Econometric Modeling

Prof. Rudra P. Pradhan

Department of Management

Indian Institute of Technology, Kharagpur

Module No.# 01

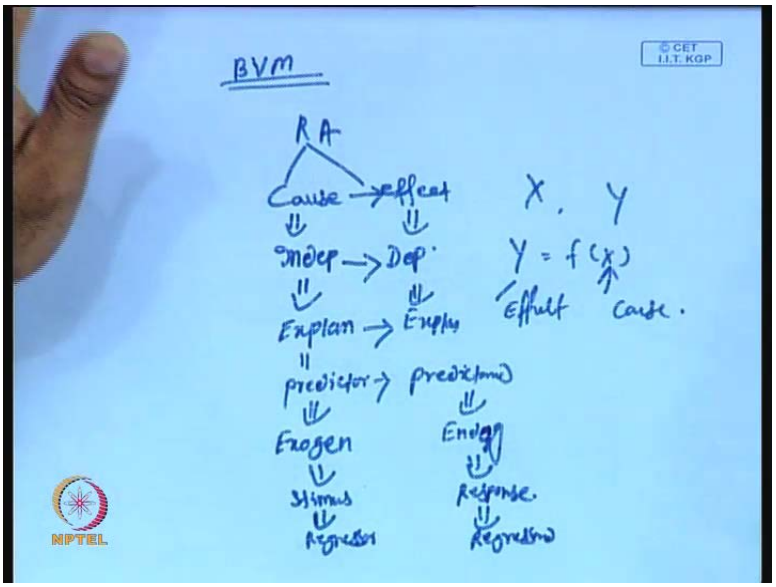
Lecture No. #07

Bivariate Econometric Modeling

Good afternoon.This is Dr.Pradhan here. Welcome to NPTEL project on Econometric Modeling.Today we will discuss the issue of Bivariate Econometric Modeling.In the lastcouple of lectures we have discussed various aspects of Econometric Modeling, various structures of data analysis,Univariate analysis, Bivariateanalysis and Multivariate analysis.We have discussed various issues under Univariate analysis, various issues under Bivariate analysis and little bit idea about the Multivariate analysis. So, today westructure is mostly on the analysis of econometric modeling.

So, let us start with what is all about the structure of Bivariate Econometric Modeling. So, it it consist oftwoaspects Bivariate setup and modeling. So, we have discussed what is the Bivariate data structure and we have also discussed the modeling issues. So, let me first highlight what is theEconometric issue behind the Bivariate Modeling. Econometric is the product of statistics. Basically it is an extension ofregression modeling.

(Refer Slide Time: 02:19)



So, the basic idea of regression analysis is to start with cause and effect relationship betweentwovariables that is the dependent and independent variables.

So, we like to know how the econometric modeling is very close or you can say somewhat different from the basic statistical modeling. So, the basic idea behind regression analysis is to start the cause and effect relationship. It is alsoa similar way of econometric modeling. So, here this issue is something different when you will go for basic regression analysis. So, we are not bothering about the various typical issues or typical problems behind this analysis.We have discussed the simple structure of regression analysis.

But, if you go in deep higher version of modelingthen, the regression analysis is very complex and very complicated. So far as econometric modeling is concerned,it is the root or beginning from this basic regression analysis. So, now, when will you talk about the Bivariate Econometric Modelingobviously, the basic idea behind this issue is to study the cause and effect relationship betweentwovariableslike we have discussed this issue.That means,it is cause and effect relationship betweentwo variables.

So, what is the cause and what is the effect?For instance, if we havetwo variables say X and Y then if we will write Y is a function of X then X is represented as a cause and Y represented as a effect. That means, this is effect side and this is cause side alright. So, nowfor as econometric modeling is concerned, it is the extension of the basic regression modeling. Econometric Modeling the issue is on the structure of research. So, there are many ways the structure can be analyzed.For instance, we are discussing here cause and effect relationship betweentwo variables.There are many names we can discuss regarding the cause and effect relationship.

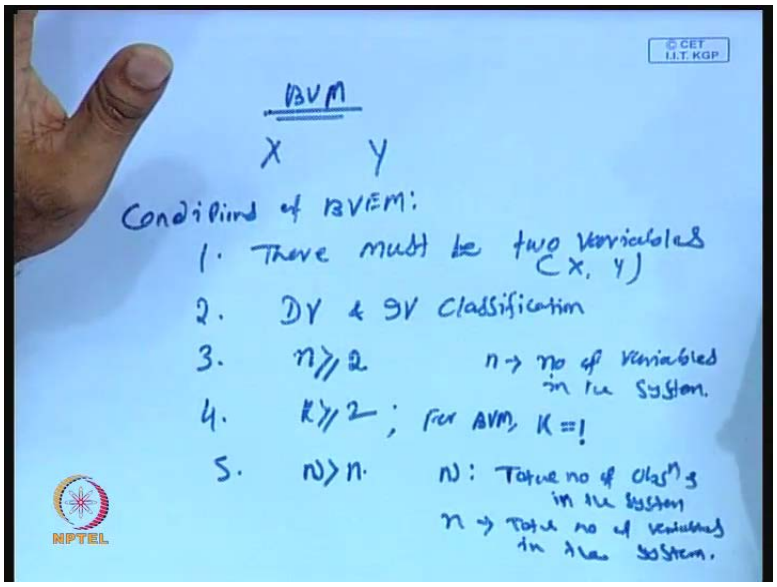
For instance, it can be the a relationship between independent variables and dependent variables.Otherwise it is alsotheissue between explanatory variables explanatory variable and explained variables. So, the structure is like this independent to dependent explain to explanatory.Then similarly, it can be also represented as this is predictor and it will stand to predictant. So, similarly, it is otherwise known as exogenous variablesand this is otherwise known as endogenous variables.

So, similarly, it is otherwise known as stimulus and this is otherwise called as a response.This is otherwise called as a regressor this is otherwise called as a regressant.

So, likewise there are various waysit can be represented. So, its cause and effect relationship the issue between or the nexus between dependent variable independent variable, explained variable and explanatory variables,covariance and covariate, then similarly, exogenous and endogenous variable, stimulus and responseandlast, but, not the least is called as a regressor and regressant.

Because Econometrics is a statistical technique which has many application in many areas.There are variousyou know ways it can be represented.Means the paper is must learn application oriented. So, as a result the same words it can be represented in a very ways it means many ways. So, it is just like oldwine in a new bottle. So, the pictures aremore or less same, but, the representation is the somewhat different. So, before we start with this BivariateModeling,you know Econometric Modeling.Let me highlight what is the issue behind thisBivariate Econometric Modeling.

(Refer Slide Time: 06:57)



The Bivariate Econometric Modeling, since the issue starts with the bivariateobviously, there aretwosets of variables. One we call it X and another is you can say Y. So, before we enter to Bivariateeconometric modeling we must haveessential requirements otherwise we cannot do anything for this econometric modeling. So, now, the issue is what are this essential requirement before we proceed for econometric modeling that too Bivariate analysis. So, 1stthing is numberoneconditions or constraints of Bivariate econometric modeling.

So, what are the conditions we need to have to build a Bivariate econometric modeling. So, number one condition is that first there must be two variablesin the system. So, let us say X and Y or X 1 X 2 like this. So, this is first and foremost condition of thisparticular problemssecond is whichthere must be classification of dependent and independent. So, dependent variables and independent variable classifications because it is the cause and effect relationship issue.So, obviously, there is a dependent structure and there isa independent structure.

So, when we talk about cause it is usually represented as an independent structure and when we call it effect it is called as a dependent structure. So, the issue iswhen we talk about Bivariate econometric modeling then, there must betwo variables in the system this is the first condition and second condition you have to classify which 1 is dependent and which 1 is independent.Becausethe model isbased on that systemof course, there is a Bivariate,you know bidirectional causality issue.So, obviously when there aretwo variables in a particular systemthen either X causes Y or Y causes X or both can be go simultaneously.

So, that particular structure is called as a time series issue. So, we are not in the process of discussing the detail about time series modeling. So, we are just in the process of beginning. So, thisrestriction must be here is that to the bidirectional issue or reverse causality. So, we are not considering here the reverse causality.That means, if X influence yso, we are assuming that Y does not depends upon X. Y may depend upon X, but, Y is cannot be treated as a again independent variables. That means, a dependent and independent classification must be very essentialand very you can say accurate or that is you know right choice of this particular modeling.

So, now third is that should be that means, in other words it called as a n greater than equal to two. So, n stands for n stands for number of number of variables in the system.Just it is extension of the first condition.Fourk must be greater than equal to two. So, that means, in this particularprogram k is treated as a independent variables setup. So, when will we go for bivariate issue then, obviously, k may be or k is exactly equal to 1.So, when we will go for Trivariatemodeling then k equal to 2.When we will go for multivariate modeling then obviously, k greater than equal to two.

But for the Bivariate analysis or Bivariate econometric modelingif k is represented as the number of independents variables then, obviously, in this particular setup k must be exactly equal to 1. That means, in this particular Bivariatemodeling your k must be exactly equal to 1. So, k is treated as a number of independent variables in this particular system. So, then finally, N greater than n represents here the capital N represents total number of observations in the systems and n represents total number of variablesin the systems.

That means, sinceit is a Bivariate setup then there aretwo variables. So, your sample size should be more thantwoat least.If your sample size is less than 2 then the system itself is inconsistent we cannot proceedfurther.So, when there is a issue of multivariate similarly, the representation of you knowcapital N small n will be very serious issue. So, for instance for trivariate analysis obviously, there arethreevariables in the systems.That means, n represents 3 and capital N must be greater than equal to three.

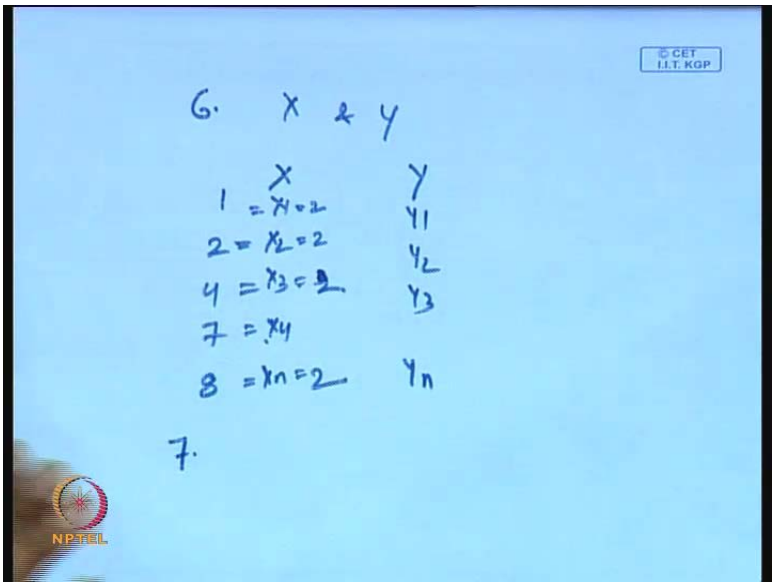
But, even if it is equal tothreethe system cannot be operated properly. So, to operate the system properly you must have sufficientsample size or samples; that means,you must have some sufficient data points.Until and unless you have sufficient data point you cannot able to you can say build the econometric models.

So, your model building or the consistency of the model or the feasibility of the model depends upon the sample setup.Higher is the sample size better is the accuracy of the model or better is the feasibility of the models.If the sample size is very less or you can say very minimum then, obviously, it will affect the system and the model by default it will be inconsistent oneand you cannot use this particular model for any forecasting or any policy use.For you knowfor the objective of policy use or forecasting your model must be perfectly ok.

So, what we otherwise called as a best fitted models, to get the best fitted models you must havehigher and higher sample size. So, that is you know toughest issue in this modeling setup that too econometric modeling. So, your sample size will be substantially or absolutely very high than the number of variable in the particular systems. So, there is a trick how to determine the a minimum number of you can say a minimum sample size in a particular system.

We will discuss in details when we will go in the different version of the econometric modeling. In thea in the very beginningyou must have knowledge that whatever variables you are using in a particular systems your samplessample size should be absolutely greater than to number of variables in the systems.

(Refer Slide Time: 14:58)



So, this is the another conditionof Bivariateyou can say econometric modeling.Thenwe are talking about sixth condition.We are talking abouttwo variablesin the systems X and y, but, we remember thatthere must be some variability in X and Y for instanceif I will take some observation on X and some observation on Y.If the observations are not perfectlyok as per the modeling rules and you can say modeling formalities then of course, again the model will be you can say inconsistent or infeasible one.

For instance,let us take a case.Here is if I have a X variables and I have Y variable.If I will take only X consist of somany observations like X 1 X 2 X 3 like up to X n similarly, Y consist of Y 1 Y 2 Y 3 up to Y n. So, now, X 1 X 1 X 2 X 3 X n these are all you know implicitly from other means we do not know it is X 1 what is X 2 what is X 3 what is X n and we also do not know what is Y 1 Y 2 Y 3 Y n. What we can say represent here that X 1 X 2 X n are the sample points of X and Y 1 Y 2 Y n are the sample points of Y.

But what is X 1 what is X 2 or what is Y 1 or what is Y 2 we have no idea.Now I will give the structure.Let us say X 1 equal to 2, X 2 equal to 2, X 3 equal to 2,and X n equal

to 2 then in this particular setup there is no variation on X samples.That means, every point it is 2.If there is a no such variation and obviously, by default the model will be inconsistent. So, there must be a some kind of variability in the sample observations it should not be highly distance or it should not be or you can say very equal. So, you have to find out the optimumone.So that means, it is the midpoint or you can say somewhat middle between.You can say exclusive equality and exclusive inequality. So, there should be some optimum one.

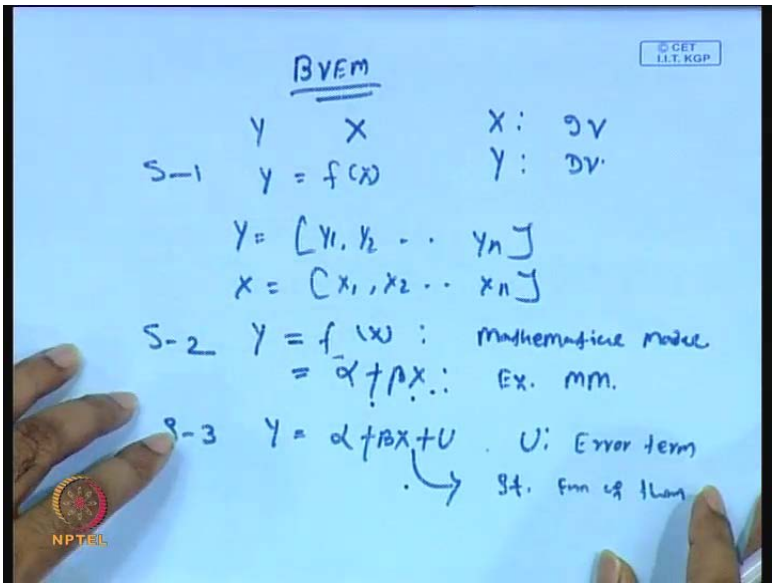
For instance, if like the sample observation like thisinstead of 2,2,2 if I will put X 1equal to 1, X 2 equal to 2, X 3equal to 4, X 4 is another sample say is equal to seven then X n is another sample say eight then there is a some kind of variability. So, this particular setup is very consistent for the a model building.Of course, by initial look this data points are somewhat, but, still there is a statistical test whether this particular variables observations are definitelyor not we have to verify it. So, there is a statistical techniques that means, we have to check the normal distributionstructures before you go for a any econometric modeling.

Similarly, in the case of Y there should not be any problem like a 2, 2, 2case. So, there should be some variability in Y also for instance Y 1 equal to 2, Y 2 equal to five, Y 3 equal to seven and Y five equal to eight. That means,if the setup is a some kind ofvariations then, obviously, there is a way to build a model. If all the data points are equal then we sometimes very handicap to handle the particular situation.

So, we need some variability in the data points and that variability should not be so high.If it is high then again it will turn to inconsistent. So, to make the consistent it should not be absolutely equal and it should not be absolutely unequal. So, it has to be in between the two. So, that is what we call as a optimum ones all right.

Then seventh or last, but, not the least condition is that X and Y should be random in natures so that means, somewhatit is attach with the issue of probability.Means there is a some kind of chance factor which can you can say involve in this modeling scenario that too Bivariate analysis with this particular setupof you can saycondition of Bivariate econometric modeling.

(Refer Slide Time: 19:46)



We have to proceed furtherto what is the structure of this particularissue let us the basic structure ofBivariatemodelingBivariate Econometric Modeling. So, Bivariatemodeling the initial starting point we must havetwo variables Y and X ok.

So, here we will assume that X is represented as a independent variable clusterand Y is represented as a dependent variable clusters. So, now, the extension is like this Y equal to function of X this is just like a mathematics. Sonow the extension is the how you have to set this particular Bivariate econometric modeling. So, lets Y equal to the structure of Y 1 Y 2 up to Y n and X represents X 1 X 2 up to X n all right. So, now, when we have Y and X then we cantrans the functional relationship between the 2.

When we trans the functional relationship between the two then there are 2 different techniques.We usually use either correlation that is the extension of covariance and there is another technique called as a regression that tooextensions are vacant correlations.What is upon as econometric modeling is concerned there is something more thanthat it is not just to correlate and just to regress. So, in between there is a lots of hidden issues. So, that hidden issue is the crucial point of you know higher version ofresults or you can say higher complex problem. So, now, we have to discuss all these issue and the beginning of econometric is that from this particular basic levels.

So, when you have a particular relationship that too correlation and regression then there are various measuresyou can say bistructure.We can represent the relationship and that to

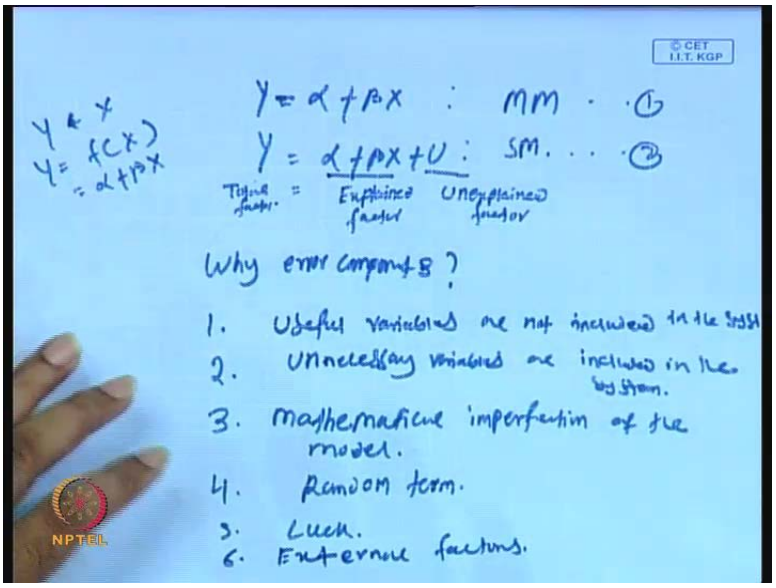
be in we perfect ones to get the perfect 1 we have lots of by you can say structures techniques tools to get the better picture. So, now, we have to see how quicklywe can have that particular best fitted models and what are the problems we have to face or we have to find out to get this best fitted models.

So, this is you know very complex issue and very you can say typical issue we have to discuss step by step. So, let us start with this particular relationship. So, when we havetwo variables in this particular system having the observation Y 1 Y 2 up to Y n and a the observation X 1 or X 2 up to X n then; obviously, the first and foremoststep you can say is that we have to build a mathematical form of the model that is nothing, but, Y equal to function of X that is we called as a mathematical models.It is simply mathematical model. So, now, we know we have a variable in the systems.

So, first you transfer this particular theoreticalinformation to mathematical informationthat too the individual variable into some functional forms that functional form is treated as a mathematical form of the models. So, now, we have to transfer this mathematical form of the model into statistical form of the models then the econometric issue will be coming in to the pictures. So, now, before we go to statistical form of the model let usjust represent the a explicit format of this particular problem you can say model or relationship. Y equal to function of X means there are many ways this Y and X can be you can say worked out. So, what you have to do here is..

We have to see in anexplicitly format; that means, with the relationship is linearoneor the linearshipis a non-linear or not because this is very strong issue for this modeling behaviors. So, let us assume that there is a relationship and that too linear relationships.

(Refer Slide Time: 26:02)



So, now, we have to represents Y equal to alpha plus beta X.Just like it is a straight line equation Y equal to m X plus c where m is the slope and c is the constant. Here instead of putting Y equal to m X plus c we are putting beta X plus alpha, beta is the slope and alpha is represented as a supporting factor, constant factor and X is independent variable Y is the dependent variable. So, this is what we called as a explicit format of mathematical models.

So, now this is this second step of this particular process and this is this step 1 process of this bivariate setup. So, step 1 is slope.Bivariate econometric modeling is that we have to bringtwo variables and you have to build its relationship and that too in a functional form and that functionalform again has to be in a explicitly format. So, now, when you have a explicitly mathematical model then we have to transfer in to statistical form of the models. So, what is the statistical form of the models that too you have to move in to step three.

So, Y equal to alpha plus beta X plus another term called as a U where U is represented as a error term and this particular model is called as a statistical form of the model. So, we have simple Y and X then we have to transfer in to mathematical form of the models that too in explicitly format Y equal to alpha plus beta X.Then again this particular model has to be transferred in to statistical format that is Y equal to alpha plus beta X plus 0.

For instance, I will put it in differentway. So, Y equal to alpha plus beta x. So, that is mathematical models. So, then we are transferring Y equal to alpha plus beta X plus U it is statistical models.

So, now the difference between these 2 models is with respect to this particular U term. So, U is represented as a error term. So, now, the issue is what is this component U why there is a U in this particular systemand where you have brought this U?Initially we have our beginning isour journey is from Y and x. So, now, in between U is introduced in the system. So, now, the question is why because there is a debate about this issue.

So, basically there is a always fighting between the mathematics and statistics mathematicians are alwaysin the believe that everything is in exact; that means, what is in the right side it should be exactly equal to in the left side.But statistician does not you can say like all these issues they are in the view that there is this something who is hidden in natures.So that means,nothing can exact in the society. So, there is a always in exact process.So that means,something which we cannot exactly explore or we cannot exactly represent in the particular system. So, if you do not exactlyrepresent in that particular system then there is a something gap. So, that gap can be fill through the term U that is nothing, but, error components.

That means, if I will put this particular equationslet us say this is equation number 1 and this is equation number 2 this is statistical form of the model.So that means,this is cause sight and this is effect sight this is independent, structure this is dependent structure. So, now when there is a question of effect.So, now, there are 2 dimension here this 1 dimension is alpha plus beta X and [another] another dimension is called as a U so; that means, alpha plus beta X is called as a explained factorsthis U error term is called as a unexplained factors and this is called as a explained factors and this is somewhat it is called as a total factors.

So, that means, the total effect depends upon from explained issue that is your that is derived from the X issue and which is not derived through X or through independent variables then it will go to you can U component errorcomponent that is not in your hand.So, that means, all explained items are known to us why U is unexplained in nature because it is in not in your concludes and we do not have any idea about that particular item. So, our target is to find out what is lacking in the system.So, that means, how much

we could not represent or we could not explain in this particular system. So, that is the main issue or main agenda of this econometric modeling.

So, we like to know what is the error component which we cannotyou can say have in the beginning. So, that has to be adjusted continuously so that means, our objective is always we have to build a model in such a way that the error components would be at the minimum levels.So that means, we have to build or the model can beyou can say model can be represented as a best fitted.If everything can be explained nothing can be unexplained, but, it is very difficult to say something is a total explained and nothing isunexplained. So, there is a little even if it is 1 percent then also that 1 percent has also weight age sometimes.

So, we have to see or we like to know why there is a error component in the particular system of statistical modeling. So, now, the issue is why error component in the issueof statistical modeling. So, our ideais to see why you like to use error component in the systems. So, now, there are many ways we can represent this error issue. So, you see we are in a Bivariatesystems even if in the case of multivariate system error component is must. So, now, the issue is your our justification is why we like to introduce error component.There are many reasons for that.

Why error components in the systems?Number one.First is there are certain variables which can explain the dependent variables, but, we are not in a position to include that variables there may be many reasons for that may be not available in our head with respect to information wise or with respect to structure wise or sometimes what happens even sometimes the idea is there, but, we are not able to represent in a particular format or sometimes we have no idea at all.Some variables may be effecting, but, for the time being we are not in a position to represent with that particular variable which can also influence the Y component.

That means some of the relevant variables or you can say useful variables are not included in the systems. So, since some variables are not using the systems so, obviously,there is this some percentage which cannot be explained so, that means, there must be some error component. So, useful variables not included in the system secondsome ofthe you know unnecessary variables means or not relevant variables are included in the system are includedin the systems.

So, this may be also because of this you know unexplanations. So, there may be error tone because some of the variables which may not have any contribution, but, it will affect the system. So, as a result we have to introduce the error problem.That means, what is our commenting factors for this effect sight.Third is there is a sometimes mathematicalimperfection of the models.For instance so, we are sayings Y and X and we are just putting Y equal to function of X all right. So, that too Y equal to alpha plusbeta X that is our issue.

But there are many ways alpha I mean Y and X can be represented for instance Y can be alpha into beta to the power X or Y equal to alpha by beta to the power X or you can say alpha beta to the power X or you can say alpha log X log beta like many ways we have to represent the relationship.Since for the time being we are assuming Y equal to alpha plus beta X then there may be some problems technical problem or mathematical problem.At a particular point of time we have to use only 1 relationship so, that means, at a time we cannot take Y equal to alpha plus beta X or Y equal to alpha into beta to the power x.

So, yes of course, what we can do we have to test the model with a different function alpha.For instance Y equal to alpha plus beta X in oneextent and another extent we will take Y equal to alpha into beta to the power X and we have to setup different forms of themodel.Test the model to get the best fitted model between these 2 which 1 is the best.We have to consider finally, and we have to say that this is the best fitted model which we have derived on the basis of some decision making process. So, now,likewise there are many ways the functional form can be established.

So, now feel there are many ways the functionalforms are represented then the model building structure will be completely different and or also the result will be completely different.But, there is way for particular mathematical form has to be use. So, basically we will start with the simple oneand by chance will we get the best fitted model with the simple one.Then we are in the right track.If the model accuracy is not on the basis of the above information or above functional form then; obviously, we have togo onebyonewith or we have to proceedoneafter another process to get the best fitted model.

So, mathematical imperfection of the modelalsooneof the committingfactor which came you can sayinvolving in the eve issuenext fourth there is a misspecification of the

random terms.There is a question on misspecification of the random terms.We are always talking about X and Y are random in nature.So that means,there must be some level of or some environmental probability in the particular system.The term probability itself represent this chance of occurrence.That means something which is not in your control. So, now, which is something not in your control means obviously, that control may be in many ways.It can be at a higher level it can be at lower level it can be at the medium levels.

So, now what you have to do sincewe have no idea whether it is higher onelower oneor medium one. So, we have to assume at leastonethen accordingly that error involvement must be incorporate in the systems.Since we are not sure whether the impact is higheroneloweroneor medium one. So, we have to do that. So, this is how the error is involve in the systems.Then fifth,there may be some question of luck in the systemstake a case of you know social problems.For instance you like to know what is the implement of expenditure on a particulars you can say sales revenue. So, expenditure that too lead to you can say advertising expenditures.

So, now the theoretical knowledge is that it will put more and moreinvestment on advertising.Then obviously, there is a strong impacton you knowsales revenue. So, now, the issue may be in something different because we are discussing about one problem.So, that means, we are discussing a particular issue.Let us say thisis a pen. So, now, I like to know if there is a some kind of investment on this pen advertisement.Then obviously, the growthor sales of this particular pen will bein a increasing sequence.

But you are you are not in, you can say monopoly situation.There are many competitors in this particular business environment. So, everybody is doing like this way. So, behind there is a competitive issue.Then obviously, the formula issomewhat you know direct one. So, you are involving other peoples are also involving. So, by the ways there are certain factors means which is again you can say third variable in natures.It can also you can sayincorporate or you can saygive the accuracy of the models. So, as a result there isyou can say luck which can involve in the issue.Everybody is you can say objective that if you will put more and more investment on advertising our sales will be go increasing.

So, just we are believing thatone.That means,we are assuming that if you will put more on advertising then obviously, sales is good.So that means,we are not sure it is just not like your mathematical way, you will put 2 plus 3 you will get five.You will put 4 you can say 3 plus 3 you will get six.It is not like that way because we are putting something then the effect will be somewhat in other way.That means, in between cause and effect there are certain variables which can be also effect the system. So, as a result sometimes that factor may be considered as a luck factors.

So, that luck because of you know you are not sure and sometimes luck is notsupporting you for this particular issue.Then obviously, you can say moral cannot be accurateoneor cannot be perfectly explained one. So, some part of unexplained is there. So, as a result error must be in the systems.Then last, but, not the least is called as a external factors.Besides luck there are certain factors which is not in your control.For instance either you are not aware of it or it may be coming in certain you can say at the particular situation. So, in that contest since you are not sure or you are not certain then, obviously, there is a error issue.

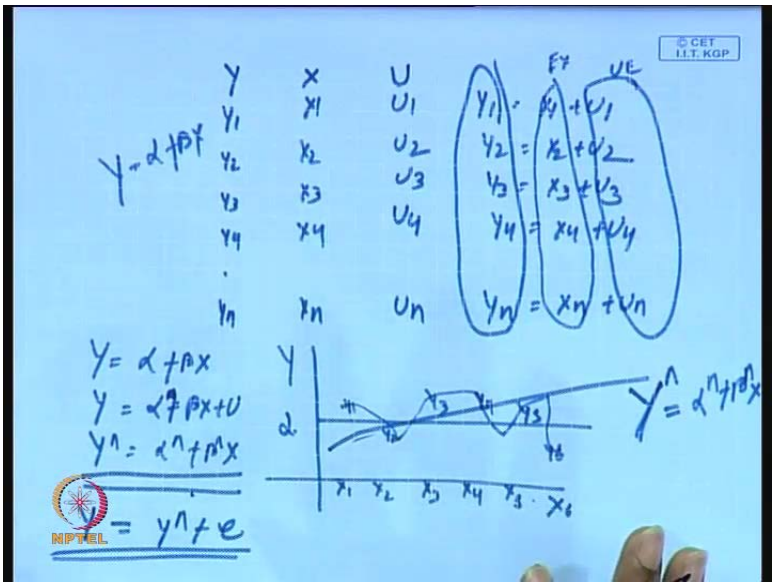
For instance take a case ofterrorist impact. So, everything is a planned in a proper way we are we are very serious and we know all these variables are explained which is used in a particular system.We are in the process to design that build that, but, unfortunately there is in between there is a terrorist activity. So, as a result there should be some inconsistent.Take a case of same thing in say you know in between advertising and sales. If you know putting more advertising and increasing the earns among the people. So, that your sales of that particular item can go on increasing.

But by any chance terrorist attack on the your plant say then obviously, your plant will be get damaged totally and whatever investment you have done on advertising on that particular product and thatproduct cannot be also available for the market.That means, since production is not there. So, whateveramount you have put on advertising it is no meaning at all. So, it is no impact at all. So, as a result some of the external factor which are not in your control as a result we have to put it in new component that is error component.So that means, your erroris always there in a in a particular system.

When we will talk about statistical form of the model,now we have to see what are the variableswhich are particularly explained in nature and what are the variable which are

not explained that we will represent in the form of a U. U is treated as a proxy for unexplained variables which is a not known to us or which is not exactly identified. So, since we have no idea about it. So, we are assuming that it is in U only. So, error will incorporate all this defects which is not in our controls.

(Refer Slide Time: 43:07)



So, that means,.So, for a Bivariate econometric modeling is concerned then system will be like this our starting point will be Y then X in between U is introduced in the system. So, now, like this Y 1 Y 2 Y 3 Y 4 up to Y n then X 1 X 2 X 3 X 4 and up to X n similarly, U 1 U 2 U 3 U 4 and U n. So, now if will we go by simply mathematics.Then obviously, Y 1 equal to X 1 plus U 1, Y 2 equal to X 2 plus U 2, Y 3 equal to X 3 plus U 3, Y 4 equal to X 4 into U four. So, similarly, Y n equalto X n plus U n so that means,all X are inonegroup and all U are in another group and the total effect will be on Y. So, this is explained effect, this is unexplained effect.

So, now our objective is to minimize this particular activities sothat means, the way we have to minimize you need to have a best fitted models. So, you need to have a best fitted models for instance like this. So, now, if will we go by simple framework then let us assume that for this particular variable your graphic structure will be like thisside X measurement and this side Y measurement. Since the functional form is Y equal to alpha plus beta X then alpha is a constant. So, thiswill be just supporting factor like this. So, now, for every X 1 every X 2 every X 3 every X 4 X 5like this. So, X 1 there may be

someyou can say Y 1 for X 2 there may be Y 2, X 3 there may be Y 3, X 4 there may be you can say Y 4, X 5 then there will be Y 5then X 6 then obviously, Y 6 like this.

So, now if will we join all such points then the picture will be coming like this and this is the true picture of this particular setup.So, that means, we have Y and Y information and X information and our idea is how Y and X are related to each other.This is first objective and if Y and X are related to each other how best can they beyou can say related to each other.This is the basic objective behind econometric modeling.Obviously, when you will go for investing the relationship between Y and X there will be certain relationship.Eitheryou assume it or by theory you have to bring these variable in such a way there is a somewhat relationship.

So, that means, that relationship is there, but, we have to predict or we have to forecasthow best they can be you can say related to each other. So, that the effect will be very positive and you know very accurate. So, that is how that is that should be our main agenda. So, as a result within the particular setup we have to build a you can still line which is the bestfor you.

That means, if you will consider this is a path and this path is very much uneven in nature.It is not at all straight forwarditjust like a non-linearone.So, that means, we have to being in to a linear path what difference you have to bring in a best part so that the model accuracy or forecasting can be very perfect one.

So, as a result let us assume that this particular line is the best fitted one. So, if will you say that best fittedonein statistic we call it as the Y headestimated lines. So, this is what we call it as a estimated lineor otherwise called as a expected line.Yhead equal to alpha head plus beta head X.Yhead equal to alpha head plus beta headX.That means, in other waywe havethreeforms of functions. Y equal to alpha plus beta X this is mathematical form of the model.

Then we have alpha plus beta X plus U.This is input statistical form of the model.Then we have Y head equal to alpha head plus beta head X.When will you call it Y head equal to alpha plus beta head X,this is estimated line.So, we will be say that this is the estimated line this is the best line this is the perfect line then of course, the error issue will not be there.So, that means, the way we will choose the model is the best one.Obviously, as per your knowledge it should be veryexplained one.

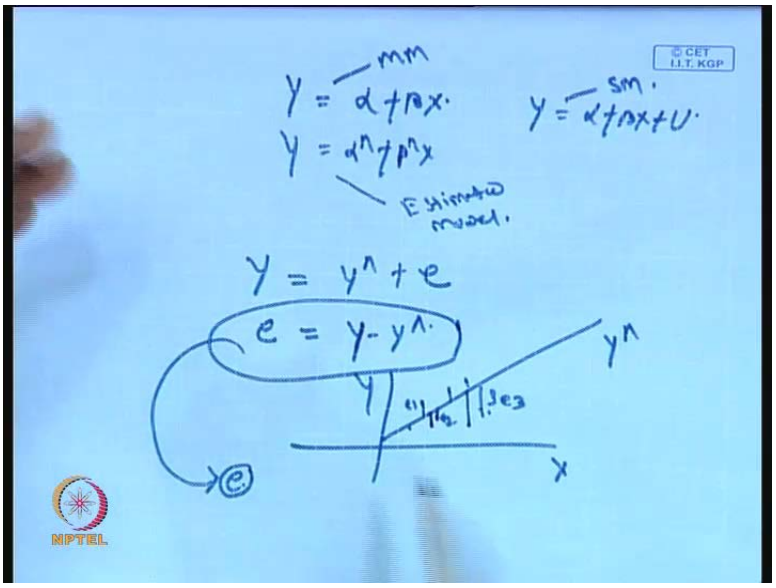
So, if it is explained 1 then, obviously, theerror will be not there in the system.So, that means, we firststart with the exact model then in between you have to assume that the model is not exact.So, that means, we have to bring the inexact of that particular system then again we have to verify or you have to come to this stage again.It will be transferredto the same exact model that is ina way of mathematical form of the model.

But the mathematical form of the model in a initial setting in the estimated model of the model the latter setting may not be exactly equal. So, here the issue of this mathematical form of the structureform of the model is that we know this should be the relationship that is the exact relationships. Now why there is a statistic because statistic always object this particular mathematics. So, if there is a question of objection then there is a need of information to verify that one. So, statisticsstatisticians you can say assignment is to the way they will be verify to that particular mathematical problem mathematical form of the model. So, that the judgment can be accurate onein same way the structure isall about the econometric modeling.

So, now this is called as the best fitted model. So, now,if we will integrate all this things then we will have Y equal to Y head plus e. So, this is the another form of the equation.So that means,yourtrue value Y which depends upon estimated value and error terms. So, that estimated value may be perfectlystill there is a question of error term. So, we have to see how much error is committed in the system and whatever you know error is that in the systemthat should be in least. So, that is the more you knowaccuracy of this particular system.

So, altogether..

(Refer Slide Time: 50:49)



So, what we have discuss is that Y equal to alpha plus beta X.This is mathematical form of the models.Then Y equal to alpha head plus beta head X.This is estimated models.In between from the mathematical models we assume that Y equal to alpha plus beta X plus U is the statistical form of the model. So, this is what mathematical form of the model, this is what statistical form of the model and this is the estimated model.Now if will integrate all these things then Y equal to Y head plus e.

So, now what is e?e is the other way or other way representation of error terms. So, because we have already in the estimation process. Obviously, we are putting the error components in different names, but, it is more or less same. So, e equal to basically a difference betweenYminus Y head.That means, whatis the true value and what is theestimated value,that is the committee of errors. So, error meanswhat is the actual and what is the predicted or estimatedor assumed value. So, we are we are assuming that this is should be the perfect one. So, there should be actual. So, we like to know what is the difference between the actual and estimated. So, that difference is called as an error issue like this. So, these here these are the true value ok.

So, we are assuming this is estimated value. So, now, the differenceis all about this error issue. So, these here are called as a error issue.Like you know for e it called as e 1 this is e 2 this is e 3 like this. So, this side is the X measurement and this side Y measurement.This is estimated models.Yheadin between it shaped to with the integration

between true lines or true points actual points and theestimated point. So, now, this is the typical issue of this or this is the basic statistic point of econometric modeling. So, now, what is our next objective?Our next objective is to minimize this error terms.

So, far as minimization is concerned or of course, when there is a question of optimization, we cannot optimize this single one. So, we have to optimize the minimum sum of the squares. So, sum of the sumof the errors, square errorshas to be minimized. So, that process is a more complex and very interesting and very useful very systematic. So, that we will discuss in next class.So, it is not possible to start here now. So, the detail structure we have to discuss in the next.Thank you very much have a nice day.