Econometric Modelling
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Module No. # 01
Lecture No. # 03
Univariate Econometric Modelling

Being and welcome to NPTEL project on econometric modelling. This is Rudra Pradhan here. Today, we will discuss the concept of univariate econometric modelling. First of all, what is univariate econometric modelling? It is a statistical analysis that considers only one factor or variables at a time.

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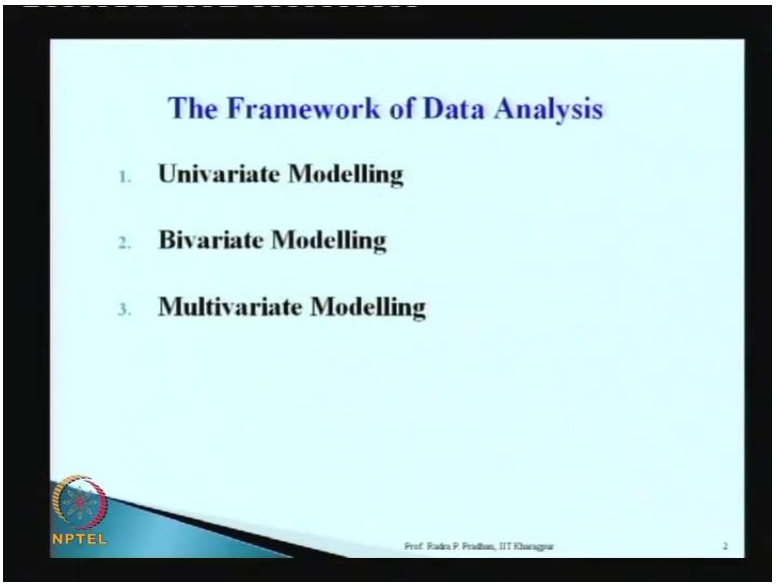

It explores each variable in a data set separately and is very essential for multivariate analysis. So, univariate modelling is an essential condition for multivariate modelling. Univariate modelling also called as a descriptive statistics. It is it is concerned with the description or summarization of individual variables in a given data set. So, let me explain what is all about this univariate econometric modeling.

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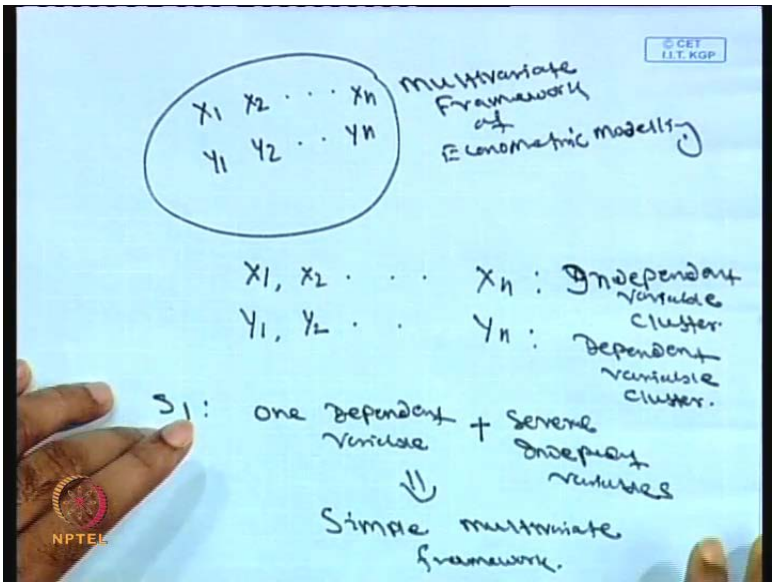

Let us take a case here. We have series of variables X 1, X 2 up to X n. Y 1, Y 2 up to Y n. So, this is what is all about multivariate framework of econometric modelling. So here, we are very much concerned about this statistical analysis of a particular variable or series of variable and their interrelationships. So, if we go through this multivariate framework of econometric modelling, then usually we have two different sets of variables. One set of variables is called as a X 1, X 2 up to X n and another set of variables are called as a Y 1, Y 2 up to Y n. This particular series called as a independent variable clusters independent variable variable cluster and this particular series Y 1, Y 2 Y n is called as a dependent variable clusters.

So, multivariate framework or multivariate econometric modelling is nothing but the structure of or integration of independent variables and dependent variables. So, it is the game between independent variable and dependent variable. Otherwise, it is also called as a endogenous variables and exogenous variables. There are two different situation altogether. Situation one: One dependent one dependent variable with several independent variables. So, the situation one is one, when one dependent variable with a several independent variables. So, this particular structure is called as a simple multivariate framework or simple multivariate modeling.

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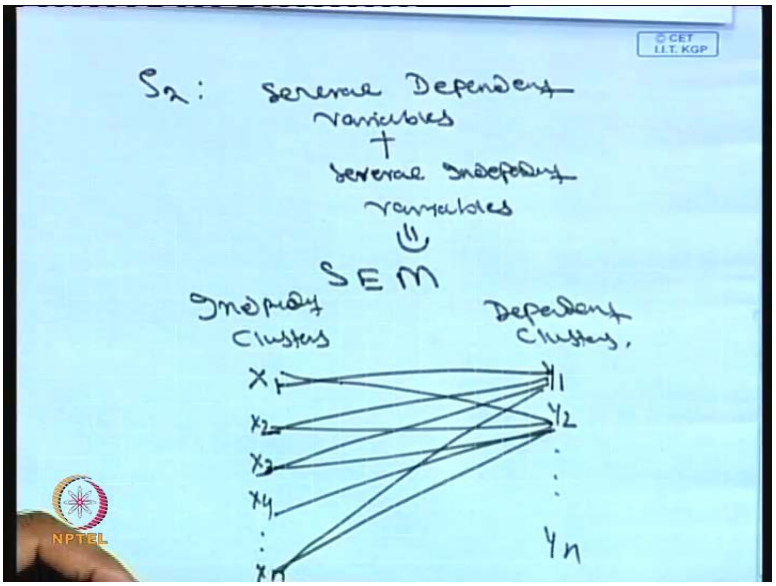

Situation two: Where there are several several dependent variables plus several independent variables. So, this particular structure is called as a simultaneous equation modelling or and structural equation modelling structural equation modelling. So, we have two different games so far as a real world problem is concerned. So, one side we have one dependent variable with several independent variables. In other situation, we have series of dependent variables and series of independent variables.

So now, let me take a case here. So, this is independent clusters, this is dependent clusters. So, we have independent clusters, we will be represent X 1, X 2, X 3, X 4, like X n. Dependent cluster, we have Y 1, Y 2 up to Y n. Now, when there is a question of situation one, then we have to integrate Y 1 with X 1, Y 1 with X 2, Y 1 with X 3 and so on with Y 1 with X n, or Y 2 with X 1, Y 2 with X 2, Y 2 with X 3, Y 2 with X 4, or Y 2 with X n. Like, we can integrate Y 3 with so many independent variables and Y 4 with so many independent variables, again with Y n with so many independent variables. So, this particular framework called as a simple multivariate econometric modeling. However, in the question of structural equation modelling, so, the structure is completely different. So, that means, here every variable has an integration with other variables. This is the condition one and the condition two is there are series of dependent variables and series of independent variables. So, now within the detail structures, so, we have to discuss here what is all about the univariate univariate econometric modelling.

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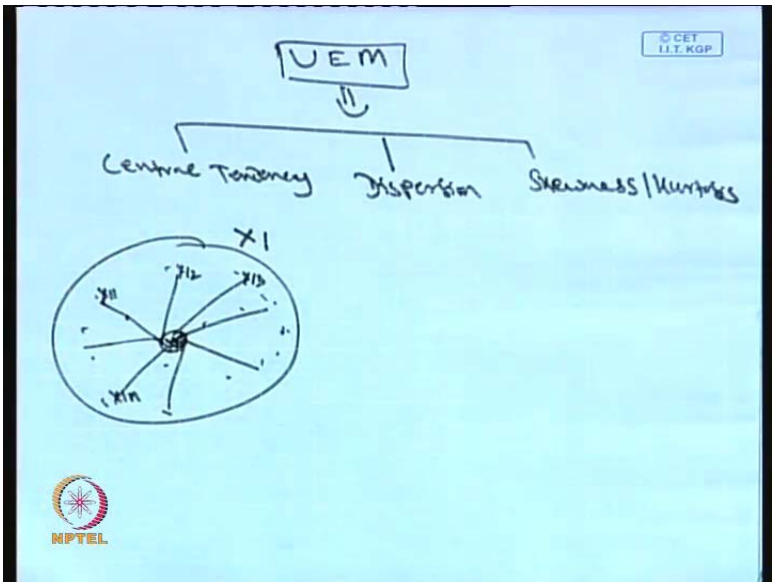

So, univariate econometric modelling is basically basically represented as here univariate econometric modelling represented as a UEM, univariate econometric modelling. So, let me first highlight here, what is the entire structure of this univariate modeling. So, the basic objective behind univariate modelling is that, we have to describe or we have summarize a particular variable in a given set up. If the setup consists of say ten variables, we have to we have to analyze with a particular variable only. For instance, if we have X 1, X 2, X 3 up to X 10, then we like to know what is the futures of X 1, what is the futures of X 2, what is the future of X 3 and up to what is the future of X 10. Because, it is the prime requirement of multivariate econometric modelling. Until, unless, you know all these structure and setup of univariate data setup, then you cannot go anything or you cannot get better solutions.

So, univariate econometric modelling gives with three issues. One is called as a central tendency central tendency, then dispersion, then third is called as a skewness or kurtosis. So, what is central tendency? It is the single figure, which describes the entire setup. So, the central tendency will give you indication about single figures. So, like this. There are set of observations here. So, we have to target which particular observation is very important which can describes the entire issue. The dispersion is within the setup again. So, it represent the variability of the observation in a particular variables. So, let us say this is this is variable say X 1. Now, these points are represented as X 1 1, X 1 2, X 1 3 up to say X 1 n. These are the data points with a particular variables.

So now, which particular variable is the central or you can say center that describes the complete information within the structure or within that particular variable. Now, let us say this is a center here. Let us let us call it, X is a unit which represents the entire structure of this particular variable. So, now dispersion is the variability of the observation in a particular variables. Now, if it is X 6, now we are very much concerned about how the X 6 component is different from X 3, X 1 1, X 1 2, X 3 1 3 like this. So, we have to see whether this is equally distributed or unequally distributed and that objective is the framework of dispersion.

Now, this skewness issue is the general shape of the distributions. So, for the distribution is concerned, we have series of distribution like theoretical distribution, under theoretical distribution, we have probability distribution poison distribution, thermal distribution, hyper power distributions and so on. But, for econometric modelling or basically structural modelling, so, the model will be best fitted or we can we can use that model or we can feed that model for better way. A data point should be normally distributed. So, that means, we are very much interested whether the setup is the normally distributed or not. So, that means, we are very much interested to integrate this structure into normal distribution set. So, that shape of the distribution is our concern and that is nothing but the skewness skewness component. So far as if kurtosis is concerned, it is the flatness of the distribution. Again, it is the within the setup of normal distribution.

So, now we have three different structure of univariate modelling. So, one structure is central tendency, another structure is dispersion and another structure is skewness. The objective is to find out the single figure which describes the entire issue. The second issue is dispersion. All other items are distance from other data points. So, this is what the dispersion objective and skewness is the shape of the distribution and kurtosis is the flatness of the distribution. So now, within the basic background or information about univariate setup. So, we like to know, how this set up can be evaluated, can be interpreted and can be used further for multivariate econometric modelling. Let me first give you the framework of univariate econometric modeling.

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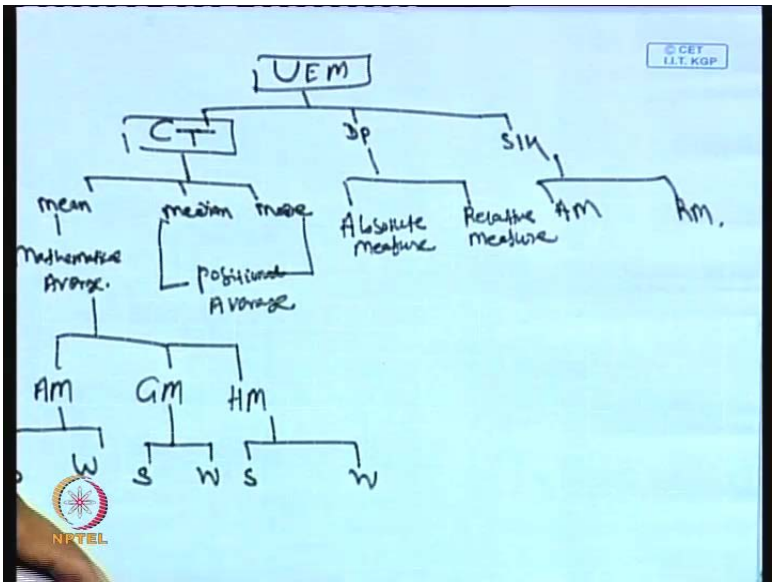

So, univariate econometric modelling as I have already mentioned, it has three different structure altogether. Central tendency, then dispersions, then say skewness and kurtosis. Under central tendency, we have three different set up. we have altogether three different setup. This is called as a mean setup, this is median setup, then this is mode setup. So, we have three different statistical tool under central tendency. So, this median and mode is called as a positional average. It is called as a positional average. Mean is called as a mathematical average. Mean is called as a mathematical average.

So, now similarly, for dispersions we have two things: one is called as a absolute measures absolute measures and another is called as a relative measure. Similarly, for the case of skewness, we have two different setup: one is called as a absolute measures and another is called as a relative measures. So now, we have to see what is the structure of central tendency, structure of dispersion and what is the structure of skewness? Now, under central tendency the objective can be evaluated through mean, median and mode. So, median and mode is represented as a positional average. Mean is represented as a mathematical average. On the other side, dispersion or variability of the information can be observed in a absolute angle and can be observed in relative angles.

Similarly, for skewness and kurtosis, we can have the absolute issue and also relative issue. Now, the mathematical average can be again various shapes. It is represented in three different forms: arithmetic mean, geometric mean and harmonic mean. So,

arithmetic mean is or it can be again calculated through simple structure and by assigning weight. Similarly, geometric mean can be calculated with the simple structure and by assigning weight. Harmonic mean can also be calculated in simple structure and by weight.

So now, now the structure of central tendency is that we like to know, what is the mathematical average and what is the positional average. So far, as dispersion is concerned, we like to know what is the absolute issue, what is the relative issue or how is the absolute measurement of that particular variable and what is the relative measurement of that particular variable? Similarly, in the case of skewness and kurtosis, we like to know how the shape of the distribution in absolute angle and relative angle. Let me highlight here the central tendency structure first. Then, we can proceed further or you can say econometric modelling issue.

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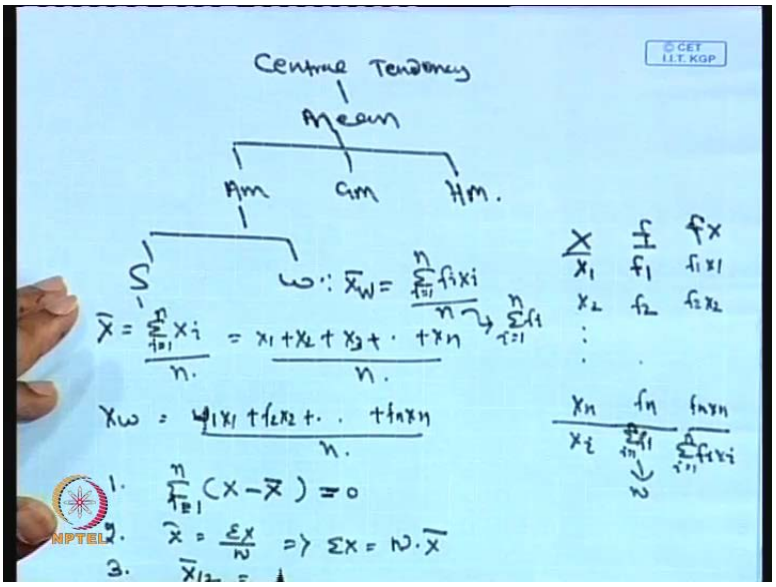

So, now this econometric modelling altogether is this here. Let us see within the central tendency, so, let me first highlight the issue of arithmetic mean first. This is mean first, then within the mean, then we have arithmetic mean, we have geometric mean and we have harmonic mean. So now, for arithmetic mean we have again simple average and weighted average. Now, this simple average is nothing but X bar is equal to summation X i, i equal to 1 to n divide by n. So, what is this? So, basically for a particular set up, if we will consider a variable say X, then it is information is represented as a X 1, X 2 up to

X n. So, what we will call it? It is otherwise represented as a X i. When i equal to 1, then it becomes X 1. When i equal to 2, it becomes X 2. When i equal to 3, it becomes X 3. Like, when i equal to n, it is X n. So, that means, one variable has the n number of information or observation. So, what is the fundamental issue of arithmetic mean? In a simple structure, the fundamental issue is to add all the observations, value of that observation and divide by number of observation; that means, it is nothing but X 1 plus X 2 plus X 3 up to plus X n, divide by number of observations. So, this is what the simple structure of arithmetic mean. When there is called a weighted average, then X bar is represented as, in sometimes it is represented as a X bar w. So, it is nothing but summation f i X i, i equal to 1 to n divide by n, where this n represents summation f i, i equal to 1 to n. So, that means, here w represents weight factors and that weight has to be represent in the form of frequency.

For instance, if we take this particular variables X 1, X 2 up to X n, then corresponding to each variables or variable information X and f, we have frequency f 1, f 2 up to f n. So, what is the usual procedure, now for weighted average? So, we have to multiply with f and X. So, we will get f 1 X 1, f 2 X 2 up to f n X n. So, finally, we like to know, what is sum of f i X i, i equal to 1 to n; that means, so, X w is nothing but w 1 sorry f 1 X 1 plus f 2 X 2 plus f n X n, divide by n, n represent sum of sum of f i, i equal to 1 to n which is designated as a n.

This is the structure of weighted average. So, weighted average structure is like this and this is this structure of simple arithmetic mean. Now, let me highlight two things here. One important issue is here, the the property of arithmetic mean. One of the interesting property is sum of the deviation of arithmetic mean from its from its mean is equal to 0. So, that means, sum of X minus X bar is equal to 0, sum of the deviation of i term from the arithmetic mean is equal to 0. Second issue is the, since X bar equal to summation X by n, so, that implies summation X is always equal to n into X bar. This is for verification only. Third issue is, it can be have combined mean. So, X 1 2 bar is nothing but n 1 combined mean. The third important property here the combined mean.

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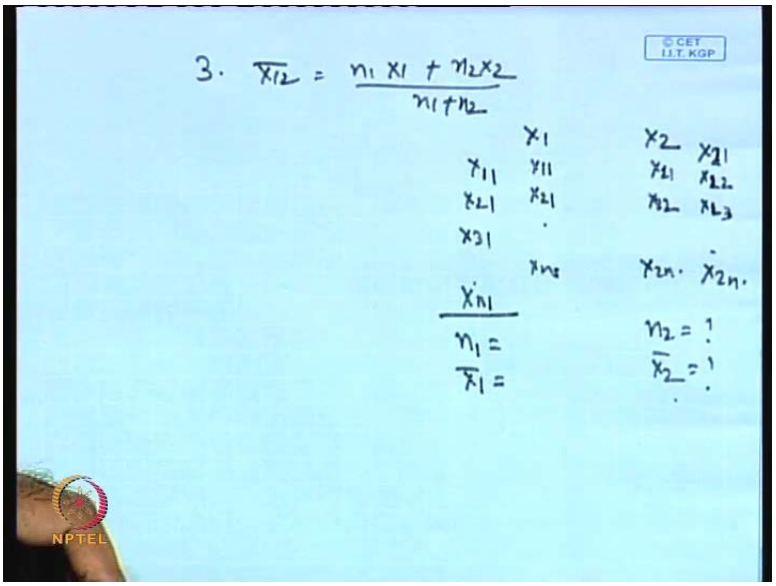

So, third important property is combined this nothing but n 1 X 1 plus n 2 X 2 divide by n 1 plus n 2. Now, what is all about that issue? That means, let us say there are two variables X 1 and X 2. So, corresponding X 1. So, if you have information X 1, X 2 up to X n, you have information, let us take X 11, X 2 1, n 1 then X 2 1, X 2 2 up to X 2 n or otherwise, we can put like this. X 1 1, then X 2 1, X 3 1 up to X n 1. Then, similarly, this side, we can put X 1 1, X 1 2, X sorry 2 1, 2 2, then 2 3 up to X 2 n.

So, now we like to know, what is n here? So, that is represented as n 1 and that is represented as X 1. Similarly, this side we like to know, what is n 2 and what is X 2, X 1 bar X 2 bar. So, within n 1 X 1 bar, n 2 X 2 bar, we have to calculate the combine mean. So, that is the joint case of the two variables. So, this is what the arithmetic mean with respect to its simple structure and weighted structures.

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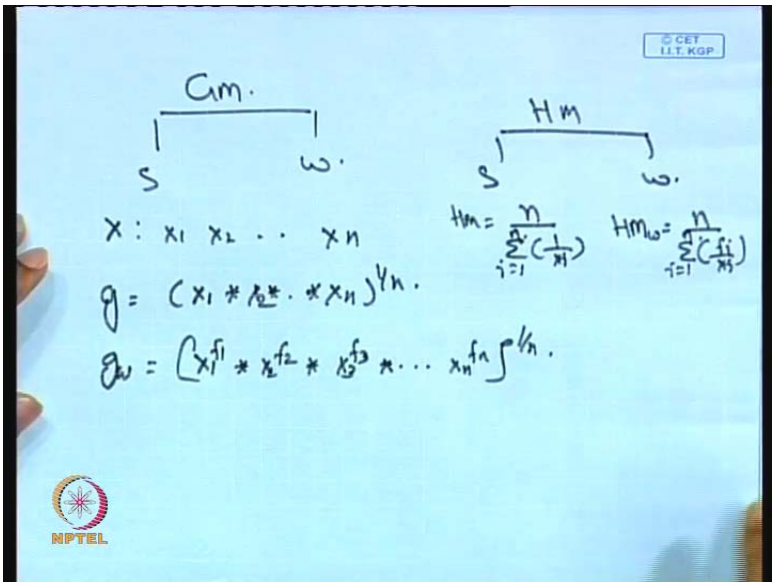

So, now come down to the structure of geometric mean here. Geometric mean can be also calculated with the simple structure and weighted structure. Now, for a series of variable say X, X 1, X 2 up to X n. Then, geometric mean usually usually represented as a small g, is nothing but X 1 multiplied by X 2 multiplied by X n to the power 1 by n. So, this is what the calculation of geometric mean.

So, now for for weighted issue, then we can call it a g w, which is nothing but X 1 f 1 multiplied by X 2 f 2, multiplied by X 3 f 3, multiplied by X n f n to the power 1 by n. So, this is the structure of the geometric mean. In the case of harmonic mean, this is also simple structure and weighted structure. Now, in the case of harmonic mean, it is nothing but n by summation 1 by X i, i equal to 1 to n. In the case of weighted average, so, the harmonic mean with weighted average is nothing but n by summation f i by X i, i equal to 1 to n.

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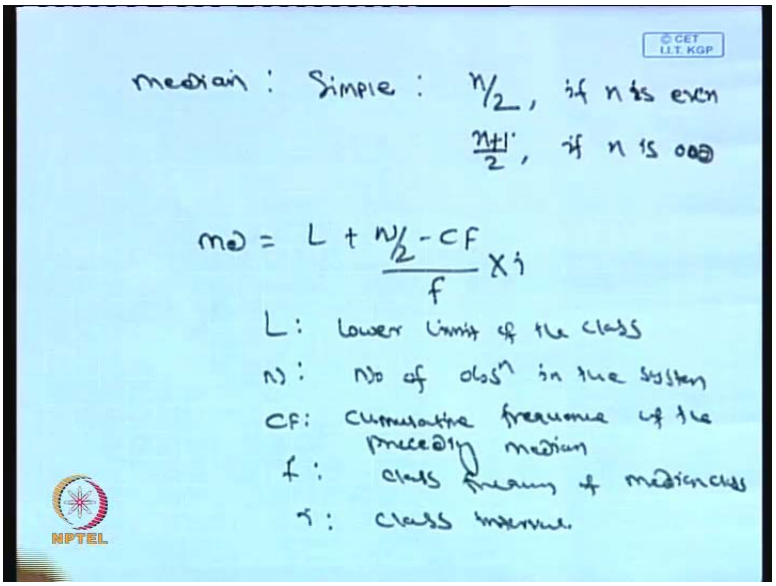

So, now. So, we get to know, what is the setup of a mathematical average, that is arithmetic mean, geometric mean and harmonic means. Again, that is with respect to simple structure and weighted structure. Now, within within this basic setup, within the basic set up of this mathematical average, then you will come down to the positional average. This positional average is with respect to first is the median case, first is with respect to median case. So, what is this median? Median is nothing but or you can say middle value of the sequence. So, that means, once you have a series of observation, the objective of median is you have to find out a particular variable or value, which can divide the observation into two equal parts, fifty percent above and fifty percent below. So, that means, median can be calculated in a simple structure. It can be calculated in simple structure. Under simple structures, the framework is like this, n by 2 provided if n is n is even, n represents number of observation in the set up. Now, when n plus 1 by 2 when or if n is odd. So, this is what the simple structure of median calculation.

So now, you remember this median is a positional average. Now, the n by 2 and n plus 1 by 2 will give you the position to describe the issue. Now, for reality or you can say complex problem the value of median will be calculated like this, L plus n by 2 minus C F by f into i. L represents lower limit of the class, n represents number of observations in the system, C F represents cumulative frequency cumulative frequency of the preceding median class, f represents class frequency class frequency of median class. Then, i represents class interval class interval.

So now, for you know, whether it is mean issue, median issue or mode issue, there are two different ways we have to calculate. One is simple setup, another is called as a discrete or continuous setup. When there is the structure is a very simple structure, then we have to just use the positional issue or you can say simple issue like summation X i Y i or n by 2 or n plus 1 by 2. But, when the structure is all about the issue of descriptive series or continuous series, then the calculation procedure is somewhat different. So, now median structure is here. L plus n by 2 minus C F by f into Y. So, I will give you detailed example, how you have to calculate or how you have to use this particular formula, when the problem is something different and you have to apply this particular formula, when the problem is something else.

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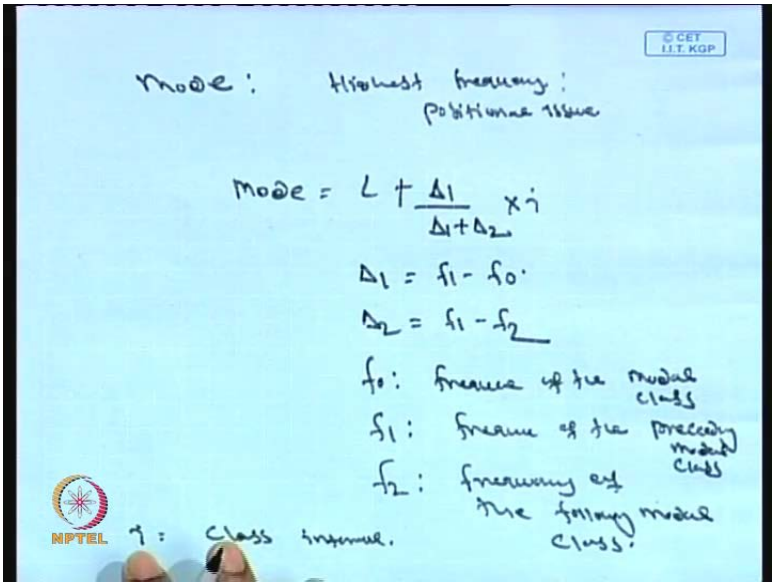

So, now come down to mode issue. Now, mode is altogether, mode is also positional average. It is the value of variable which has highest frequency value of variable which has highest frequency highest frequency. Now, this is again give you the positional issue, this will give you the positional issue, this will give you the positional issue. When the structure is individual series or simple structure, now when there is a discrete series or continuous series, then the mode calculation will be, mode will be L plus del 1 by del 1 plus del 2 into i. So, del 1 is nothing but f 1 minus f 0 and del 2 is nothing but f 1 minus f 2. So, this is f 0 represents f 0 represents frequency of the modal class and f 1 represents frequency of the preceding modal class, preceding modal class and f 2 represents

frequency of frequency of the following modal class following modal class. So now, i represents class intervals.

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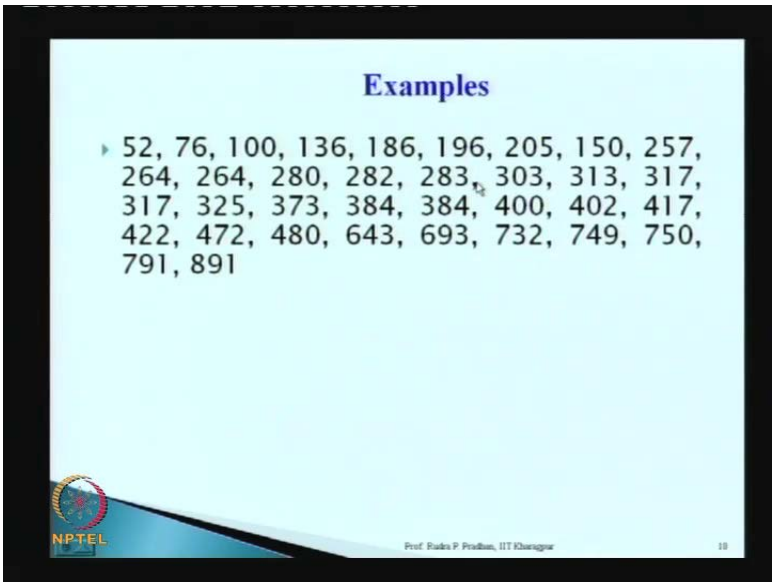

So now, let me take a case here. So, how do you calculate all these issue? Let us take a case examples here. Now, there is a series here. This series, it is with individual issues. Now, the examples which we have sited here, we have series of information: 52, 76, 100, 136, 186, 196, 205, 150, 257, like this we have to proceed, proceed, then we have 791 and 891. So, now our objective is to know what is the mean value here, what is the median value here and what is the mode value here. So, far as the mean is concerned, we like to know what is the value of these observations and what is the number of observation? Now, for simple arithmetic mean we have to just add all these items divide by number of observations. So, number of observation you have to find out what are the number of observations here.

So now, if you follow that procedure, you can have the mean value. Similarly, for the median issue or the procedure median calculation is that we have to first arrange these items in ascending and descending. Now, the moment, at the moment we arrange it in ascending and descending, then you have to apply the positional issue. So, that means, if the series is even, then you have to apply n by 2. If the series is odd, then you have to apply n plus 1 by 2. So, this will give you indication what is the median of that particular

series. So, the way we will calculate that median, then 50 percent of observation will be above and 50 percent observation will be below.

So now, similarly, in the case of mode, so, we have to first arrange the items in sequence, then you have to see what is the frequency of each items. Now, mode will be the value of that particular series depends upon the highest frequency. So, with the basis of highest frequency, you have to calculate the mode. For instance, let us take a case of 150. So, 150 item, we have to find out whether it is available in other place. So now, if it is available in other place, we have to see how many times. Similarly, take a case of 196; that means, what is the best procedure is that like this.

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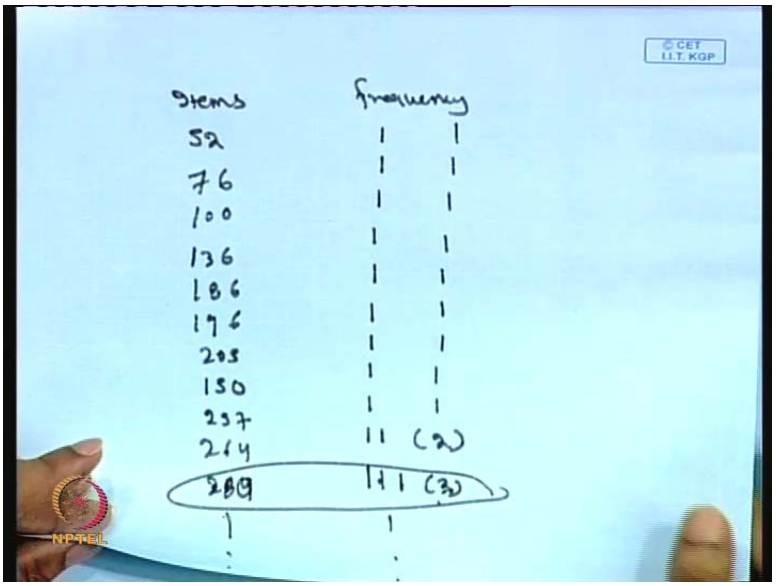

The best procedure is that you have to see here. Take a case of items. So now, these are all items then it is corresponding frequency. So now, you check it here, 52. Let us take a case of 52. Now, again 76, then 100, then 136, then 186, 196, 205, then 150, then 257, then 264, then 264. Now, if you compare here, 76 here, sorry 52. This is 1, 76 1, 100 1, 136 1, 186 1, 196 1, 205 1, 150 1, 257 1, 264 1. So, since you see again 264. So, instead of writing here, you put it and mark here. Now, instead of 264, you put it here 280. So, now you have to see how many 280s are there. If it is 1 here, then if it is again 280, you put mark here. If again 280 you put mark here. Then, final you have to observe how many frequencies are there. Let us say 280s are there. This is available in three times. So, it is frequency is nothing but three. Here frequency is nothing but two. This is one, this is

one, this is one, this is one, this is one, this is one, this is one, this is one, this is one. Now, there may be other series also. There may be other series also but within the particular setup, so, we can call that this is the modal class becaus it is the highest frequency in the particular series. So, this way we have to calculate the calculate the value of mode.

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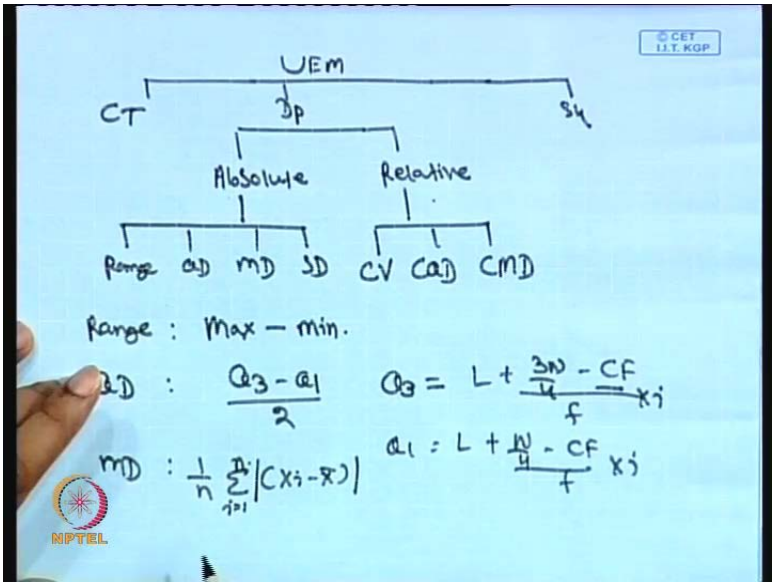

So now, we have to proceed further for other issue of this, a particular univariate econometric modelling. Now, univariate econometric modelling, we have the setup, central tendency, dispersions and skewness. So, central tendency, we have already discussed what is the structure and how is how is it setup? Now, suppose a dispersion is concerned, we have two different structures. One is called as a absolute structures and another is called as a relative structures. So, that means, absolute measure of dispersion, absolute measure of dispersion and relative measure of dispersion.

Under absolute measure of dispersion, we have series of techniques. We have series of techniques: range, quartile deviations, then mean deviations, then standard deviations. And under relative measure of dispersions, we have three different techniques called as a coefficient variations, coefficients of quartile deviations, coefficients of mean deviations. Coefficients of Coefficient variation, coefficient quartile deviation, coefficient of mean deviation.

So, now I will explain what is all about all about these components. Let us start with range. How do you calculate this range? The range is the difference between a maximum of the series and minimum of the series. In this particular in this particular example, in this particular example, if you like to know what is the range, then you have to see what is the highest number of this particular series, then what is the lowest lowest value of that particular series, then the difference will give you range.

In econometric modelling, if the range value is very high, then obviously, it is the negative aspects of econometric modelling. So, the econometric modelling will be better or you can get better fitted modal, if you are descriptive information or univariate information is very accurate. For instance, for this particular issue range, if the range is very minimum, that means, it automatically give you the spreadness of that particular variables. If the range is very small, then obviously, the dispersion is very low.

So, that means, the variability of that particular variable is you can say a low. So, it will be better indication for further econometric modelling. So, similarly, come down to quartile deviation. So, quartile deviation is nothing but, a difference between Q 3 minus Q 1 by 2. So, third quartile minus first quartile divide by 2. What is third quartile? So, third quartile, we have we have to get by L plus 3 N by 4 minus C F by C F by F into i. And Q 1 equal to L plus N by 4 minus C F by F into i. We have already discussed what is C F? This is a cumulative frequency of the preceding median class and F represents frequency of the median class, i represents class interval, L represents lower limit of the series, Q 3 represents third quartile and Q 1 represents first quartile.

So far, as quartile deviation is concerned, so, it is calculated with the difference of third quartile minus first quartile by 2. Now, come down to mean deviation. So, mean deviation is nothing but, 1 by N summation X i minus X bar. It is in deviation format. So, the specialty of this a component is that it is the, it ignores usually sign. So, the moment you will take deviation, then the minus component will be plus component. So, as a result, it may be a better for, you can say calculation. But, it has also limitation because the negative signs are ignoring. So now, this is what the procedure of mean deviation. If there is a frequency, then obviously, you have to add frequency here. Then, accordingly, you have to calculate the mean deviation.

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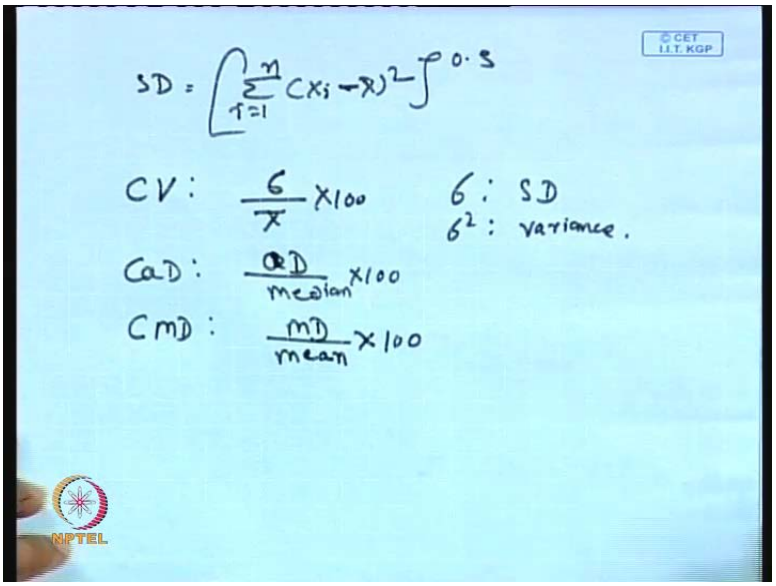

So, now come down to standard deviation. Standard deviation is nothing but, summation X i minus minus X bar whole square, i equal to 1 to n to the power 0.5. This is the calculating procedure of standard deviations. Now, you get to know what is range, what is quartile deviation, what is mean deviation, what is standard deviation? And I am just explaining the a simple structure, that is with respect to individual series. So, when the series is continuous and discrete, then obviously, the calculating procedure of all these components starting from central tendency to dispersion is completely different. Though there is the the lots of integration or similarity but the only problem is the calculation procedure.

So, now standard deviation is basically the square root of this, you can say sum of the observation from its central point. Now, come down to relative measure of central tendency. On the relative measure of central tendency, the first standard technique is called as a coefficient variation. Coefficient variation is simply represented as a sigma by X bar multiplied by 100. Sigma usually represented as a standard deviations. This square of standard deviation is called as a variance.

So, now come down to coefficient of quartile deviations. So, coefficient of quartile deviation is calculated with respect to median. Now, quartile deviation divided by median multiplied by 100 will give you coefficient of quartile deviation. Then, some coefficient of median deviation. So, coefficient term mean deviation is nothing but, mean

deviation about mean with respect to mean or median. Mean deviation by mean multiplied by 100. This is coefficient of mean deviations.

So now, this is the calculating structure of the the relative measure of relative measure of standard deviations. So, we have complete information how to calculate how to calculate the absolute measure of dispersion and how to calculate the relative measure of dispersion. So, the important difference between the absolute measurement and relative measurement is that, in the first case, the structure is not unit free but in the second case, the structure is complete unit free. So, that is why, a relative measure of dispersion is the best measure than the absolute measures.

So now, suppress the technique wise concept is concerned. So, in the case of central tendency, the best average is considered as a arithmetic means because it is very simple very structure and is very reliable. And in the case of in the case of dispersion, in fact, standard deviation is considered as the best technique under absolute measure but in reality, coefficient variation is considered as the best technique because it is the unit less unit less measurement and it is a relative research.

I will give you very practical examples. Let me let me take a case. What is the what is the exact issue or difference between the central tendency dispersion and skewness? Because, there is a beautiful structure and you know step wise process. Now, when there is a question of central tendency, central tendency will give you only positional issue and you can say mathematical issue. But, when there is a question of comparative analysis then obviously, there is there is a issue where, two variables are there and we like to compare the two variables. There may be possibility that the mean of that particular variables is the same. So, that means, if X 1 is a variable and X 2 is a variable, then number of observations are same or different, then obviously, we like to know what is the average of this particular series? Then, you can say that, if the average is high for second series than the fast, then you can say that this second is better than first or first is better than second.

Now, the situation will be completely different. If the mean of both the series will equal, then in that case, you cannot get any conclusion or you cannot make a comparative analysis. In that case, we have we have to or you have to proceed further to dispersion.

The series may have equal mean but the dispersion will be completely different. Now, equal mean may have unequal variance or unequal standard deviations.

So now, only the mean cannot be sufficient to represent the univariate structure of econometric modelling. So, you need to have dispersion, so, variability structure. So, variability will give you the indication or comparative analysis between this series. Again, let us take a case of mean is mean is same and standardization is also same for both the cases. Then, still you you like to have the comparative analysis and in that case, there may be some situation, mean is equal and you can say standard deviation also equal, then still you cannot get a conclusions. So, in that case, you have to apply a relative measure of dispersion or you can go for you can say skewness and kurtosis.

Let me take another issue here. Particularly take a case of absolute measure of dispersion and relative measure of dispersion. Yes, of course, there is two different problems. Let us take a case of foreign exchange issues. So, take a case of Japanese currency yen, another case is US dollar. Now, some of the observations are in yen form and some of the observation in dollar form.

So, now we like to know what is the what is the stability of yen and what is the stability of dollars? Now, to know the stability of dollar and yen, you need to have apply the standard technique called as a dispersions. The component stability component will be more stable if the variations or variability is very less.

So, now in the case of in the case of say yen, if the standardization or variance is very high, then you can say that it is the not stable. But, in other case, if it is say variation is very less, then you can say that it is stable. So, that means, the stability of a particular currency depends upon the variability structure. If the standardization is very low, then the currency is very stable one. If the standardization is very high, then obviously, the currency stability is currency stability is not too good. It may be negative. So, that means, it is not at all stable. That may be instability.

So, now in that case, the example may be in a different shape. For instance, this is to how you measure the stability. But, suppose I like to compare the yen with dollar which is more effective and more accurate. But, in that case, sometimes it may be more complicated also. For instance, the moment you get the result by applying the standardization for yen and for US dollar. And obviously, if the items are represented in

yen, then the mean and standardization you will get it in yen. But, if you have the observation in dollars, then obviously, the mean and standardization, you will get it in also dollars. But, if it is a comparative analysis, then the mean which is in mean standardization which are in yen and other side mean standardization, which are in dollar format cannot be comparable because yen and dollars are completely different.

That is the foreign exchange market. We can make the distinguish but in that case statistics is very a handy. So, if we apply econometric tool, particular coefficient variation or coefficient of quartile deviation, coefficient of mean deviation, then obviously, this particular problem can be solved without any additional information. Suppose, you have information what is the dollar value and what is the yen value, then you can either yen into yen or dollar into dollar. Then, you make a comparative analysis. But, if you have no information, such information, then you just apply the standard statistical tool, say coefficient variation then you can get the result. So, this is how, you have to be very careful to solve the particular problems.

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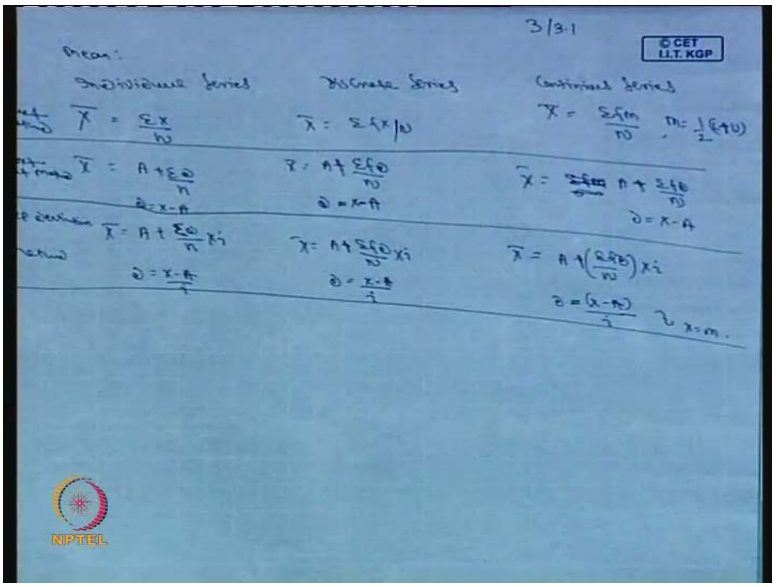

So now, we have to move down to another issue. Let me let me give a brief idea about to the structure of individual series and you can say a discrete series and continuous series. I have discussed detail about the calculation of mean, median, mode and standardizations and also coefficient variance, etcetera. So, there may be some issues here with respect to

discrete series and continuous series. Now, there are series of structure here. So, all these structure are almost all same here.

Here, we are just, whatever discussion we have till now, we are just following the particular particular format, that is individual series components. When there is discrete component, then obviously, weight factor has to be assigned. And in the case of continuous series, then obviously, the internal structure must be there. And that interval may be in a particular you can say class interval. So, with that class interval and you can say proper structure, we have we have to calculate the mean and you can say a standardization or coefficient variation in different way. The complete calculating procedure is altogether different, but the result is almost all same. The detail structure of calculation, I may highlight in different class, because it is not possible now to take example to solve. So, we will discuss in next class the detail about when we will go for bivariate modelling. That time, I will explain how it can be possible, when the series is incompletely discrete series and continuous series.

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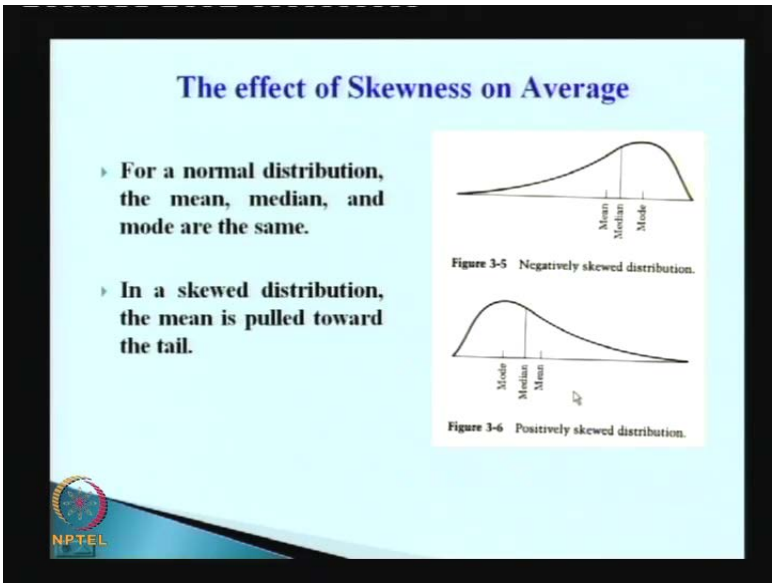

So now, I will explain one thing here. That is, the one other aspects of this particular problem, that is skewness and kurtosis. This skewness is nothing but step of the step of the distributions. So, that is, we like to know what is the position of this particular series? So, we usually look for normal distributions. Normal distribution, if it is normally distributed, then obviously, this distribution is called as a symmetric distribution where

mean, median, mode are equal. If mean, median, mode are not equal, then this distribution is called as a skewed distribution. It may negatively skewed, it may be positively skewed.

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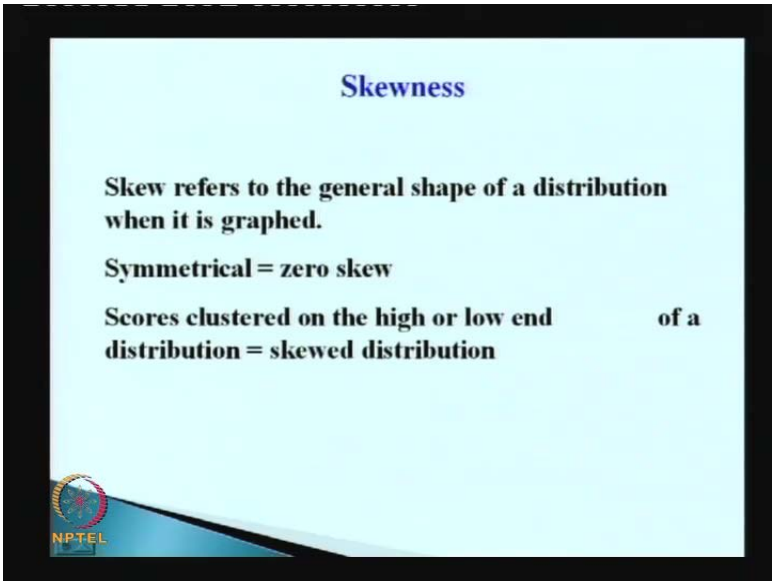

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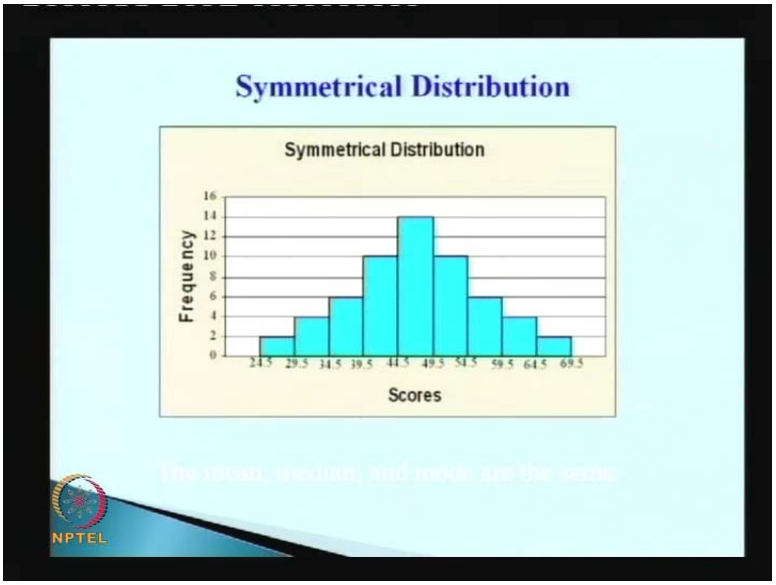

So, now. So, we need to have, you can say the structure like this. This is symmetrical, zero skew and when there is positive negative skewed, then it is called as skewed distribution. Generally, we look for this structure of data setup. If you have a data setup like this, then obviously, it is called as a symmetrical distribution and that is very

effective for modelling or particularly multivariate modelling. All these variable information is like this, then obviously, you are in the right track. If not, then obviously, your structure is completely different. If your data setup is not normally distributed, then obviously, you have to apply the transformation rule. We have series of transformation rule starting from exponential transformation, logarithm transformation and first difference transformations. So, the way you transfer the data, automatically the series can be transferred into normal normally distributed.

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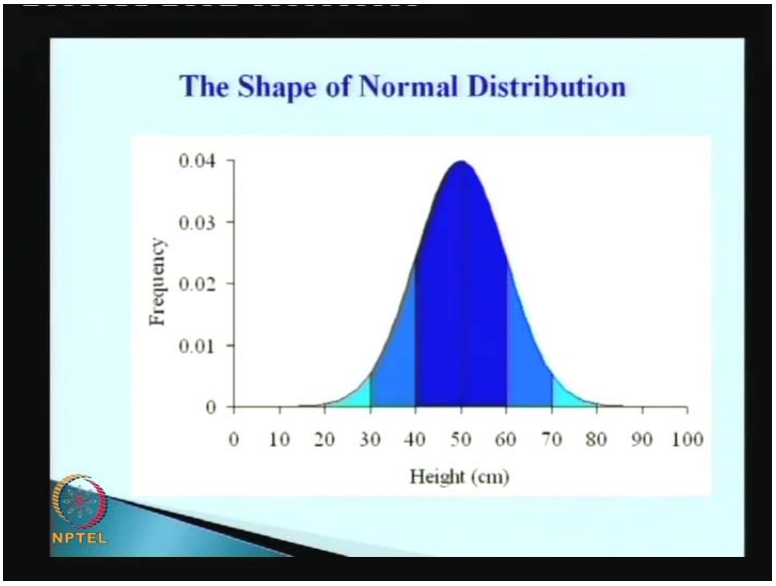

So, this is very important point. So, this is another shape of the normal distribution. Now, this is positive positive skewed distributions and this is what negative skewed distributions and this is the this is the case of both the distribution altogether.

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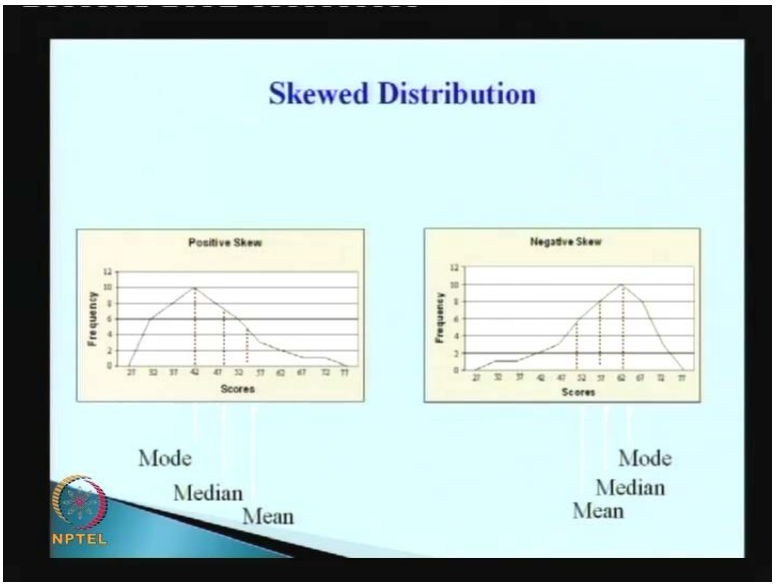

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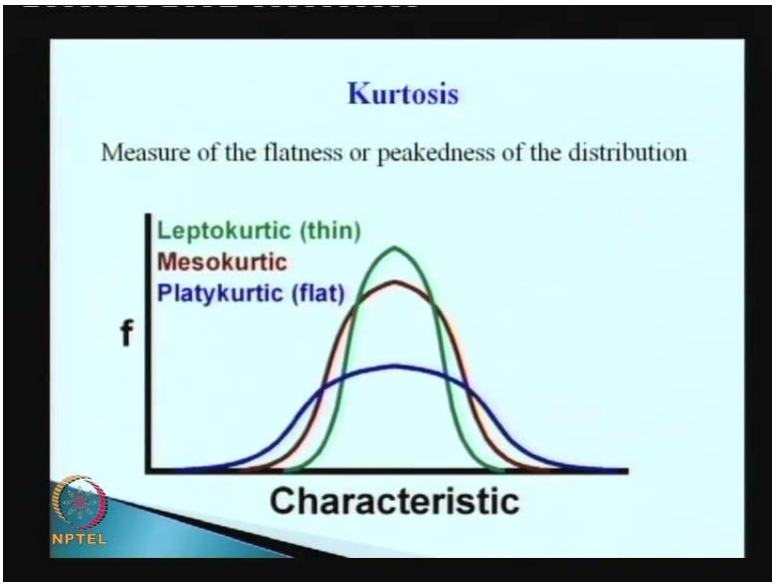

So now, last but not the least component on the univariate modelling is kurtosis. It represents simply the flatness of the distributions. There are three different structures. It is the, you take it here case, this is one shape, this is another shape, this is another shape. So, this particular shape is called as a thin structure, this particular shape is called as a flat structure and this is what, is the middle between this thin and flat. Generally, within the setup, we consider that this rate structure is very beautiful and it is very effective for further modelling. So, this is usual shape of the normal distribution curve. It is usually

called as a bell shaped curve. If that is like this, then obviously, the structure is a very feasible for further econometric modeling.

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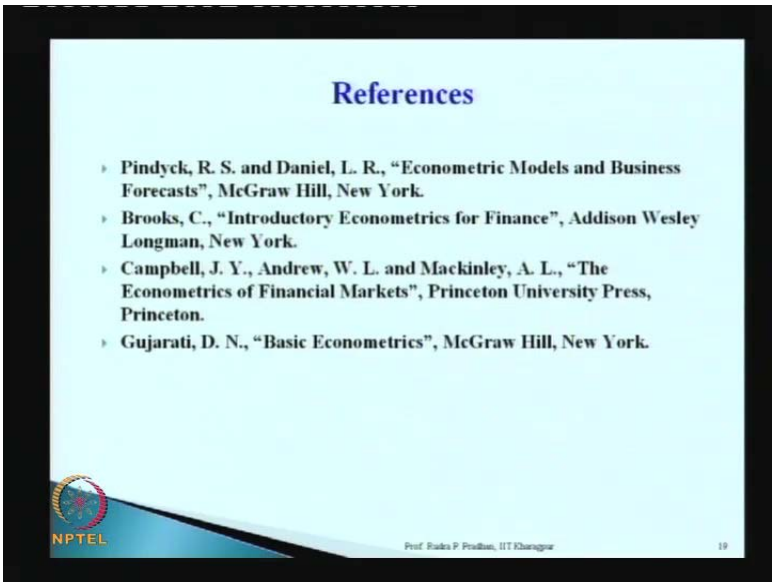

So, with this we have to finish this session here. So, we will discuss detail in the next class for, you can say with beautiful examples and different structure. So, thank you very much. Have a nice day.