Micro Economics Notes PDF

On

Statistical Tools and Interpretation

(Class – 11)

CENTRAL TENDENCY

A central tendency refers to a central value or a representative value of a statistical series.
According to Clark, “An average is a figure that represents the whole group”.

MEAN

The mean is a measure of the central tendency of the data and is also called the average of the numbers. The mean is found by adding all the numbers and dividing that by a number of values in the data set.
x1+x2+x3+……..+xn/ n

For eg: Strength of IIM Ahmedabad is 300, the strength of IIM Bangalore is 400, the strength of IIM Calcutta is 200 and strength of IIM Shillong is 100, you need to find the mean of the strength of all the four IIM’s.
You will start by adding all the numbers in the given data-
300+400+200+100= 1000
Post that you need to divide this number by the number of values i.e. 250
Hence, 1000/4= 250
Mean of all the four IIM’s combined is 250
This is the most basic concept behind finding mean but most important as well. If you understand what is being done, no matter how tricky the question might be, you just need to remember the core concept.

MEDIAN

“The Median is that value of the variable which divides the group into two equal parts, one part comprising all values greater than the Median value and the other part comprising all the values smaller than the Median value”.

- If the no of values is odd- you just pick the middle value and that is your median.
- If the no. of values is even- find the average of middle two numbers and your median will be the answer you get.

MODE

Mode is the easiest measure of central tendency to calculate. It is the number that occurs the most number of times in a data set.
For eg: 2,3,4,2,5,2,2,2,5,9
The mode in the above data set will be 2 as it is the only number which has appeared 5 times in the above data set.

MEASURES OF DISPERSION

It is the measure of the variation of the item”. According to Spiegel, The degree to which numerical data tends to spread about an average value is called the variation or dispersion of the data.

Different methods of measuring dispersion are:

- Range
- Quartile deviation
- Mean deviation
- Standard deviation

1. Range: Range is defined as the difference between two extreme observations i.e. the largest and the smallest value.
Symbolically, R = L-S
Where, R = Range

L = Largest Value
S = Smallest value
Coefficient of range = L-S/L+S

2. InterQuartile Range: Difference between third quartile (Q_3) and first quartile of a series, is called Inter quartile range.
IQR = $Q_3 - Q_1$

3. Quartile Deviation: Quartile deviation is known as half of the difference of third quartile ($\mathbf{Q_3}$) and first quartile ($\mathbf{Q_1}$). It is also known as semi interquartile range.

$$Q.D. = \frac{Q_3 - Q_1}{2}$$

Where, Q.D. = Quartile deviation
Q_3 = Third quartile or upper quartile.
Q_1 = First quartile of lower quartile.

4. Mean Deviation: Mean deviation/average deviation is the arithmetic mean of the deviations of various items from their average (mean, median or mode) generally from the median.
The Formula for Mean Deviation is:
Mean deviation= Sum of absolute values of deviations / the number of observations
There are three types of series for which mean deviation can be found:

1. **Individual Data series -** when all the data are given on an individual basis.
2. **Discrete Data series -** when individual data is accompanied by its frequency.
3. **Continuous Data series -** when the data are given is not on an individual basis but a range of data along with their frequencies.

Examples:
Individual Data series:

Items	22	24	26	28	30	32	34	36

Discrete Data series:

Items	20	40	60	80	100	120	140	160
Frequency	9	6	1	4	0	12	7	5

Continuous Data series

Items	0-5	5-10	10-20	20-30	30-40
Frequency	5	5	1	8	3

5. Standard Deviation: A standard deviation is a statistical tool which measures the dispersion in a data set in respect to its mean and is calculated as the square root of the squares of items from the mean values.

(I) CALCULATION OF STANDARD DEVIATION

(a) Direct Method: This method involves the following steps: firstly, the arithmetic mean is calculated using the formula then deviations of all the observations from this mean value is calculated. In the next step, these deviations are squared and their addition is divided by the number of observations. And finally, the square root of the above calculation results in the derivation of the standard deviation.

(b) Short-cut Method: In this method, any random value for the calculation of deviation is assumed such that it lies around the middle of the range of values. On choosing an extreme value the deviations would be large with long calculations.

(c) Step Deviation Method: The step deviation is also known as an extension or the simplification of the shortcut method. It is done by selecting a common factor among deviations such that when the value is divided by this factor, all the deviation values get reduced to a simple number. This reduction makes the calculation simpler and so it is preferred more than the other two methods.

(II) CALCULATION OF COEFFICIENT OF VARIATION

(a) Individual series = σX × 100

(b) Discrete series = σX × 100

(c) Frequency distribution series = σX × 100

CORRELATION

Correlation is a statistical tool which studies the relationship between two variables e.g. change in price leads to change in quantity demanded.

Correlation studies and measures the direction and intensity of relationship among variables. It measures co-variation not causation. It does not imply cause and effect relation.

Types of Correlation:

Correlation is commonly classified into two:

- **Positive Correlation:** When two variables move in the same direction, such a relation is called positive correlation, e.g., Relationship between price and supply
- **Negative Correlation:** When two variables change in different directions, it is called negative correlation. Relationship between price and demand.

Degree of Correlation:

Degree of correlation refers to the coefficient of correlation:

(i) Perfect Correlation

- Perfect positive(+1)
- Perfect negative(-1)

(ii) Absence of Correlation

(iii) Limited Degree of correlation

the degree of correlation between 0 and 1 may be rated as:

- High (0.75 and 1)
- Moderate (0.25 and 0.75)
- Low (0 and 0.25)

Methods to Calculate Correlation:

- **Scatter diagram-** A scatter diagram is a type of method which helps in understanding the degree and direction of correlation. After all the variables are plotted on the graph, those clusters of points are called a

scatter diagram and their overall direction and their degree of closeness tells us about the relationship of two variables.

- **Karl Pearson method-** The Karl Pearson method is a completely quantitative method and provides numerical value in order to establish the intensity of linear relationship between the two variables.
- **Spearman's rank correlation-** This is a formula developed by Charles Edwards Spearman. It was devised to calculate the coefficient of qualitative variables. It is also known as Spearman's Rank.

INDEX NUMBER

An index number is a statistical device for measuring changes in the magnitude of a group of related variables. It represents the general trend of diverging ratios from which it is calculated.

According to Croxton and Cowden, "Index numbers are devices for measuring differences in the magnitude of a group of related variables."

Features of Index Number:

- Index numbers are expressed in terms of percentages. However, percentage sign (%) is never used.
- Index numbers are relative measurements of a group of data.
- Index numbers offer a precise measurement of the quantitative change in the concerned variables over time.
- Index numbers show changes in terms of averages.
- They are expressed in numbers.
- Index number facilitates the comparative study over different time periods.

Importance of Index number:

- It serves as a barometer for measuring the value of money.
- Gives knowledge about change in standard of living.
- It helps the business community in planning their decision.
- Helpful to determine the rate of premium.

Limitation of Index Number:

- Limited applicability
- International comparison is not possible
- Limited coverage
- Difficulty in the construction of index number

Methods of Constructing Index Numbers:

A. Constructing of Simple Index Numbers

- Simple Aggregative Method
- Simple Average of Price Relatives Method

B. Construction of Weighted Index Numbers

- Weighted Average of Price Relative Method
- Weighted Aggregate Method

Construction of Simple Index Numbers:

There are two methods of constructing simple index numbers:

(i) Simple Aggregative Method In this method, we use the following formula:

$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$

Here, P_{01} = Price index of current year
ΣP_1 = Sum of prices of the commodities in the current year
ΣP_0 = Sum of prices of the commodities in the base year

Current year: Current year is the year for which average change is to be measured or index of index number is to be calculated.

Base year: Base year is the year of reference from which we want to measure the extent of change in the current year. The index number of the base year is generally assumed to be 100.

Simple average of price Relatives method:
Here, P_{01} = Price index of the current year
$P_{01} = \frac{\Sigma P_1}{\Sigma P_0} \times 100$ = PRICE
N = Number of commodities

Weighted average of price relative method:
$P_{01} = \frac{\Sigma RW}{\Sigma W}$
Here, P_{01} = Index number for the current year in relation to base year
W = Weight, R = Price relatives i.e. $\frac{P_1}{P_0} \times 100$

Weighted Aggregative method:
(i) Laspeyres method :- $P01 = \frac{\sum p1q0}{\sum p0q0} \times 100$
(ii) Pasche's method :- $P01 = \frac{\sum p1q1}{\sum p0q1} \times 100$
(iii) Fisher's Method :- $P01 = \sqrt{\frac{\sum p1q0}{\sum p0q0} \times \frac{\sum p1q1}{\sum p0q1}} \times 100$

Fisher's Method is considered as 'Ideal' because:

- It is based on variable weights.
- It takes into consideration the price and quantities of both the base year and current year.
- It is based on Geometric Mean (GM) which is regarded as the best mean for calculating index number.
- Fisher's index number satisfies both the Time Reversal Test and Factor Reversal Test.

Some Important index numbers:
(i) Consumer price index (CPI): CPI is also known as the cost of living index, measures the average change in retail prices.

Methods of constructing CPI:
Here,
$CPI = \frac{\Sigma RW}{\Sigma W}$
$R = \frac{P_1}{P_0} \times 100$
W = Weights

(ii) Wholesale Price Index (WPI): The Wholesale Price Index (WPI) measures the relative changes in the prices of commodities traded in the wholesale markets. In India, the wholesale price index numbers are constructed on a weekly basis.

(iii) Industrial Production Index: The index number of industrial production measures changes in the level of industrial production comprising many industries. It includes the production of the public and the private sector. It is a weighted average of quantity relatives. The formula for the index is:

IIP= ∑[q1q0×100]W∑W∑q1q0×100W∑W
Here, q1 = Level of Production in the current year
q0 = Level of production in the base year
W = Weight

(iv) Index of agriculture production (IAP): IAP is used to study the rise and fall of the yield of principle crops from one period to another period.

(v) Sensex: Sensex is the index showing changes in the Indian stock market. It is a short form of a Bombay Stock Exchange sensitive index. It is constructed with 1978-79 as the reference year or the base year. It consists of 30 stocks of leading companies in the country.

Purpose of Constructing Index Number:

- Purpose of constructing an index number of prices is to know the relative change or percentage in the price level over time. A rising general price level over time is a pointer towards inflation, while a falling general price level over time is a pointer towards deflation.
- Purpose of constructing index number of quantity is to know relative change or percentage change in the quantum or volume of output of different goods and services. A rising index of quantity suggests a rising level of economic activity and vice-versa.

Inflation and index numbers:
Inflation is described as a situation characterised by a sustained increase in the general price level. Generally, inflation is measured in terms of wholesale price index.

$$\text{Rate of inflation} = \frac{A2-A1}{A1} \times 100$$

Here, A1 = WPI for week first (1)
A2 = WPI for week second (2)