Econometric Modelling.

Prof. Rudra P. Pradhan

Department of Management

Indian Institute of Technology, Kharagpur

Module No. # 01

Lecture No. # 01

Introduction to Econometric Modelling

Good afternoon, this is doctor pradhan here. So, welcome to on nptel project on econometric modelling. So, today we will start the introduction part of econometric modelling. So, we will basically highlight what is all about means econometric modelling? And how it is very useful for you know our academic point of view?

So, now basically you know we are living in a dynamic world where everything is you know problematic so we are always bounded with various socio-economic problems and its very dynamic, very uncertains and totally unpredictables. But with with this this problems so we need to have a solutions.

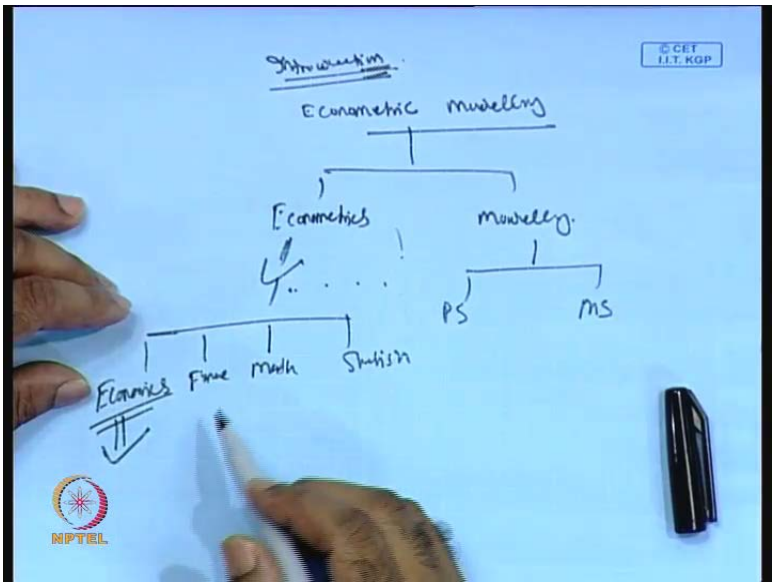
So, that means we have to apply proper strategy how you have to tackle such type of dynamic problems. So, without without having proper strategy it is very difficult to handle you know various such as economic problems.

So, econometric modelling is means in this scenario econometric modelling is very important tools to solve these particular problems so means it will give you guidelines or it will give you green signal what are the strategic aspects you have to apply through which you can solve this particular problem so which is very volatile barely uncertain and it is totally unpredictable in nature.

So, econometric modelling will give you fundamental idea so how you to solve this you know uncertain problem or volatile problem in to stable problem or certain problems. So, this is how the beginning of this econometric modelling.

So, now what is all about this econometric modelling the econometric modelling is divided into two parts.

(Refer Slide Time: 02:08)



So, it is divided into two parts one is called as econometrics and another is called as a modelling ok.

So, let me first ah before I highlight the econometrics and modelling. So, what is my core agenda here? The core agenda of econometric modelling is to fit data into a particular problem so that is we need to have fit means best fit, best structure of data into that particular problem.

So, data is usually represented as a informations so the way you will process the information so that the problem can be solved immediately or you can say you can transfer these uncertain problem or volatile problem to certain problem or stable problem so that you can wipe out that socio-economic problem.

So, now to have or to fit data or to get a structure of goodness of fit is not straight forwards ok it is very very complex problems. So, now we like to know what are these complexities. So, how to get this means how how to get this best fitness of the model or you can see best fitness of the data setup so that we can solve the problems.

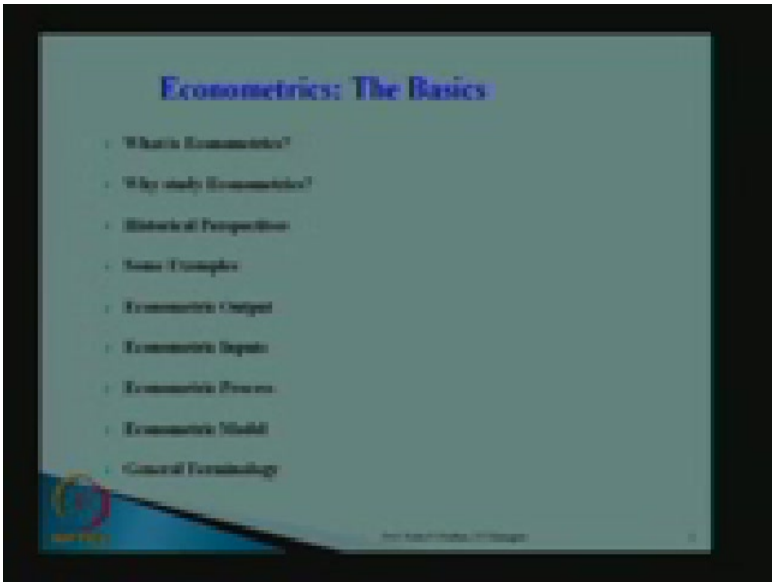
So, we have various strategic issues, various strategic fundamentals so that we can come to a particular conclusion. So, it requires huge skill setup first thing is, you know you need huge skills, huge mathematical knowledge, huge statistical knowledge and you

know relevant softwares because nowadays without softwares to tackle multivariate problem is very difficult because we we are always having time constants ok.

So, in this particular scenario so you must be very careful so how with limited limited resource base you know with respect to time, methodology, issues, setup, etcetera. So, we have to quickly find out a solution and within that solutions we have to get best fitness of the particular model and by the way that model can be used for solving your problems or you can see use for forecasting etcetera.

So, now I will highlight few things here is so in our today's with this basic introduction so today we are going to discuss these are the aspects so first of all what is econometrics? so why we know econometrics its historical background and some sighted examples then econometrics outputs, inputs, econometrics process then finally, the basic framework of econometrics modelling and basic you know some of the basic knowledge about econometrics because it should be mandatory you know something little bit before we go for econometric modelling

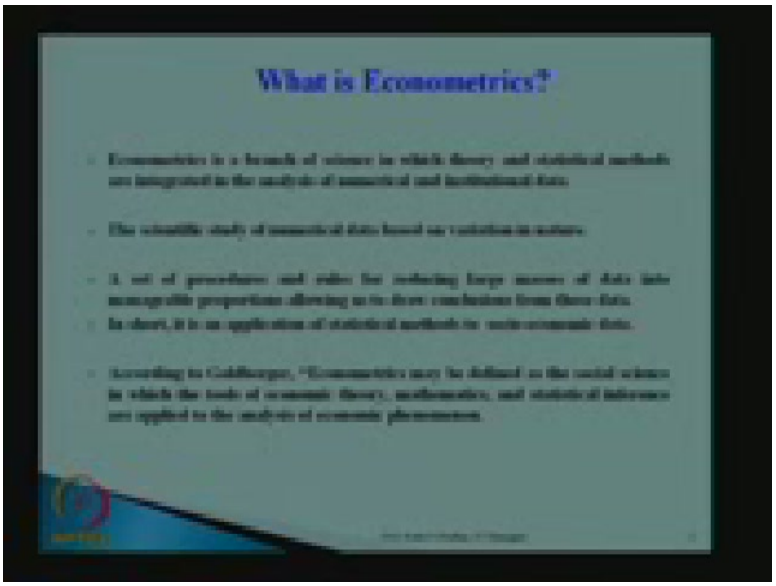
(Refer Slide Time: 04:30)



Econometric modelling is a very complex problem and it is very difficult problem without knowing all such aspects or we can say basics it is very difficult to answer to this econometric modelling ok.

So, let me first we start with econometrics so let me econometrics is a a branch you know econometrics is a branch branch of science where you can say a its which theory and statistical methods are integrated in the analysis of numerical and institutional data.

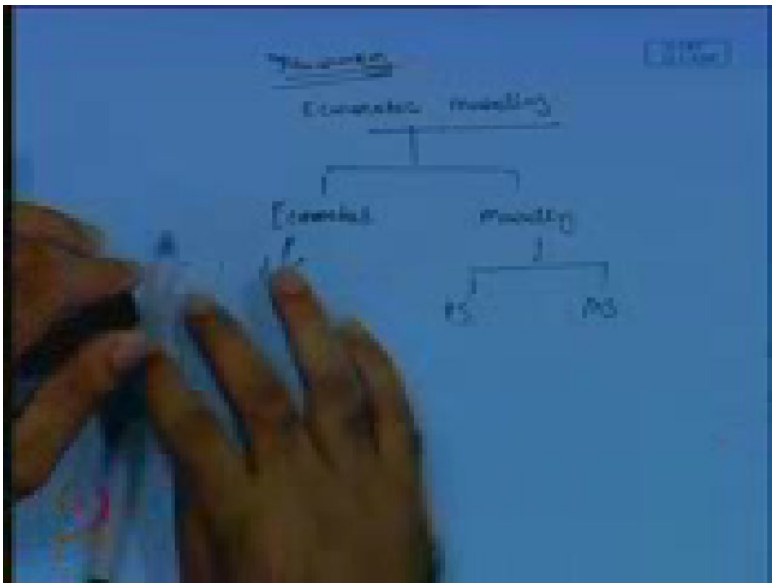
(Refer Slide Time: 05:13)



It is otherwise called as a scientific study of numerical data based on variation in natures so that is means it is a set of information, collection, summation, estimation and interpretation of you can say a data. So, this is what finally, one called as a econometrics aspect ok.

Econometrics is a set of informations, collections, summation, estimations and interpretation of data so in the in the case of modeling it is a process so it is the integration of physical simulation and mathematical simulations so that means it is a process of presenting a real world object as a set of mathematical equations ok.

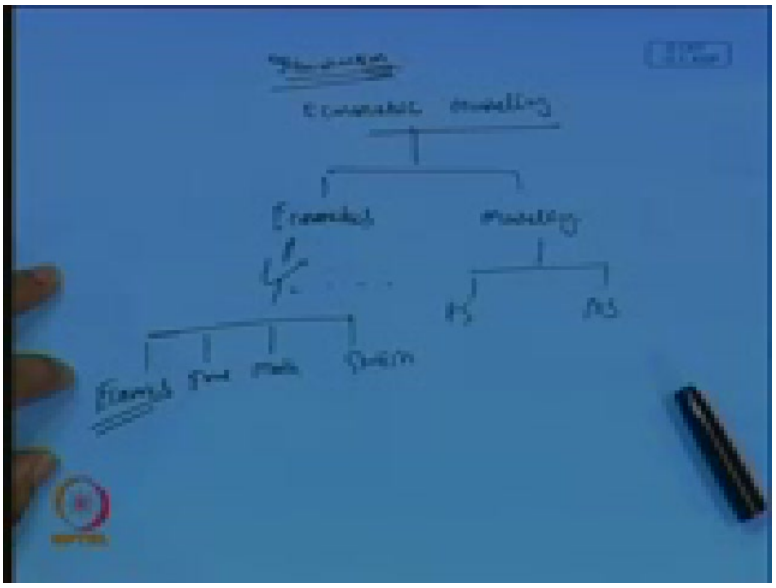
(Refer Slide Time: 06:09)



So, now so we have to transfer the physical problem into mathematical problems ok. So, now econometrics will apply so whether in these transformation this modelling is perfectly ok or not so that is how econometrics play a big role. So, econometrics means a means you know modelling will transfer the real world problem into mathematical problems to the equations so that is means it will build a mathematical form of the model and econometrics will you know enter to that particular aspect and investigate whether that problem is perfectly ok for ok or not. So, the way it will be investigated that is this structure of econometrics ok.

So, econometrics all together it is you know divided into four aspects is the it is the you know integration of four different papers all together it is called as starting with economics you know then a finance then mathematics then statistics ok statistics.

(Refer Slide Time: 07:18)



So, economics is the principle of consumption, distribution and wealth management. So, it is the branch of social science which is concerned with principle of consumption principle of you can say principle of production, consumption and distribution wealth and their management so this is what the economics all all about.

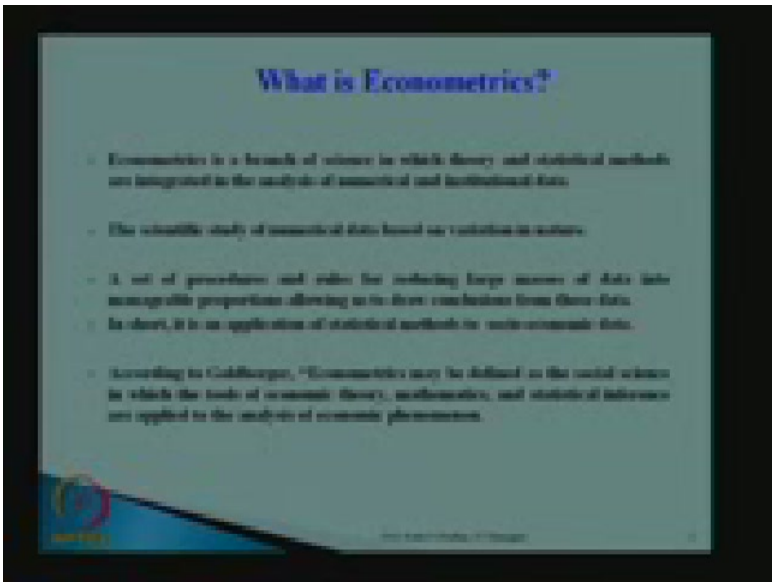
Similarly in finance it is the branch of economics that studies the management of money and other assets now so a means finance is route from economics so economics is the bigger concepts where we are studying the principle of production, consumption, distribution of wealth and their management.

So, for finance is part of it it is the branch of economics that is studies the management of money and other assets ok so similarly, so we can define the the term mathematics it is branch of science dealing with a logic of quantity (( )) and its arrangements ok.

Similarly statistics we can define branch of science where we can plan gather analyze information about a particular collection of individuals or object under considerations so ok. This is how these structure of you know econometrics so that means econometrics is the a cluster of economics, finance, mathematics and statistics there is many way we can integrate all these thing because nowadays it has spread in a many areas but, all together so in fact it is the means in brief we can saw that it is the integration of economics problem, finance problem, mathematics use and statistics use.

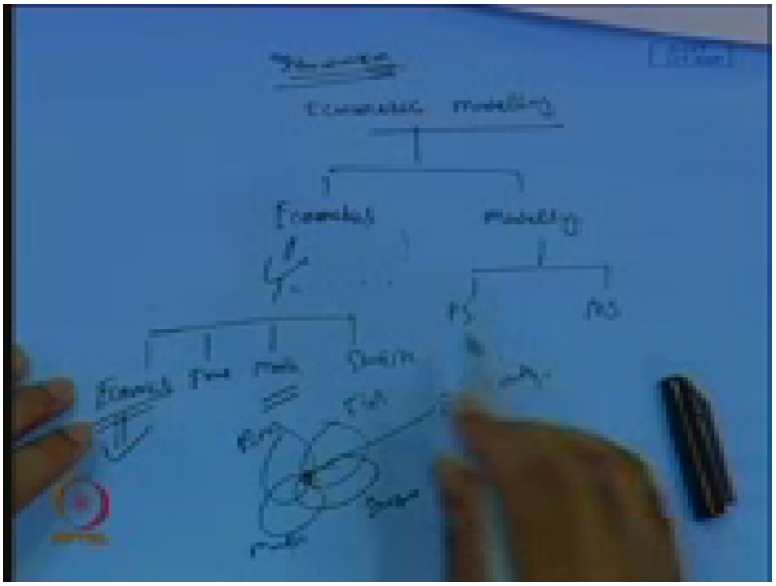
So, we use mathematics and statistic how to solve the socio-economics problems or financial problem that is what the core agenda of this econometric modeling ok.

(Refer Slide Time: 09:05)



Now there is a quickly I will highlight here ah once again what is all about this econometrics.

(Refer Slide Time: 09:28)



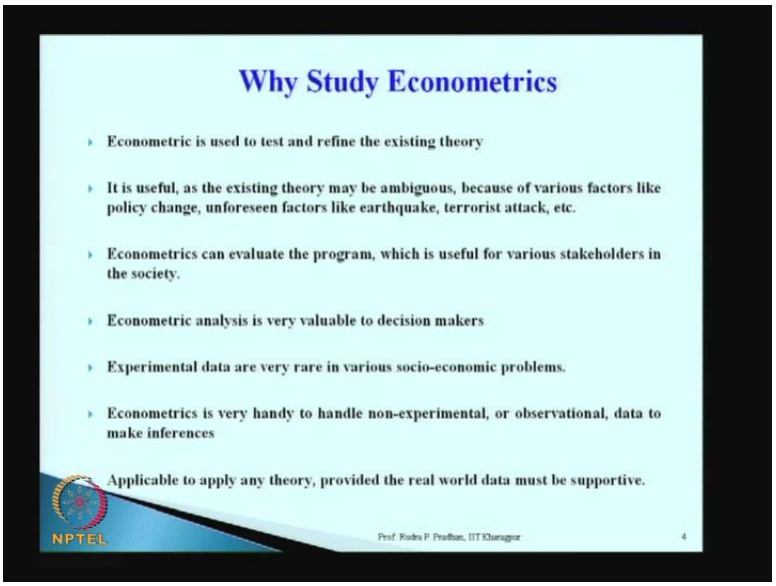
So, then you see here is so all together so econometrics is a branch of this four heads so this is the clusters which we called as a econometrics so this is you can say a economics then this is finance then this is math and this is start so the cluster will called as a econometrics ok.

So, it is a that is why I can analyze here is it is set of procedures and rules for reducing large masses of data into manageable proportions along allowing us to draw conclusion from those data so this is the fact of you know I I have very strictly mentioned in the beginning that econometric modelling is the basic core agenda is means core objective is to fit the data and that should be very structure, very reliable, very accurate.

So, the way we will fit the data that is what this specialty of econometrics so that is what the definition is also talks about. So, in short it is the application of statistical methods to socio-economic data that is nothing but, socio-economic problems so under it may be purely social problem it may be purely economic problem say it may purely financial problem that is coming under socio-economic issues.

So, there are various definition many definitions we have to interpret the econometrics so it is not possible to analyze all these definition here so I am straight forward I will I am giving one definition here, econometrics may be defined as the social science in which the tool of economic theory mathematics statistical inference are applied to the analysis of economic problem so this is how the broad definition of this you know econometrics ok.

(Refer Slide Time: 10:55)



Now come come to this why economics? Why we will know econometrics? In fact we have already discussed why why we know econometrics because we we are in the dynamic world where all problems are very uncertain in nature, very problematic, very complex so we need proper proper models where through which we can apply proper strategy and to tackle that problem.

So, economics you know come forward to solve all these issues so that means it will give you the best fit models through which you can apply proper strategy and you can solve your particular problems ok.

So, econometrics is used to test and refine the existing theory so that means I have very briefly mentioned that (( )) so for econometric modelling is concern it is a application orientated subject.

So, you must have a proper theory and with within the particular theory you have to being objective specification hypothesis specification model formulation then our idea is econometric idea is whether this particular model basically to transformation to mathematical transformation is perfectly ok or not.

So, how it is consistent with theory that is how the econometrics play fantastic rule or key rules it is very useful as the existing theory may be may be very confusing in nature

because of various factors like policy change some of the unnecessary means not countable factors like earthquake, terrorist attack etcetera ok.

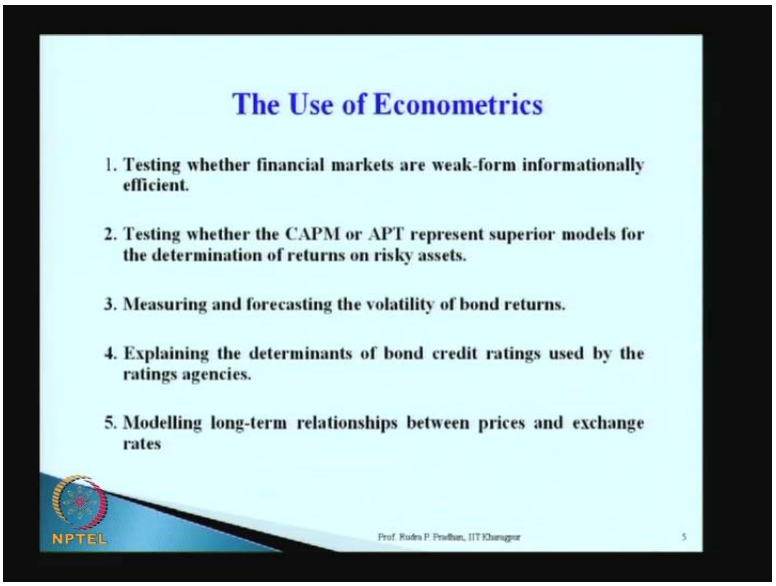
Econometrics can evaluate the program which is useful for various stockholders in that society. Because once you set the problem suppose I have a problem so I need to fit a models so through which I can make a prediction and I can you can solve my problem but, ultimately that model can be used by other people other other stockholders so that it will be multi multiple use ok.

So, econometrics is not a you know one it is not one means utility it is multi multi means utility so it is very that is why its its important is much much higher than the other subjects ok.

So, econometrics analysis very valuable to decision maker so actually since it is it is the question of fitting the data into a proper structures so suppose is a data is concerned there are many ways we have to classify the data structure sometimes it is called as a one way which I like to highlight a experimental data and non-experimental data here experimental data very rare in various socio economic problems so that is why econometrics is very handy to handle non-experimental data and observational data to make the inferences ok.

So, that is very important fact in the case of econometrics modelling it is applicable to apply any theory provided the real world data must be very supportive.

(Refer Slide Time: 13:49)



One of the interesting because the starting point of econometrics which I have mentioned the core agenda is that fitting data into a proper structures.

So, if data is not there then econometric is handicapped econometrics hand will be very handy very helpful if you have a theory consistent theory and you have a consistent informations so then they will use this information in the theory so they can predictive or they can give you better strategy how you have to go in future so ok.

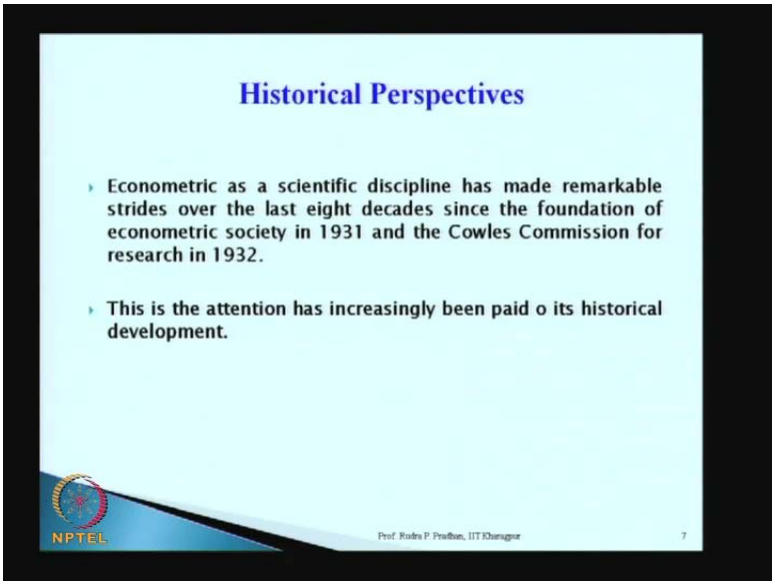
So, if something is missing then obviously econometrics is meaningless so econometrics in requires entering of econometrics require proper theory and proper information with if anything is missing in the process then econometrics is meaningless so we need consistent theory we need consistent informations.

So, econometrics will we will give basic to input so one is how strategic skill power you have how you have to handy and what are the techniques available and how you are integrating the system till to get a particular you know answers so so these use of econometrics there are many use in fact so other uses you know it is useful in financial market (( )) market in product market (( )) wherever there is a problems so you apply these model then you know you get to know how you have to fit the data and that will

give you idea or strategy how you have to apply strategy for your future direction that is how the you can say structure of econometric modeling.

So, modelling long term relationship between price exchange rates then determinants of bond credit ratings then forecasting volatility of bond returns or you can say capital a surprising model these are the most of the applications where you you means I am just giving you some kind of examples here but, in reality they it may be useful many cases most of the cases you know ninety nine percent cases whatever problems you have you can apply the econometrics so that is why it is very handy subject and very interesting subjects ok.

(Refer Slide Time: 16:06)

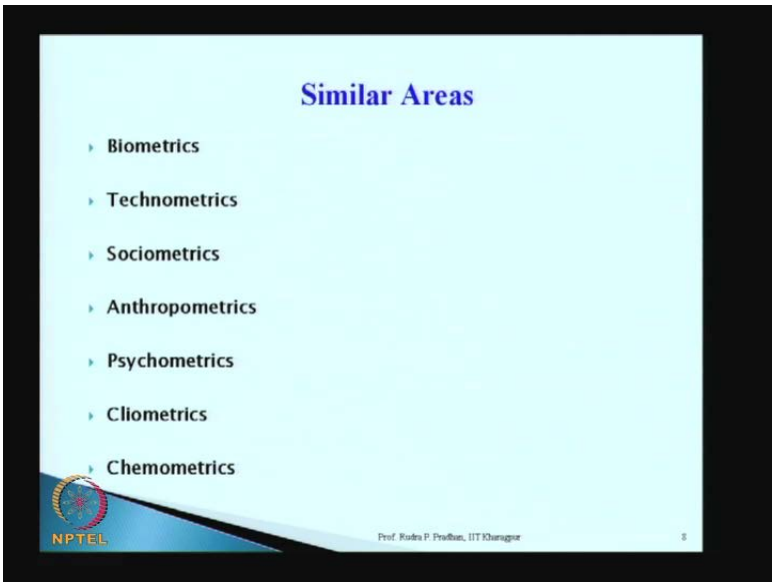


Ah similarly, these are all other of (( )) you have to means I am taking about you can apply in the stack market etcetera so anyway now so you get to know what is all about econometrics and why you know econometrics then finally, we will just get to know what is its background how it is coming into these pictures ok.

So, historically econometrics you know started with the foundation of econometrics society in 1931 and cowles commissions research in 1932 so you know so from 1931 onwards econometrics play major roles in fact in the mid of 1960 the rule of econometrics is very very you know at the higher rate and right now in this particular era (( )) era the use of econometric modelling is you know at a you know at the highest level so we have to using econometrics modelling its very very difficult to go for any forecasting or any policing matters ok.

So, econometrics is very useful so that is why you need to have information about econometric knowledge without econometric knowledge or without econometric modelling so it is very difficult to go for any policy discussion or policy use it is very difficult.

(Refer Slide Time: 17:16)

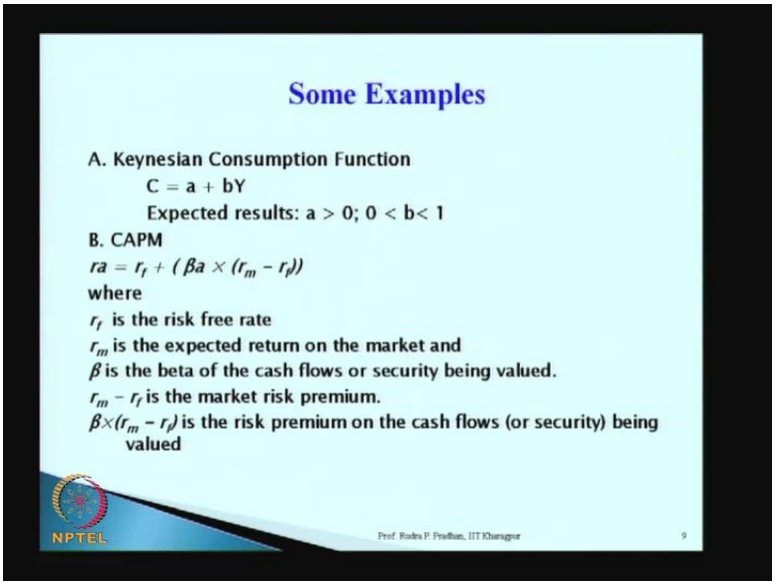


Yes so by by the way you can get to know here what is the utility and usefulness of econometrics so it is started in the year 1931 but, purely to solve socio economic problems that to you know mostly on economic related problem and financial related problem so this is what we you called as in the social science but, it has many application in other areas like in the physical science also so like you know biometrics, technometrics, sociometrics, anthropometrics, cliometrics, chemometrics these are the

applications where now econometrics is a applied you see econometrics is a supporting subject you just bring some theory.

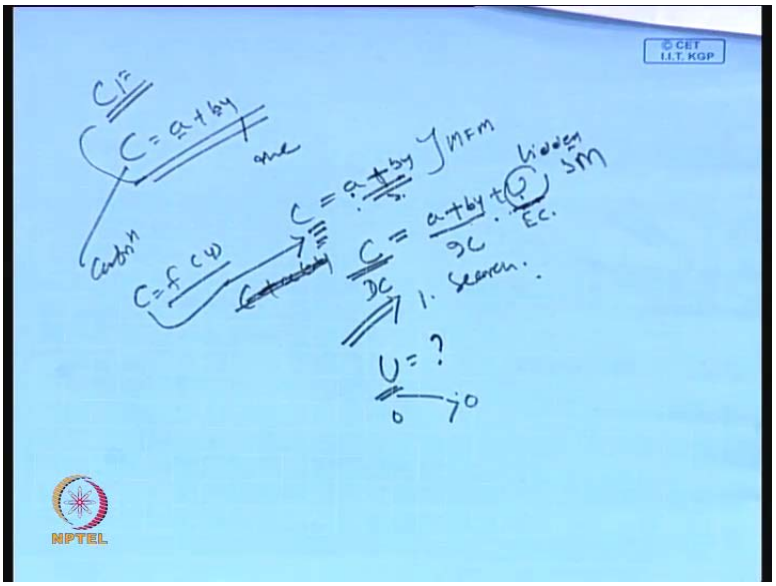
So, any any branch of science you see chemical engineering, civil engineering or mechanical engineering you bring theory so then econometrics is just like a tool so it will see how theory is there so what type of information you need then we have to either you have to test some theory or we have to redesign the theory re-estimate the theory so that you can bring something new or we can use in a more strategic way more better way for policy matter or you can say feature prediction so this is how the econometrics all about.

(Refer Slide Time: 18:34)



So, you know there are certain you know I will sight a few example so what is all about econometrics a structural together now be careful here.

(Refer Slide Time: 18:50)



So, I will I will put a models here c equal to a plus b y so this is what we have bought from the theory of (( )) consumption function (( )) consumption function

So, c stands for consumptions and y stands for income and a b are parameters which are supporting so that means the theory says that c j function of y so this is how the theory that means so how you have to justify whether there is this theory has a fact or meaningful interpretation or not so statistics has to play.

So, there are suppose I start with the concept like a consumption as a function of income so that means a consumption if we dependent variables so it depends upon y income levels so here consumption level will depends upon your income levels ok.

Now whether this a relationship is very positive or it is significant so that econometrics will help you in later so I have put the mathematical equation c equal to plus a b y c equal sorry c equal to a plus b y so let let us means what is all econometric modelling now this is mathematical form of the model so I will infelicity format I will put it in explicitly format x equal to a plus b y so this is called as a mathematical form of the models ok.

So, now what I will do so I will transfer this model into statistical form of the model so the moment I will transfer into statistical form of the model so the model will be delete in

like a plus b y plus u so that means initially there are two two parts this is part one this is part two so this is dependent cluster this is independent cluster that to this is supporting component and this is the main component ok.

So, now now once we will transfer into statistical form of the model statistical model then it is a three parts so this is dependent cluster this is independent cluster and this is error cluster ok.

So, we will get to know details when will move into a direct econometrics problem so after couple of lectures means basic of all econometrics now less than we will move to that pure econometrics model so how will start and how you have to end with the a particular issues.

So, now in this particular setup so we have consumption equations so c g e s consumptions then uh it is function of incomes so here is a and b are the supporting components. Now what is the main agenda econometrics is that so every times so that is how we called as a one type of exploration so what you have to do here so every times that means here u is in a hidden natures it is in a hidden

So that mans some of the machine components are there so is it possible to find out what are the hidden components are there so this is once means this is give you signal for search it will give you a search. If not, then first of all you have to find out what is the error terms so what is the contribution of error is it 0 or is it something greater than 0 ok.

So, there are two aspects in fact so what is the error contribution such the model will be best fitted if you know consider a you can consider as the best models if the error will be at the minimum levels so if you will say 0 then obliviously it will be perfectly fit model.

So, now in most of the cases because it is a simple models consumption is function of income only but, consumption depends upon so many other factors in fact similarly, any any problems you take lets price and quantity relationship so quantity dependent function of price so it does not mean that quantity always depends upon price there are certain other factors are there (( )) just like a you know stock price, stock price depends upon you can say market news so there are several other factors like business condition, impression, exchange rate, so many things are there so these are the factor which can you know influence stock price.

So we like to know first of all here the idea is so you have to identify the particular problem from that particular theory what is the main variable, instrumental variable so that will that will declare as a core variables and we call as a dependent variable then others are is the you can supporting variables so how the supporting variables are you can see influence in the core variables that is one way of econometric modeling.

But you I I will clarify one thing you that when will enter to the econometric modelling there are various types of structures you will find basically the entire structure are classified into four different games so one is purely cross sectional modelling then there is a time series modelling then panel data modelling in structural equation modeling.

So, you know structural equation modelling is a completely one part of the game and other you know time series modelling means cross sectional modeling panel data modelling another part of the problem so means what I like to say so there are two different games all together in the econometrics system.

So one system it is one one way classification and another is a multi-way classification. One way classification I mean so it is the every time there is one dependent variable with one independent or multiple independent variables so this is one system in where means it is this particular stack structure it is called as a one way causality ok.

So, basically this econometric modelling is the mostly on causality issues so means causality is very important in this particular ah frame work of econometric modelling now in this particular first uh particular system first system so we assume that there is always one dependent variables and one independent or several independent variables so we will like to know how these independent variables are influencing you can see dependent variable that is the structure of causality.

So, now in the second structure so we have series of dependent variables or we have series of independent variables I get to know what is this dependent independent variables means in particular equation the right left side we will call is a dependent and right side we will call is a independent variables ok.

So, now so here this structure is that so you have to see so how many are in the dependent how many are in the independent side so most of the cases you will find one dependent with multiple independent so another case multiple a multiple dependent or

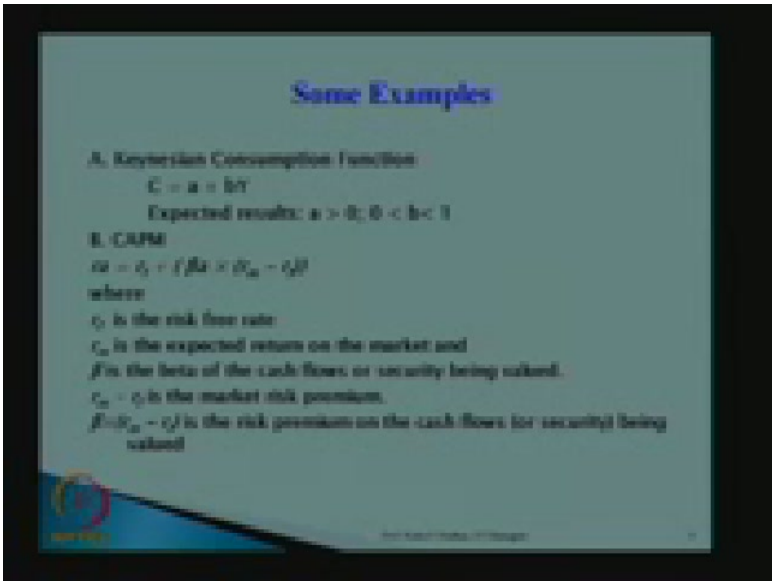
multiple independent so if that is the that is the structure then we we we have a different problem called as a simultaneous equation modelling and structural equation modeling.

In other cases so we have this system called as a one way causality so that is one dependent variable with multiple independent variables so this is how the system all about so means these are all basic examples so what all together so we have we have theory different setup all together dependent setup independent setup and to justify that ones we have a error setup in fact we have a different games for error component we have a different game about dependent and independent.

So, we get to know details when we will enter to this pure econometric modelling so in the in the beginning we showed we very careful that so we we are in the core objective that is our dependent structure so this is main ok then others are you can say just supporting factors so these are all instrumental trough which how the objective can be achieved so this is the core fundamental knowledge of econometrics ok.

So, I have just highlighted here you know consumption model similarly, capital a surprising model so how this you know this (( )) and you know market premium will

(Refer Slide Time: 18:34)



influence this is a a set value so that is can be discuss in detail so we will discuss details when we will got to the analysis first ok.

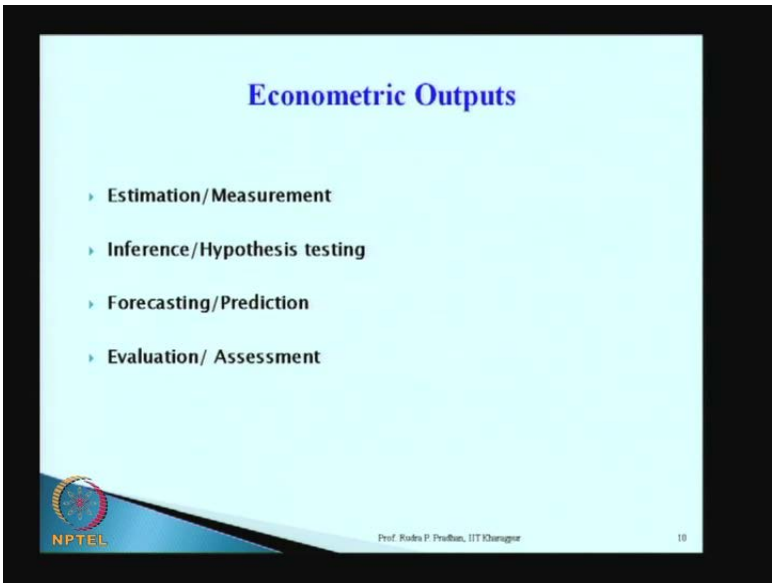
So, now econometrics all together just like you know in the system of business or productions so we have input and we have output so we have to process inputs we will get the output so econometrics is just like a technical process ok so it is a technical or mechanical process so we need we need to insert inputs then we will come out with a output take because you know there are two way we have to handle this type of structures as usual you know recently we have a multi numbers of softwares (( )) through which we have to solve this problem.

But you know we can go for manually also manually there is a systematic structure how you have to process this inputs and how you will get out the outputs that means you should know what should be your output levels so output classification is very important and in the same times input classification is very important.

So, the thing is that means output classification is means that is your objective specification what what is your exact objective so means it tentatively your objective is very much very much you can say known to you now what what you have to do so you have to you have to process the inputs, whether these are tentative objective is obtained or not if these not obtaining then what is the difficult and why it is not obtaining or whether there there is any way to redesign or restructure till you get your objective or you can say whatever analysis you are getting according you have to change your objective setup ok.

So, this is how econometrics will give you signals means it is just like it may it say it is a very strategic subjects it is very strategic subject it will give you means very dynamic knowledge for various problem so how you means it will design redesign a structure is structures till you get a a best models so through which you can solve your problems carefully perfectively ok that is how is called econometrics.

(Refer Slide Time: 28:58)



So, now you see here is in the econometrics there are two groups of things one is called as a output side another side is called as a input side so in the output sides we need estimation that is measurements, inference hypothesis testing and forecasting predictions then evaluation assessment.

So, these are things we have to do in this output side that means these are our objective core agenda here is so we need to estimate measurement inference hypothesis testing that means whatever object is specification is there so we have to test it properly means as for the hypothesis construction hypothesis that means the a structure is that ah first first you have a theory that is what we will be generate means from the theory you have to identify a particular problem

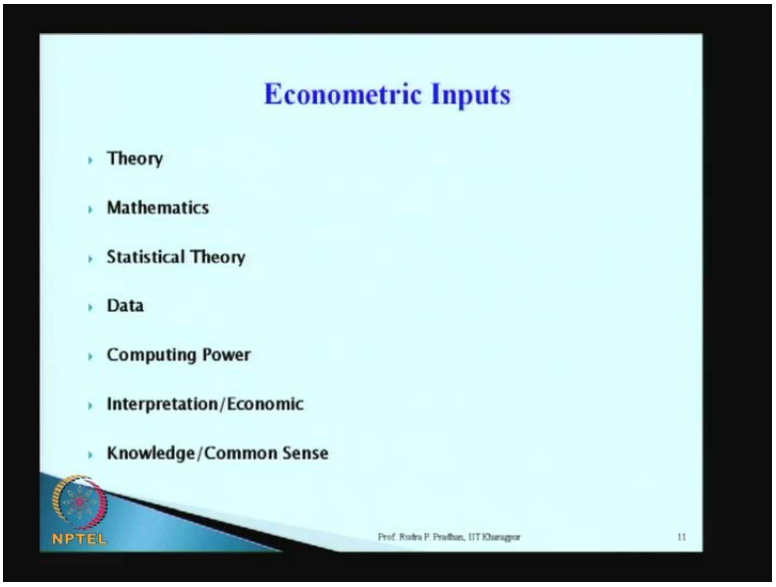
So now once you have a problem so you have setup hypothesis that means the objective has to be constructed in the form of a hypothesis that means a this the way you are transferring objective to hypothesis that means it is the give you theoretical knowledge about the mathematical transformation into statistical transformation

Hypothesis testing means it is a statement which is not verified which is to be verified so that means in which is to be verified means it will use of statistics only so statistics will

verify these ones so it will give it will a means ah it is the econometrics job is to verified the fact whether it is or not ok.

Ok so these are the outputs means object is specification how you will a how you will achieve this particular items but, we do not have any idea about the inputs specification ok.

(Refer Slide Time: 30:42)



So inputs specification here you see you must have a theoretical knowledge for means sound theory behind this modelling without having sound theory and idea so it is it is totally unnecessary to enter to the econometric modelling because without theory econometric is totally meaningless totally meaningless ok.

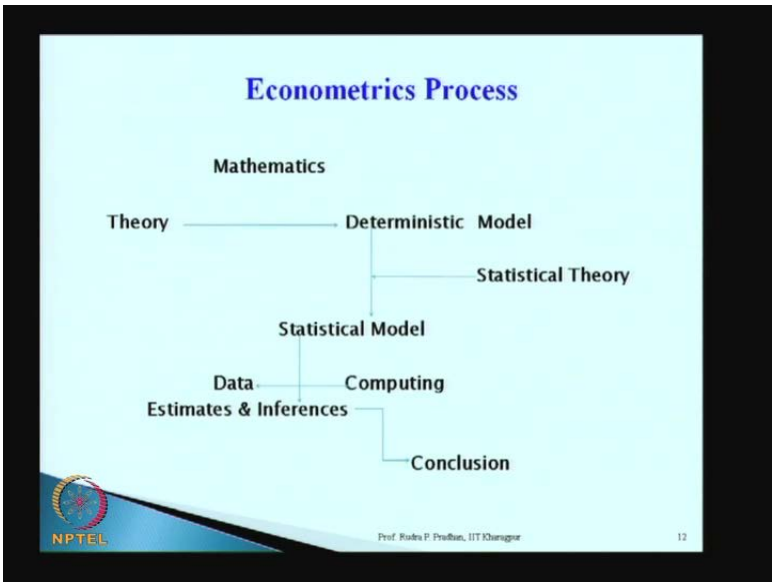
So, now so theory is the most then mathematical knowledge see you must have a sound mathematical knowledge you must have sound practical knowledge then you must have a information ok so theory problem will give you but, sometimes information will not give you so information you have to generate sometimes it may be readily available you bring that information or its not readily available it create or you have to you have to means creation means either it is somewhere possible to create or sometimes you in artificial creation you can create like you know there is technique called as a dummy variable modeling so you will get to know when we will enter to that particular problem ok.

So, data or information is must then computing powers so means it is not every times you hand is or you can see your mind brain power is always suppose when you handling huge setup of data or huge number of variables and that way you can say take a case of problem say structural equation modelling it is very difficult to handle any hand particularly if your problem is very big and very means too much multivariate in nature then that time it is very difficult to solve in a class rooms yes you can solve this problem in the class room provided I will give you support that is what it called as a softwares ok.

So, we will call it is a computing power, computing power means we have a statistical software through which we have to just operate it properly the programs are design in such a way so it will give you means you give those input command you process the inputs then automatically output will comes ok.

So, that is how its computing power is all about so then once you get the computation means computation is above then you have a model results so then you have to interpret then you have to check with you can say your existing theory so interpretation then knowledge must be required how you have to interpret then how you have to integrate with the proper theory ok.

(Refer Slide Time: 33:00)



Ah you see here is econometric process is all together to to means is to means job so one is called as a deterministic models another is called as a statistical model I have already mentioned so econometric starting with you know question of mathematical you know theory then the theory will be transfer into mathematical form of the model then mathematical form of the model will be transfer into statistical form of the models so that is how econometric modelling because I I have means very beginning I have mentioned econometrics modelling is nothing but, the integration of econometrics and modelling

So, modelling will give you the signal of physical transformation to mathematical transformation and econometrics will see whether the transformation is perfectly or not so it it will give you a common type of job so you have to check yourself whether you are in the right track ok.

So, the way we will move in the process so I have just represented here in that technically now what is what is the core foundation here see because you see I mentioned here economics, finance, and math mathematician statistics but, generally econometrics mathematical statistics is the main core elements and economics finance they will give you the theoretical funda only so theoretical funda or you can say mathematical formulation of the models but means mathematical formulation of models you will you will you will design through the mathematical knowledge only but, economics and finance will give you perfect fundamental theory so through the theory

you have to apply your mathematical knowledge and transfer this theory into mathematical form of the model then ultimately you have to apply this statistic to investigate the problem so that the theory can be tested or you can say retested the region a as for the need of the stockholders ok.

So, basically so theory from the theory you have the deterministic models then that is you know mathematical theory then you you have this apply this statistical theory then deterministic model will be transfer into statistical form of the model that means you see when there is a theory here is so then we have to apply mathematics to transfer this theory into deterministic model that will call it mathematical form of model then you have to apply this statistics then there is deterministic models will transfer into statistical form of the models that means statistical application is applied to the mathematical.

So, the mathematical form of the model will transfer into statistical from of the model then once you will transfer the statistical from of the models then you need to verify so as I have already mentioned so when when we will put put into statistical from of the model so this is what the you know transformation here this mathematical form of the model and this is statistical form of the model,

So, I will write it her once again so c equal to a b y simply so I will write it here c equal to a plus b y plus u u is state as a error component ok error component so because what is mean by verification verification means something is not hundred percently correct ok so we need to check whether it is hundred percent correct or not correct.

So, now error let us assume that the this is not hundred percent correct that is why we are starting with the error component we are saying that an hundred percent not correct that means some percent is lucking so that some percent is lucking something nothing but, u here is now we have to see what is the value ultimately if the u value is minimum or 0 then these this is fact this model is perfectly so that is our so if u is is something positive then obviously this model is not perfectly so that is what the econometric will teach you ok.

So, now this is statistical from of the model then statistical form of the model transfer into data means we have to process the data with computing power then finally, will get the estimated model so once we will get the estimated model then obviously this estimated model has to be checked or you can say investigated properly a through sound

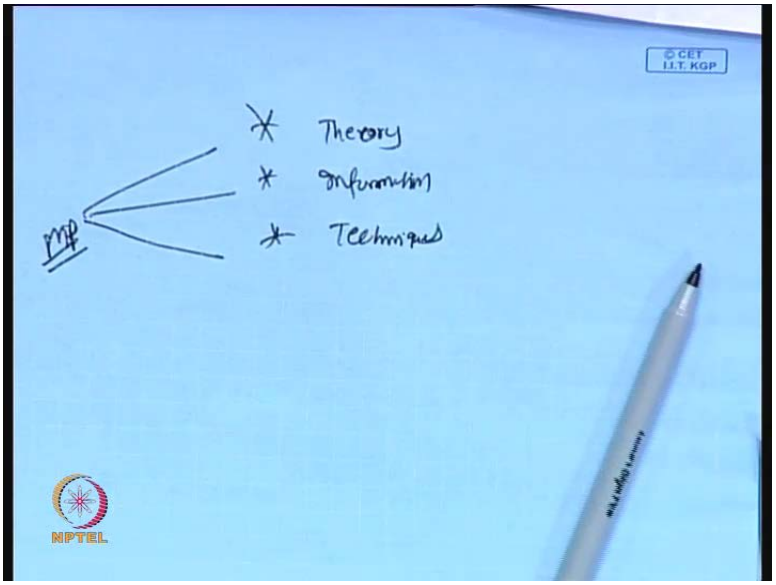
statistical test so we get to know details when we will go to the particular process generally these these test are you can say three in nature one is called as a goodness fit test, specification test and out of sample prediction test it is called as a digi test ok.

So, now we we like to first have the estimated model then that part is called as a reliability checking so for a reliability checking concern then these three test has to be taken care of so through the again econometrics then finally, you have to find out the inference so whether this model is perfectly reliable one or your fit of the data is structured one or not so if it is reliable then it will be structured if it is not reliable then it means reliable test will not give you signal green signal then it is unstructured data.

So you have to again redesign reprocess till you get the structured fit this structured fit means it is correctly specified and that can be used for you can say prediction and forecasting so with with help of you know once you get the a proper reliable model or best fitted models then obviously that has to be tested ah the hypothesis and finally, you have to give your conclusions so how you have gone through all together ok.

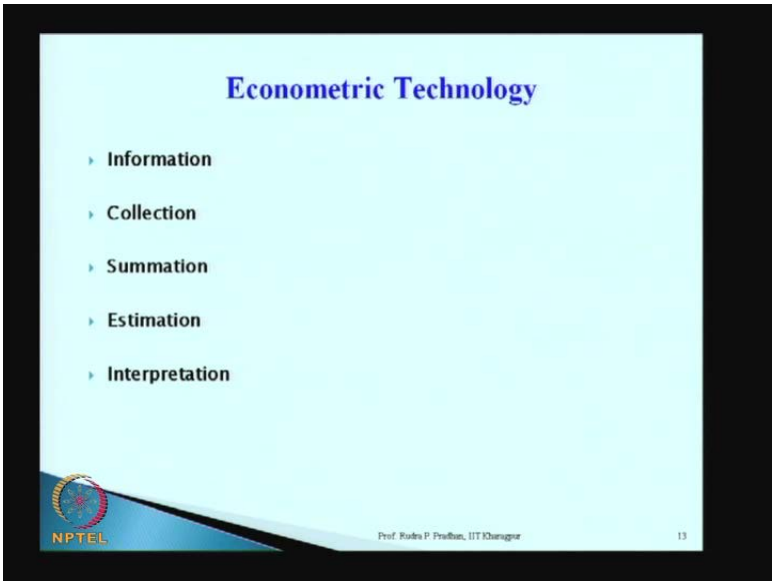
So similarly, econometric technology so there is need of a information information is must its three parts theory then techniques then information that is what is called as a data. So, that means econometrics all together it is the cluster of theory, information and techniques theory information and techniques theory data and techniques or tools

(Refer Slide Time: 39:19)



So these three components are very very important that means it three fundamental issue is very important theory then informations informations then then theory information then techniques then you have to apply the your mind power your skill how you have to apply or process this theory information to consistent the theory and how technique you have to apply to justify the theory ok.

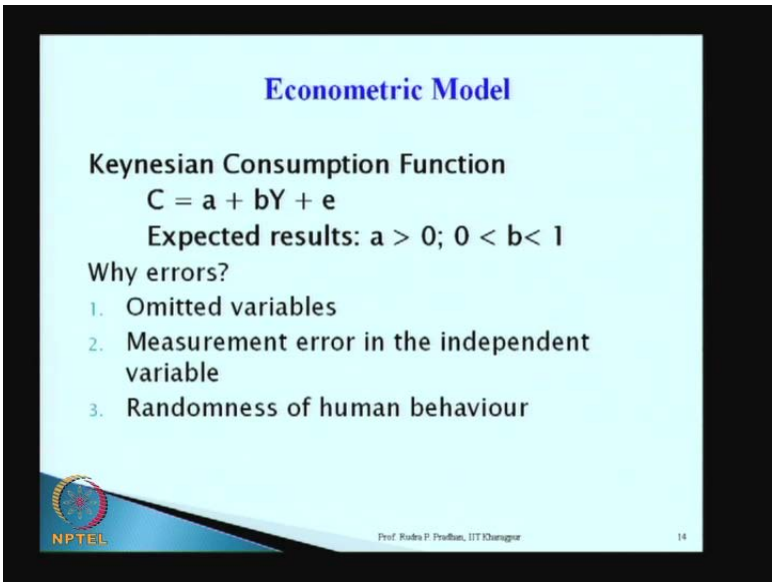
(Refer Slide Time: 33:00)



Then collection, summation, estimation and interpretation what is means what is all about the econometrics so econometrics it is the set of information collection, summation, estimation and interpretation so this is somewhat we can called as a statistics but, here only converts the extra part is you can say theory theory is the must its that is why it is not purely statistics ok

So it is majority part is ninety percent activity is statistics but, ten percent must be consistent with theory so that theory is very important means ten percent theory is very important so for is econometrics is constant ok.

(Refer Slide Time: 40:28)



So, as I have mentioned here so very means just like I have already mentioned here so for econometrics modelling is concerned so we assumed that this model is not deterministic it is you know it is in the form of some error environment so there are three specific components here so first thing you know when we will put here is you can say c equal to a plus b y b y plus e b y plus e.

So, now we start with c is we start with c equal to a plus b y and ultimately we transfer with transfer to a plus b y plus u now the obviously the question is why u why u why error term is always there there are many reasons you know that is how I have mentioned here why errors first things there are lots of omitted variables so for instance c equal to c is the function of y here.

So, that means consumption is function of income but, do you think that consumption is always only variable which can influence by income so it is obviously then answer is not so there are certain other variables which can influence the consumption current consumption say instead of putting c like this way I can put here c t equal to a plus b y current consumption level depends upon current income in fact current consumption may be depend upon past income ok so that is current consumption may be depends upon your needs so that is how some of the factor which cannot be it is not possible to a you know capture sometimes it is possible but, you are not interested for because of some

reasons anyway whatever may be the case so these are the reasons why error terms are always there ok.

So, that means if I will specifically highlight then obliviously why errors means its omitted variables cases because we are omitting few variables which may be relevant may not be relevant means omission of variables means some of the variables relevant variables we are not including for different regions hence some of the sometimes you know ah you know unnecessary variable your also including initially you may not have idea but, when we will go for modelling process you get to know whether it is perfectly or not ok.

So, then second is the measurement error in the independent variables so because these some of the independent variables may not be correctly specified so if it is not correctly specified then obviously the model may not be correctly specified so if model further we assume that there are some error component means whatever problems we we cannot you know capture so that will take care by error terms ok.

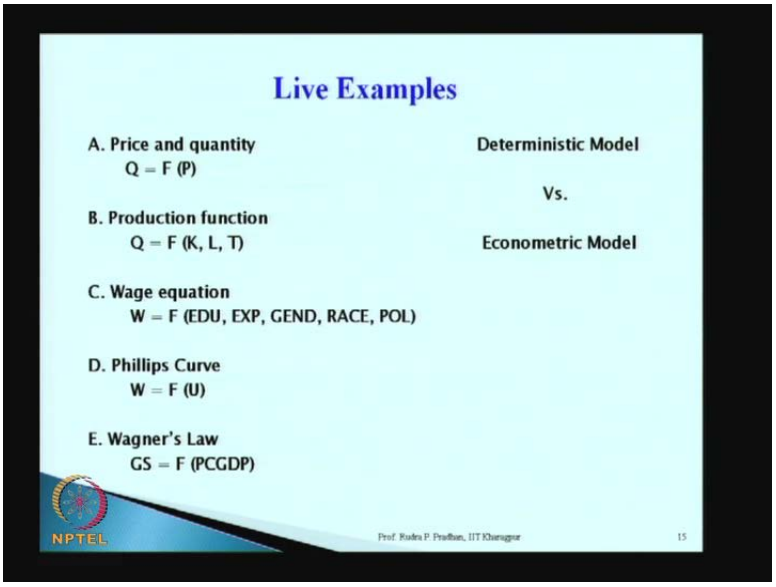
So similarly, last but, not the least cause is randomness of human behavior for instance we like to know the lessons between c and y so we have c information we have a y information so we like to correlate c and y by any chance suppose I am just entering data ok.

So, instead of thirty I will put three hundred; instead of you know forty I will put forty two so like that there may be human errors so that mistakes if it is severe mistake then obviously the model will give you rough results that is how it is it is a continuous process redesign redesign till you get best fitted model if it is coming perfectly then obviously you have to go continuously back back back back back till you get you know fault where is exactly your problem.

So, by the way you have to expire and accordingly you have to sort out it solution yes there are live examples here is basically the game is between deterministic model with econometric model so deterministic model is purely say straight forward concept econometric modelling is a complex process we are assume that something is not straight forward like you know means it is game between a we mathematically we can call its linear version non-linear linear means it is a very straight forward non-linear means it is not straight forward in between there is lots of hidden factors in nature.

So, econometric one of the core agenda what I have mentioned that to fit a data in a proper structure and second core agenda is to to explore the hidden information's so what is the hidden information which can you can say which is very much of tackle to your modelling scenario or which may not be perfectly you can say not schedule so you have to be very careful how we have to investigate

(Refer Slide Time: 45:10)



So, now you see here live example there is price versus quantity then productions means output versus inputs then wage equation wage productivity versus you know its its determinants then philips curves which is the game between money wage rate and unemployment rate so its impression issue.

So, wagner's law then government expenditure then external income these are the things means these are all you can say these are all purely theoretical base this here theoretical model we have a theoretical base so through the this price quantity that means theory says that there is some relationship between price and quantity so we will assume that quantity is function of price ok.

So, the may be linear or may be non-linear so we means whether the relationship there is relationship if there is relationship whether its linear or non-linear whether it is you can say in deterministic deterministic stand or econometric stand so that we have to know once we have a information why the basis of information we have to check the setup

accordingly we have to we have to come means we have to fit the data so that we can come to a better structure better feasibility ok.

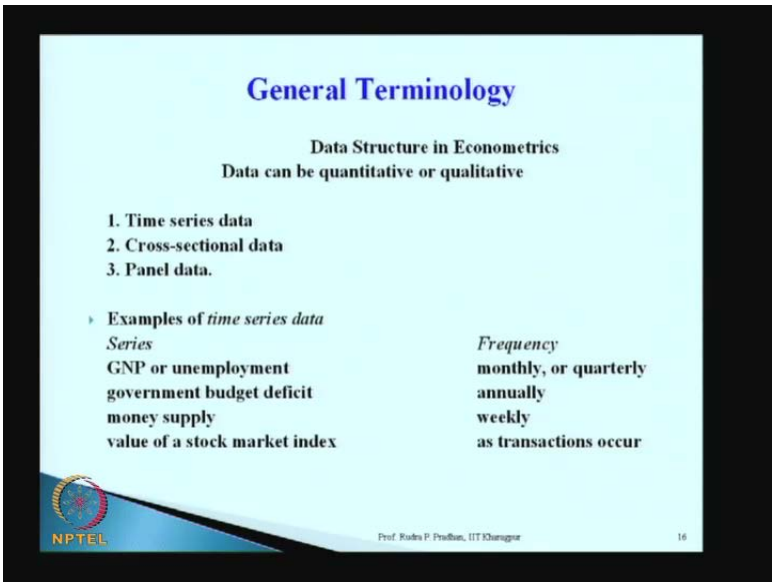
So, similarly, in the production every times what we have to do so you need information that is you can say econometric inputs and ultimately your according to your objective specification we have to process we have to collect or we have to redesign design till you get the objective means verification of your objective.

So, once your objective is done then obviously is your process is done so with respect to particular objective you have to process your inputs very carefully so that you will have the objective done yes so I have a I have a analyzer properly one thing here is that you need three things in the econometric setup one is consistent theory information that is data and you know tools and techniques that is you have to derive from mathematics and statistics ok.

So, theory information's and you know techniques theory information and techniques three things I have already highlighted here so theory information and technique these three things are very very important for econometric modeling.

So, now suppose is information I am just tracking one thing so we will get to know lots of things about the techniques obviously theory is must then we information techniques will be ultimate game so these are the instrument we have to play with this theory so techniques we do not touch today anything about techniques we will get to know details in the coming classes so information basically in the quantity term technical term is called as a data.

(Refer Slide Time: 48:08)



So data basically divided into three forms so the structure of data first thing a it may be experimental it may be non-experimental it may be quantitative it may be qualitative but, you know if it is qualitative structure then you know the setup is completely different

So what what I like to say so in the beginning we like to handle so quantity setup of data then we will see how qualitative setup of data will means how do we solve the or handle the qualitative setup of the data in the econometric modeling.

So, far as a quantitative data is concerned so we have three way of collections so we have three way of you know collecting the means combining the information so then one is called as a time series setting. That means data or information available about the about the time frame so this is called as a time series modelling means sorry time series data.

So, then another is called as a cross sectional data cross sectional data is data or information collected about the sample units cross sectional units for instants you know populations across the country say you say u k india etcetera this is called as a cross sectional data and with respect to india what is the population of india over the three years 1981, 1982, 2001 I say this is called as means stack price for various years 2001, 2002, 2003 like this way this is called as a time series a representation.

And finally, there is called as a panel data panel data panel data is the combination of combination of time series data and cross sectional data so the specialty of panel data is that it will increase increase the sample size because so for econometric modelling is concerned you have a theory and then you have built a model then you have to apply statistical to investigate whether the theory model is perfectly for that you need information then you have to process.

So, information is very important and that to huge and huge information you need so in that case we call it it is a sample size so sample size should be substantially very high in the case of you can say econometric modelling higher the sample size higher is the higher is the model accuracy lower the sample size lower is the model accuracy.

So, you have a substantially a high sample size so that you can justify your model fitness in more perfect way more structure way so panel data will give you green signal how you have to increase the sample size sometimes some of the problem if purely in cross sectional way and that information is very limited in nature sometimes some of the information is purely times series nature in that way very limited in nature.

So, now if will clog these two then obviously you will increase the sample size then that will be very handy for the say econometrics to verify a particular theory so then these are all various variables it can be available through cross sectional unit it can be available through time series unit then it may be first available times region cross sectional panel data you will artificially create the panel data setup ok.

So, sometimes data may be divide monthly wise quarterly annually weekly so many ways you have to you can say see all these structure of data so that means we get to know the details about the econometric modelling so what is the definition what is the what is its utility then how what are its applications then what is the core agenda what are the objectives what is the historical issues behind econometric modelling then you know proper structure of econometric modelling then basic themes that to specifically the modelling rules and you know the structure of data etcetera.

So, with these basic introductions so we we I am very serious you get to know little bit about what is all about econometrics and how it is important or relevance in the current current business environment ok.

Ah so we means what my suggestion is that is very useful useful subject very interesting subject very relevant subject so that it has a broad features of academics and some policy makers without having econometrics very difficult to handle so many big big problems and big big issue so econometrics to learning econometrics is most and it is very essential and very useful so we just highlighted what are the basic issues and how interesting this particular subject and what are the entry point of econometric modelling so what is the what are the requirements you need to have so that econometric modelling can be applied properly and to justify or to integrate the problem setup etcetera.

So, with this we can conclude this particular session here; so, thank you very much. Have a nice day.