariate models alright ok.

So, now now I will explain what is all the what is all about this a multivariate framework and bivariate frame work but, before before I proceed to explain that component let me explain one more here here when will go for for that particular problem when it we greater than one and when if we less than one if we less than one then obviously this structure is like this and this structure is like this.

So, now let say this is the original position this is the original position now you are targeting something or you are applying some strategy so that the step of this industry can be transfer into some difference step like say profit itself now for that need to go for price increase or you can say price decrease but, one thing you remember here so we are moving in this particular corner only.

So, that means only price which can influence this quantity but, this is nothing but, simply this is p p you can say q 1 this is q 2 this is q 3 this is p 1 this is p 2 this is p 3 but, when will apply a this is very correct when we will apply q simply as a function of p only but, when you apply q is a function of other factor then obviously here profit of that particular business depends upon the moment of this particular curve market demand curve so that will a increase to this sides ok.

So, this side also increase to this side so obviously this as an large impart on this organization so the loss making concept or organization can be transfer into profit making organization alright so before I go to explain detail about econometric modelling let me explain the entire structure of the that analysis ok.

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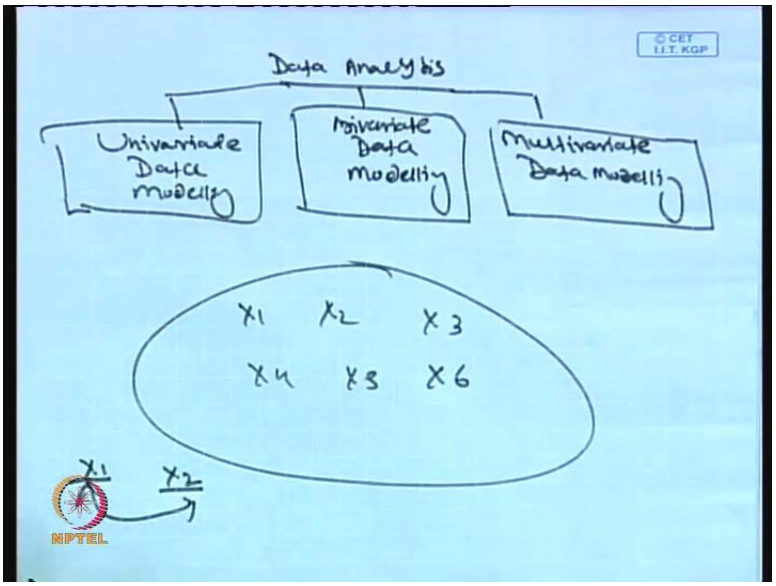

The structure of data analysis because I have already discussed what is the standard structure of the you can say econometric modeling? So, this standard procedure is a you have to start with the theory then you identify the problem transpose the problem into mathematical form then statistical form you must have information you process the information by applying some tools and technique then you get estimated model after having the estimated model you have to go for reliability check if the reliability estimated model is a reliable one then you have to go for you can say into you have to interpret that model go for hypothesis testing forecasting then its future you future you can policy use.

So, now the issue is what is the entire structure of econometric modeling? The structure of econometric modelling is a part and personal of you can statistical modeling so statistical modeling again is a vast concept and econometric modelling is part of that.

So, now I will highlight here first what is the entire structure of statistical modeling; then will being the concept of structure of econometric modeling.

So, data analysis basically divided into three parts data analysis basically divided into three parts first part is called as a univariate data modelling univariate data modelling then bivariate data modelling then multivariate multivariate data modelling ok.

So, we have univariate data modeling, we have bivariate data modelling and we have multivariate data modeling ok. Now what is univariate modeling? what is bivariate modeling? And what is multivariate modeling?

Univariate modelling means to design the problem means structure of a particular variable at a time.

So, now here game boundaries very very simple and very easy because its only one variable which can give you the indication and strategy that is what forecasting strategy so with one variable we have to play the game so this is what it is called as a univariate data modeling.

Bivariate data modelling is basically it it is basically two variables games.

So, that means only two variables can explain as the entire structure so that means how one variable will affect the other variable and other variable will affect the first variable so multivariable multivariate data modelling is the complete structure of or you can say simultaneous simultaneous structure of all this variables together that means let me take it guess here is this is the this is the boundary here is so we have several variable say x 1 x 2 x 3 x 4 x 5 and x 6 alright.

So, now what have to do now if I am concerned about only the e structure of x 1 or x 2 x 3 x 4 like this then it is called as a univariate data analysis now if I discuss about to the relationship between x 1 and x 2 or x 1 and x 2 then it is called as bivariate modelling.

So, now if I will target x 1 x 2 x 3 x 4 x 5 x 6 all together it is all about called as a multivariate data modeling. Now there are various techniques available unders univariate data modelling various techniques available under bivariate data modelling and variable various techniques are available under multivariate data modelling under biva under univariate data modelling is standard techniques are central tendency, dispersion and skewness under bivariate data modelling the standard techniques here covariance, correlation and regression and under multivariate data modelling it is a very huge component and it covers number of techniques as starting from multiple correlation, multiple regression, vector analysis, cluster analysis, disjointed analysis, conjoint analysis, discriminate analysis, path analysis, structural equation modelling and

simultaneous equation systems so these are the complete setup of data analysis that is with respect to univariate model, bivariate models and multivariate models.

So, now this is what it is called as a the complete frame work of statistical modelling however we are not in a position to discuss the entire structure of multivariate data modelling so econometric modelling is a basically in between bivariate modelling to multivariate modelling in this particular course we are basically interested for two things that is regression modelling and time series modelling.

So, we have to go through various components under regression modelling like bivariate modeling, tri variate modeling, multivariate modelling and it is various problems and do not time series modelling we have to go for auto regressive scheme distributed scheme haringa model, arch model, garch model, bar model. So, and other problems now for regression modelling and time series modelling we have to go through series our components and it is a problem setup so will discussed detailed when will go for this you can say econometric modelling in detail in the next class with this we can conclude the session thank you very much have a nice day.