Engineering Econometrics
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Lecture – 13
Descriptive Econometrics (Contd.)

Hello everybody. This is Rudra Pradhan here. Welcome to Engineering Econometrics and today we will continue with Descriptive Econometrics and that too we start with you know the same discussion that is on covariance and correlations. In the last lecture, we specifically highlighted the covariance issue and the correlation issue to know the kind of you know requirement, the kind of you know need as for the engineering econometrics, you know it is concerned and we have gone through the particular you know process to know how to calculate correlation coefficient, how to interpret and what is the beauty of this particular, you know kind of you know component.

So, ultimately whatever we have discussed in the last lectures, that is related to simple correlation structure and that too between you know two variables only that is exclusively bivariate game, but in reality most of the engineering problems can be connected with you know more number of variables. So, as a result correlation can be applied in a multiple situations means multivariate case, where we may have the situations of you know three variables, four variables and so on.

So, that means typically more than two variables if it is only one variable case, then we cannot use this technique, but if it is two variable case we can absolutely use this technique. You have provided there is in need of that technique and the kind of may require. If there are more number of variables, then you can still use this particular technique and then, we connect differently. That is how the issue of you know covariance matrix and correlation matrix is coming into the picture.

So, when we talk about covariance matrix and correlation matrix, then you know any variables you have by default you can you know obtain this particular matrix. For instance, if it is the two variables, you really have a matrix of you know 2 into 2. If it is 5 variables, then you will matrix of 5 into 5, where you will get 5, you know cross correlations, you know where will have a kind of you know you know kind of you know covariance matrix and variance matrix, where 5 variance issues and different covariance

issues. Typically if it is 5, then the cross correlation coefficients will be 5 C 2. So, these are the things we have to know and you have to calculate accordingly, but in the mean times, I will let you know how is the particular you know structure. So, this is what we have discussed in the previous lectures.

So, ultimately data and data analysis and correlation; so, what we have done actually, we just indicate the variables and the data rates. Ultimately software will help you to report the correlation coefficient and that too in that case of you know bivariate structure and same, in the same time if you have a multivariate structure, again you just you know highlight the entire variables with the particular you know dense. By default this software will give you a correlation matrix. So, what do we have already mentioned? If it is a two variable case, you will get a matrix of you know 2 into 2.

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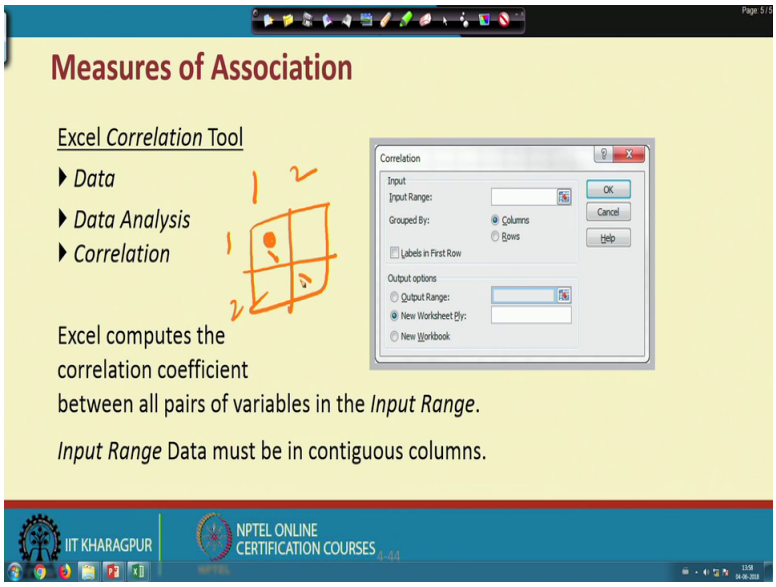

If it is 3 variable case, you will get 3 into 3. So, that means every time it will give you a square matrix format and the beauty of this particular format is like this a let us start with the examples here two variables, 1 2 and 1 2.

So, here we have a correlation matrix of you know 2 into 2. So, this is actually correlation upon same variables and as a result this will be always actually 1. So, when you correlate same variables, then the correlation coefficient will be 1. So, as a result our all the diagonal elements of the correlation matrix will be always 1 and the of diagonals are always actually give you the correlation coefficients and diagonals are the major

requirements or the kind of you know basic inputs through the regression modeling or the further you know engineering econometrics processing.

So, here if you know the issue is you know prepare either a covariance matrix or in a correlation matrix, the difference is the difference like that you know in the case of covariance matrix, all the diagonal elements are not standardized, but in the case of correlation, the diagonal elements are you know standardized whatever may be you know sample size or whatever may be a kind of you know variable size.

So, your diagonal elements will be always represent 1 and off diagonal elements or on diagonal elements will be in between minus 1 to 1 only. So, it may be 0, it may be a say 0.3 or you know 0.7 or something like that. It may be positively linked or it may be negative link, but ultimately the values will be coming in between minus 1 to 1 only, but all the diagonal elements will be always 1. So, that is the beauty of correlation matrix in comparison with the covariance matrix. So, that means technically when you solve any kind of you know engineering economics, economic engineering you know problem by using engineering econometrics. So, first you report the univariate statistics, bivariate statistics, then you look for the complex modeling to investigate the problem and you know more accurately in that to in a kind of in depth you know a kind of you know way.

So, the particular matrix will give you know beautiful signal through which the model will be you know I really you know more active or you can think about the most strength about this particular you know models, otherwise without any such evidence. So, you are connecting any models or using any model for the investigations, sometimes there may be error in the later stage. So, having basic background, it will give you better results, better inference to the complex analysis. So, ultimately this is how the particular you know processing.

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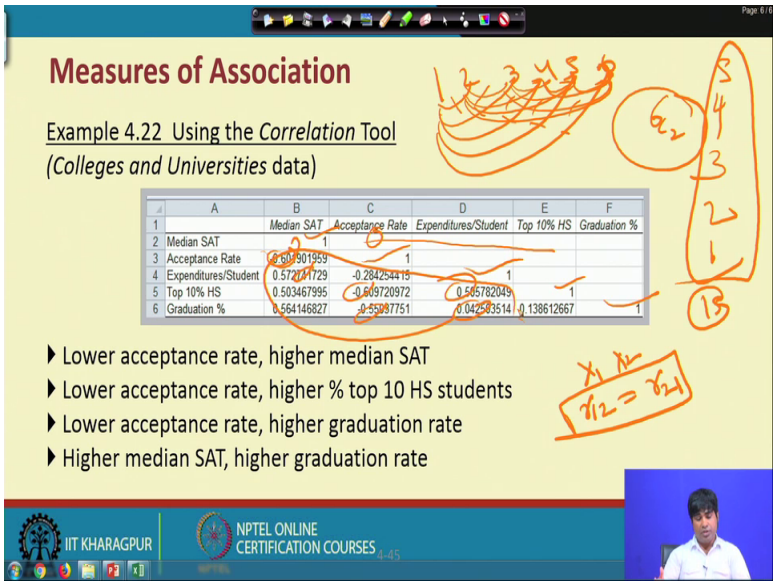

So, then what is the you know what I see here. So, what is more about this particular structure is, so this is actually 6 variables case and what I have already mentioned in the you will get the correlation matrix of you know 6 into 6. So, see here is all these diagonal elements are 1 1 1 1 1 and off diagonal elements are in between minus 1 to 1. So, this is negative, this is positive, this is negative, this is negative, this is positive, this is positive.

So, ultimately what I mentioned, so you will define you know 6 C 2 correlation coefficients you can obtain from this particular matrix and the beauty of this particular matrix is that you know you have to just report the on diagonals and transpose on diagonals will be of diagonals that you know entry. So, that means if we have a two correlation coefficient x 1 and x 2, so we can either call as r 1 2 or you can call r 2 1 so, both will be having same result. So, that is how correlation coefficients are technically called as you know symmetric in nature. So, similarly if you connect with you know standard deviation, you know sigma 1 2 and sigma 2 1, they are also same.

So, ultimately so the diagonal elements can be actually transpose and then, it can get a therefore fully you know correlation matrix. Ultimately if all these reporting are there and these are or not you know available, so it is not an issue because the same value will be appearing here. It is a still double you know a double kind of you know entry and there is you know need to actually go for double entry that itself we indicates the particular relationship. That means, technically we are starting from left to right and

other side we start with right to left only, but ultimately we need that particular point. What is the association? That means, technically what is the association between 1 1 with 2 and 1 with 3 and 1 with 4; similarly 2 with 3 2 with 4 and similarly 3 with 4. So, that means technically if there are you know six variables say 1 2 3 4 5 and 6, so that means the relationship will be like this 1 2 1 3, 1 4 1 5 1 6. So, that means technically the correlation coefficient will be 1 2 3 4 5. So, in the first instance 5 and against you connect with 2 3 4 2 5 2 6 so, it will give you 4 more.

So, again you have 4 more. So, then again you start with you know 3 4 3 5 and 3 6. So, it will give you three more, again 4 5 4 6, 2 more and then, finally 5 6, 1 more. So, these are the total correlations you will have. So, it will be 9 12 and then, 3 15, 15 correlation coefficients you have find here. So, you can if you count all these things and by default you have 15 correlation coefficients.

So, ultimately it will give you better you know understanding about these variables involving the particular you know econometric modeling process. So, then ultimately will move and what is more about this particular process is like this.

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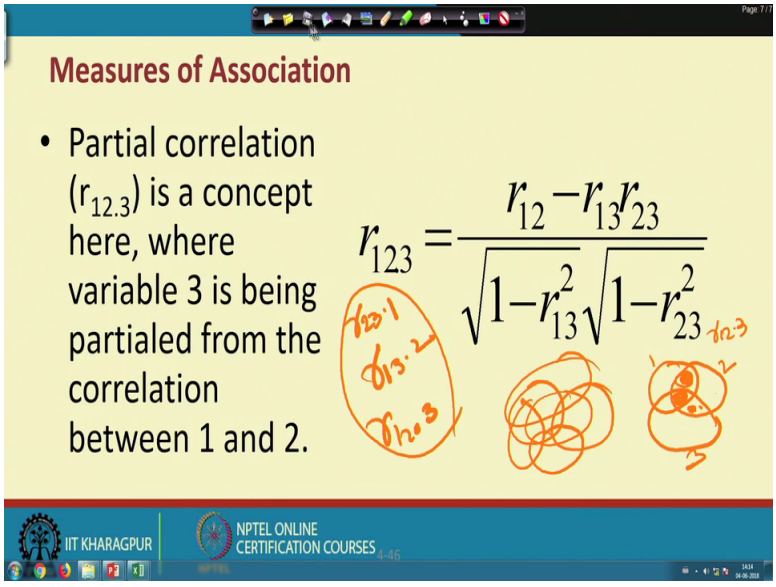

Sometimes what happens you know means what I have already pointed out. So, we are living in a kind of you know scenario or you know dynamic world, where you know more number of variables can you know come closer. So, you know can you know associate each other. So, you may start with the two variables, but ultimately there are

other variables may be treated as you know post factors or pull factors which can affect this relationship. That means, at the end of the day we will find multivariate you know structures. So, if it is a multivariate structure, still correlation can be used. So one to one so, like you know whatever we have a correlation matrix, we have already discussed. That is actually a matrix of you know 6 variables, but ultimately the reporting is you one to one only. So, that means variable 1 with variable 2, variable 1 with variable 3, variable 1 with variable 4, variable 1 with variable 5, variable 1 with variable 6 and so on.

So, ultimately we are targeting each variables different you know different levels, but there may be actually you know a kind of you know issues or something like you know structure. We are you know all the variable simultaneously can be linked. So, that is how the correlation structure can be of you know three types. One is called as you know simple correlations, where we have two variables at a time. It may be 1 2 or 1 3 or 1 4 or 2 3 2 4 something like that or maybe all variables simultaneously. So, as a result simple correlations and something called as you know kind of you know partial correlation or you know multiple correlations. So, one of the classic example here is the partial correlation coefficient.

So, partial correlation coefficient structure is we are connecting two variables with the 3rd variables as a kind of you know interactive kind of you know structures. So, that means with the presence let us say I can write like this r 12.3 means I can prepare a structure like this, I can prepare a structure like this for instance. So, r 12.3, then I can put you know r 13.2 then, r 23.1. So, like this there are three you know partial correlation coefficient we can have.

So, ultimately the partial correlation structure will be like this. So, this is how the kind of you know structure is means for a three variables scenario the structure will be like this. If you want more variable, then you just add up like this. So, this is how the path diagram for you know partial correlation or a multiple correlation, but ultimately the issue is you know you are just reporting the correlation coefficient between two variable in presence of you know other variable what we call as you know interactive effect.

Sometimes it should be in real life there are instances where we need actually reporting partial correlation coefficient rather than in a simple correlation, because if you apply simple correlation in that scenario, then your you know output will be very biased and it

will not give you correct inference and correct kind of you know output to address the particular you know engineering problems as per the need you know requirement.

So, for instance you are just establishing the relationship between a price and you know quantities. So, there are lots of you know theory you know if you increase the price, then quantitatively down if you decrease the price, then sales quantity means this cell will be you know high. So, that means a theorem says that you know management, in the management field or you know kind of in a engineering economics field, the cells and price what we call as you know demand theorem where you know price and quantity are inversely related to each other. So, that means this will give you negative correlation coefficient. So, the simple interpretation is that if you increase the price, then cells will be down. If you decrease the price and cells will up, it is not always true, but you know many instances the theorem you know holds true.

So, now what is happening this relationship, the universal relationship can be very active provided if there is 3rd variable in the pipelines. For instance, you are increasing the price level and decreasing the price levels and you are doing at you know organization and you are not informing anybody else. So, that message should go to the really customers or the kind of you know consumers whatever changes you are applying so, this message should go to the consumers immediately. So, you know the theorem can means whatever strategy you are applying, that will be work in the market.

If you are not, if whatever you understand is you are applying it and if that message will not go to the consumers or customers, so ultimately your strategy will not be reactive. So, that is how it is your duty whatever strategy you are applying for the customers and consumers, you have to communicate properly. So, that is how the issue of advertising will be come into the picture. So, that means whatever message you like means whatever strategy like to apply, you know create awareness among the people. So, that is why I put either in the form of advertising or something like that. So, as a result this message will immediately go to the consumers.

So, technically in such a kind of a scenario, so advertising expenditure is the kind of you know control variables. So, when I am writing are r 12.3, so 3 will be the control variable. So, with the simple interpretation is that you know with the assumption that or with the condition that you know we are putting the advertising that there is a price

change whether you see you know in a downward or you know upward and how is the relation with you know cells. So, that means advertising is the control variable here and having advertising is the control variable what is the price and quantity relationship.

If you remove this advertising, then there will be relationship and relationship will not be perfect, because if here the issue is see the interactivity end will be coming into the picture, because without any source control, you cannot actually you know establish this relationship or you can establish this relationship, but this relationship may not be very perfect. For instance you know means another way I can highlight for instance you know suppose you like to you know put you know more hours in a particular you know work, then obviously productivity will be very high.

Now, you know I start with you know let us say day time 8 o'clock and you know working hard and you know obviously production will be increasing, productivity will be increasing, but you know working hard and productivity may be actually positive related to each others. If you know spend more time in production then, obviously production will be high, but ultimately you know you cannot you know continuous products or you know continuous involvement until unless the infrastructural availability is there in the system.

So, that means one of the typical requirement to sit longer hours or to involve longer hours in the production process to him, more production is the infrastructure. For instance, let us say power, electricity. If electricity is there and the facilities let us say AC facility is there, then you can in a position to sit long times or you know involve long hours and look for more production. So, here the infrastructure is the control variables having the infrastructure so, you may be in a position to sit long times in for long times and look for more productions.

So, that is how you know means these are the areas where you know the multiple correlation or partial correlation come into the picture. Sometimes you know all the variables jointly can influence each other. That is how multiple correlation coefficient come into the picture. For instance, I will take 3 variable cases for better understanding. So, this is how the case and this is how the case.

So, this is how the perfect in a path diagram for partial and multiple correlation and this combination is nothing, but called as you know multiple correlation and when you look

for actually partial correlation that say this is 1, this is 2 and this is 3 and ultimately, this area this area is called as r 12.3. So, that means technically this you know common interactions should be actually controlled. So, then with these controls what is the relationship between the two? So, when I am talking about r 12.3, that means I am talking about this point only.

Similarly, when I am targeting about actually the correlation between 2 and 3, so this is the area where r 2.3 and the control variable is 1. So, these are all actually called as you know partial correlations and the combination is called as you know multiple correlation. So, that means multiple correlation coefficient in the presence or the kind of you know interpretation is that you know it gives the you know simultaneous you know or you know kind of combined association between this in a three variable. That means they are connecting each other actually absence of a particular variables may effort the relationship in a significantly or considerably you can say.

What is happening here means the issue is very simple. You have a simple correlation, you have a partial correlation, you have a multiple correlation. In fact, multiple correlation structure will be discussed in details in regression Modeling. Similarly partial correlation is also there in the regression modeling. In the regression modeling, we call as you know the regression coefficients where you know we have some kind of you know control mechanism or partial regression coefficient we have to calculate and report, but here before you go for regression model, we can report these things and you can you know find out the particular you know requirement, understand the problem more accurately and visualize as per here in a requirement.

That is how I have actually elaborated the kind of you know items. There is the partial correlation and multiple correlation. In addition to whatever we have discussed, the simple correlation and I have also cited a couple of examples where you can apply partial correlation, where you can apply multiple correlation and sometimes there you know you have to apply the particular you know tools as per the particular requirement and the need you cannot just blindly use the technique and you know applies you know somewhere and then, get the kind of results also and this is the process which is completely biased actually and the particular inference and the particular outflow will not be very active and you know efficient.

So, that is how you should know the details, understand the particular technique, understand the problem area where you can apply and then, look for the particular you know outcomes as per the requirement and the need of the engineering problems. So, ultimately this is how they call as you know partial correlation coefficient and likewise this is a kind of you know multiple correlation coefficient.

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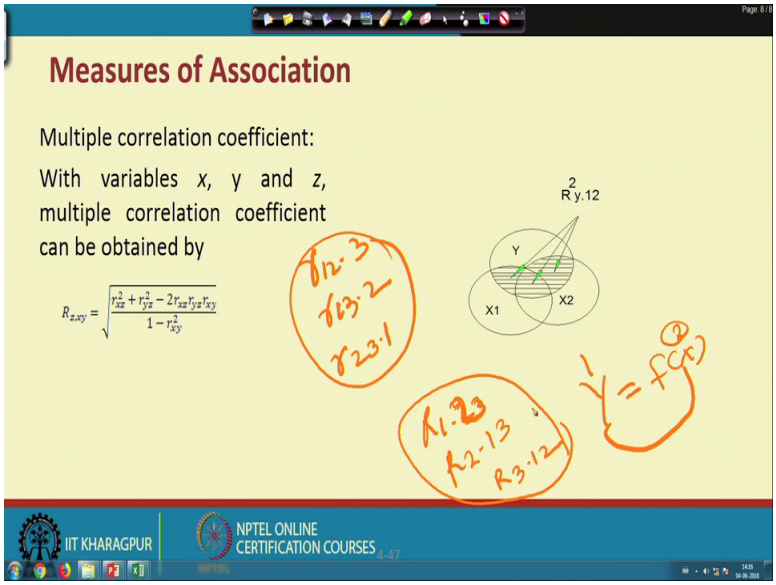

Here the signal is actually like this you know let me once again highlight here, so three variables. So, partial correlation will be r 12.3 r 13.2, then r 23.1 and similarly, in these are all partial correlation coefficients with respect to three variables variable 1 1, variable 2 2 and variable 3 3. So, then in the case of multiple correlations, you will find R 1.23. That means, this is a control variable.

So, this is actually solid component for you know regression modeling because in the regression modeling we start with actually bivariate because like correlation and covariance, the minimum requirement of regression modeling is two variables where one will be dependent variable and another is independent variable. For instance, when I am writing r 12, so assuming that you know 1 is the dependent variable, 2 is the independent variable, for instance I write like you know y equal to f of x. So, that means this is the independent variable let us say 2 and this is 1.

So, now correlation coefficient will also give this similar kind of in a signal. So, when I am writing multiple correlation coefficient that to R 1.23, so that means R is the kind of

in base, then it will be connected with you know variable 2 and variable 3. Similarly, I can change the domains. I can put R 2.13 and R 3.12 like this so, these are all called as you know multiple you know structure through which you can actually look for the particular you know investigation and you know the kind of you know econometrics output to address these problems as per the particular you know need.

So, this is how actually which I have already in fact highlighted and this is how the particular you know structure through which you can understand the partial correlations and multiple correlations. Ultimately whatever we are discussing whether simple correlation, partial correlation and multiple correlations, so every time the range will be unique or you know uniform for instance the range will be minus 1 to 1 only.

So, if there is an association, so you find they are not equal to 0 and the values will be in between minus 1 to 1 that to like you know 0.954, 0.005 or minus 0.025 something like that and if it is close to once highly positively correlated, if it is close to minus 1 highly negatively correlated, if it is close to 0, then it is in low associations. If it is a let us say you know close to 0.5 negative or positive step in system in a medium, there is association. So, that is how the interpretation will be different and then, you understand the problem as per your you know requirement.

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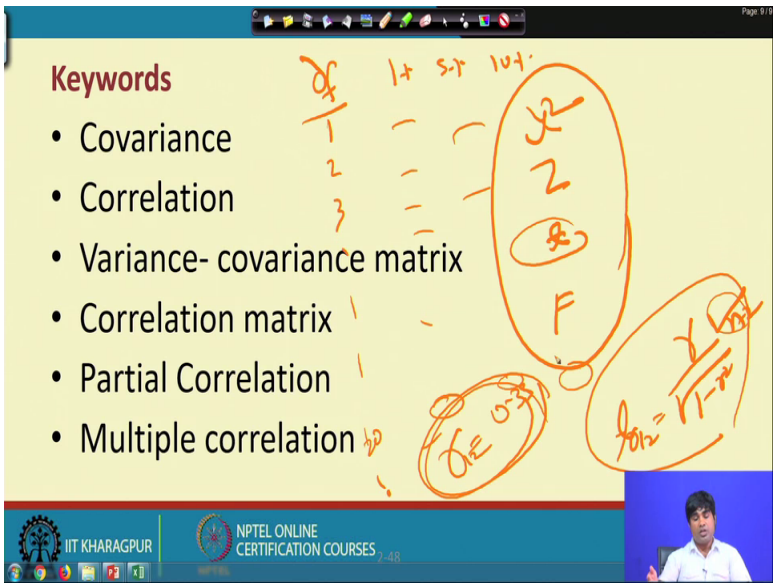

So, that means technically whatever we have discussed till now is the kind of you know bivariate structure between a covariance correlation and with the intention of you know

simple correlations, then a partial correlations and multiple correlation and in addition to these, you know econometric output, these are all called as you know econometrics output correlation coefficient.

This is a kind of you know econometrics output whether it is a simple one or whether it is a partial one or it is a kind of you know multiple one. What is happening here is once you get the correlation coefficient and to validate the particular you know structures, what we like to have? You have to statistically test it and there is need of statistical in a signal.

So, whatever we are getting, it is just you know statistical output until unless you validate and test. You cannot just you know declare or you cannot just go for you not applying it. So, that is how these structure are called as you know inferential you know econometrics and that too otherwise called as you know hypothesis testing. The hypothesis testing is very straight forward which I have slightly highlighted in the last lecture. I said the null hypothesis with the assumption that you know the correlation coefficient you know not equal to 0.

But ultimately the data is saying that you know there is a correlation coefficient and then, you specify the probability level of significance you know to test the particular you know test statistics. So, as per the econometrics requirement most of the instances we use three levels; 1 percent, 5 percent and 10 percent. So, what is happening in the testing procedures if you go by men, you know manual procedure.

So, we have actually statistical tables and that is called as a benchmark values with the different probability levels and that depends upon you know corresponding degree of freedom. Ultimately in the next you know lectures I will highlight in details. So, ultimately hypothesis testings there are 3-4 things are very you know common. So, you have to choose the probability level of significance. There is at the 1 percent 5 percent and 10 percent, then we have to choose a particular test statistics for instance we are getting r square. Here r square is not a test statistics.

We have a different test statistic, for instance we start with you know Z statistic, t statistic, Y sqaure and F ultimately. So, in the inferential you know analytics or inference of econometrics, the test statistic follows let us say we have y square and then, Z t and F.

So, these are all you know very standard you know for test statistics and most of the instances you know correlation and regression, we frequently use actually t statistics. So, that means when you get correlation coefficient r with respect to two variables say r 12, that is 0.35, so that does not mean this is statistically supportive. So, we need to test it actually.

So, there is a test formula. So, for that there is you know you need to calculate t statistics and it depends upon you know. In fact, like you know correlation coefficient r we have a formula. So, you have to calculate at t r 12. So, then this for there is also formula how to calculate. For instance, the formula if you know correlation coefficient testing is like this. So, this formula can be used to test whether correlation coefficient will be statistically significant or not.

So, this will give you know test statistics value on the basis of whatever correlation coefficient you have reported and that too depends upon the sample size and degree of freedom. So, once you get you know this is what called as a calculated test statistics and then, you can compare with the tabulated test as we have t tables and in the t tables, it is benchmark values and the tables will be with respect to probability level of significance. We will find 1 percent level, 5 percent level, 10 percent level and sometimes in between and then, that depends upon the you know sample size what we call as you know degree of freedom.

Generally, degree of freedom is the difference between sample size you know and the variables involvement usually called as you know n minus k indications; n represent sample size k represent number of variables involved in the investigation process. So, ultimately degree of freedom is the balance between means balance it between n and k. So, that is the sample size and the variables involved. So, when you are you know sample size is high and you know variables environment will be low, then your degree freedom will be very high. Ultimately we need actually high degree of freedom to you know to justify our you know validation.

So, that means every time when we are going for you know testing our main intention is to reject null hypothesis which we start with that you know there is a norm value, but ultimately there is a look whatever value we have, that need to be statistically significant. So, that means one way to justify is that you know you must have high degree of

freedom and you must have also high correlation, then ultimately you can actually reject. So the comparison will be calculated test statistic and tabulate registered statistic. So, the tabulated statistic depends upon probability level of significance. So, like this the tabulated value will be this is a degree of freedom, then probability level say 1 percent and 5 percent and 10 percent, there may be in between, but I am just reporting the major ones.

So, I start with the degree of freedom 1 2 3 and you know so on like this. So, then you defined you know reported figures, so that means technically the tabulated test statistic corresponding to this calculated depends upon the degree of freedom and the probability which you have fixed. So, that means ultimately you just get to know what is the degree of freedom, then you try to report you know tested you know calculated tabulated value of this particular you know test statistics at 1 percent, 5 percent and 10 percent and that will be a particular degree of freedom.

So, because a degree of freedom will remain constant for 1 percent, 5 percent and 10 percent let us say it is actually degree of freedom is 20. So, you just check what is the value of 1 percent, what is the value of 5 percent and what is the value of you know 10 percent.

So, ultimately the rule is that you know benchmark value will be very higher to 1 percent and it will be slightly lower at you know 5 percent and again slightly lower at 10 percent. So, that means technically our job is to check whether you know your calculated test statistic will overtake the tabulated statistic or not. If it is the case, then you are in a position to the reject the (Refer Time: 32:36) justified that you know this particular item is statistically significant. So, once you get that particular you know signal or evidence, then you can apply and give a kind of you know policy implication or judgment something like that. But you know having all the statistical output will not actually solve you know engineering problem.

So, this ultimate solution depends upon the econometric output and this econometric output need to be tested empirically. That is what is called as you know hypothesis testing or it is called as you know inferential econometrics. So, the standard rule is you use your test statistic corresponding to this you know econometric output like you know covariance and correlation and then, with the help of you know a sample size, the

number of variables and the probability level of significance, you have to find out the tabulated value and then compare the calculated with a tabulated within on different probability level, then check to what positions you are in a position to reject your you know null hypothesis and ultimately, you can conclude the kind of you know requirement.

So, if you do like that, then you are in a right track to address the problem as per the particular you know requirement and this is what the standard procedure and you have to apply this one with the case of you know simple correlation structures, partial correlation structure and multiple correlation structure. Again the same testing mechanism is also equally applicable in the context of you know say regression modeling.

So, in the regression modeling, the typical link is a little bit different because here the objective is to work out the cause ability kind of you know issue. So, that means the issue is the cause and effect, but here we are just establishing the relationship, the association noises relationship in our relationship, but ultimately we are not worried about which vector is cause and which vector is but which is very much essential in the real life scenario without knowing which one is cause and which one is effect.

So, the future plan or you know future kind of implications, you may not actually you know apply accordingly. So, your planning and the strategy depends upon you know all kinds of you know output or the kind of you know, so there is the relationship the kind of you know cause and effect kind of knurlings. So, ever again the cause who is more rigid less and who is it negative, who is positive. So, you need to balance actually all these things ultimately to optimize your you know engineering objectives and the kind of you know problem requirements. Once you do all these things, then you are in a right or right balance to address the problems as per you know particular requirement.

So, ultimately till now whatever we have discussed, it is all about the univariate structure or univariate statistics and bivariate statistics and both are very essential or advanced engineering economics problem. So, in the advanced engineering econometrics problems, we frequently use regression modeling with your different kind of you know functional, from different kind of you know structure to analyze the business problems or engineering problems as per the requirement objectives and the organizational goals, but ultimately to strengthen our you know process or the kind of you know movement, the

basic statistics or the univariate statistic and bivariate statistic or bivariate econometrics will be very handy.

So, ultimately till now whatever we have discussed, it is all about you know understanding the engineering problem, that is how you can quantify the engineering problem, how you have to address the problem or you know develop a model through which you can you know analyze the issue more effectively. So, typically we need to identify the variables through which you can you know quantify the problem, then to rate or to you know establish the link or the kind of you know measurement.

So, we need actually data corresponding to each variables, then with the help of some you know basic econometrics and bivariate econometrics, we need to have you know what we call as you know intermediate outputs. So, these are all called as you know intermediate output. It is not you know final output econometric output because finally, econometric output will be something different because our this you know subject objective is you know engineering econometrics where the causality issue is more important rather you know in comparison with you know simple descriptives means unvariates reporting and the bivariate report ring.

So, ultimately our main aim is you know causality suits among the variables in a particular set up in a particular engineering problem. Ultimately whatever we are in a you know knowing all these you know basically statistics, basic econometrics or bivariate statistics or bivariate econometrics, various sub, they are spread sheets and the data structures all these are actually you know requirements. These are all we can call as you know basic infrastructure for the engineering econometrics.

So, until unless you clear about all these you know basic infrastructure, if you are not acquainted with all these you know infrastructure, then you may not actually play in the game in that engineering econometrics. In order to become you know you know big players in this you know domains, you must have you know this kind of understanding and your hand must be very active in all these aspects. It is not a big deal actually having the problems if you once quantify properly with respect to variables having the data.

So, these are all you know you know kind of you know one or two of only with the use of softwares. So, just you know allow this softwares to the port and as software with you know 1 minute will give you the econometric output. Ultimately it is you to understand

and you know you know connect as per you know requirement, but until unless you know all these things, software will not help you.

Software will just you know need your command to help you know to get some kind of you know output and it is you to actually how you have to interpret and how you have to use this you know intermediate output for you know final output processing and that is how we are actually discussing this you know issues or the kind of you know tools and techniques.

In the next lecture, we will give more, you will discuss something more about the inferential econometrics where we need to understand the use of probability, probability distribution, sampling and sampling distribution because ultimately the issue of you know engineering econometrics is nothing, but you know sample specific. It is not actually ultimately population specific. In 99 percent instances, we use actually sample and then, we analyze the samples and then, finally on the basis of you know different sampling outputs with different robustness checks, we have to generalize as per the particular you know requirement.

And for that all these basics are you know essential. So, that means in the next lectures we should understand or we should get to know or we will be acquainted with all kinds of you know inferential econometrics, so that you know the predetive econometrics can be more handy while you are you know solving any kind of you know engineering problems. So, with this we will stop here.

Thank you very much. Have a nice day.