

Measures of Dispersion

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Introduction:

The previous lesson provides the measure of central tendency that sum up or describe the data into a single representative value. The measures of central tendency may not be adequate to describe data unless we know the manner in which the individual items scatter around it. In other words, a further description of a series on the scatter or variability known as dispersion is necessary, if we are to gauge how representative the average is.

Objectives:

1. To know the meaning and need of measures of dispersion
2. To distinguish between absolute and the relative measures of dispersion
3. To apply the various measures of dispersion;
4. To calculate and compare the different measures of dispersion.

MEANING OF DISPERSION:

Dispersion is the extent to which values in a distribution differ from the average of the distribution.

In measuring dispersion, it is imperative to know the amount of variation (absolute measure) and the degree of variation (relative measure). In the former case we consider the range, Quartile Deviation, standard deviation etc. In the latter case.

we consider the coefficient of range, coefficient quartile deviation, the coefficient of variation etc.

Absolute and Relative Measures of Dispersion:

The dispersion of a series may be measured either absolutely or relatively. If the dispersion is expressed in terms of the original units of the series, it is called absolute measure of dispersion. The disadvantage of absolute measure of dispersion is that it is not suitable for comparative study of the characteristics of two or more series.

Absolute and Relative Measures of Dispersion:

For example if the data is expressed in kilograms then the absolute variation will also be expressed in kilograms but if the same data is expressed in grams then the variation will appear 1000 times more. So for comparison point of view it is necessary to calculate the relative measures of dispersion which are expressed as percentage form (i.e. unitless number). These types of expressions are called coefficients of dispersion. Each absolute measure of dispersion has a relative measure of dispersion.

Properties of Good Measure of Dispersion

1. Simple to understand and easy to calculate
2. Rigidly defined
3. Based on all items
4. A meanable to algebraic treatment
5. Sampling stability
6. Not unduly affected by Extreme items.

Types of Measures of Dispersion:

Absolute Measures of Dispersion

1. Range
2. Inter Quartile Range
3. Variance
4. Standard Deviation
5. Quartile Deviation
6. Mean Deviation

Types of Measures of Dispersion:

Absolute Measures of Dispersion

1. Coefficient of Range
2. Coefficient of Variation
3. Coefficient of Quartile Deviation
4. Coefficient of Mean Deviation

Range

Range (R) is the difference between the largest (L) and the smallest value (S) in a distribution. Thus

$$\text{Range}(R) = L - S$$

Coefficient of Range:

Coefficient of Range: It is a relative measure of the range. It is used in the comparative study of the dispersion

$$\text{Coe. of Range} = \frac{L - S}{L + S}$$

Range in Continuous Case

In case of continuous series Range is just the difference between the upper limit of the highest class and the lower limit of the lowest class.

1. Range is very simple to understand and easy to calculate. However, it is not based on all the observations of the distribution and is unduly affected by the extreme values.
2. Any change in the data not related to minimum and maximum values will not affect range.
3. It cannot be calculated for open-ended frequency distribution.

Merits Of Range

1. Its easy to understand and easy to calculate.
2. It does not require any special knowledge.
3. t takes minimum time to calculate the value of Range.

Limitations of Range:

1. It does not take into account of all items of distribution.
2. Only two extreme values are taken into consideration.
3. It is affected by extreme values.
4. It does not indicate the direction of variability.
5. It does not present very accurate picture of the variability.

Variance:

Variance is the arithmetic mean of the squares of deviations of all the items of the distributions from arithmetic mean .In other words, variance is the square of the Standard deviation.

Interpretation of Variance:

1. Smaller the variance ,greater the uniformity in population.
2. Larger the variance ,greater the variability

Standard Deviation:

1. Standard deviation is the most commonly used measure of dispersion.
2. The standard deviation takes into account the value of every observation

Properties of Standard Deviation

1. Independent of change of origin.
2. Not independent of change of Scale.
3. Fixed Relationship among measures of Dispersion.

Merits of Standard Deviation:

1. It is based on all the items of the distribution.
2. it is amenable to algebraic treatment since actual + or - signs deviations are taken into consideration.
3. It is least affected by fluctuations of sampling.
4. It facilitates the calculation of combined standard Deviation and Coefficient of Variation ,which is used to compare the variability of two or more distributions.
5. It facilitates the other statistical calculations like skewness,correlation.
6. It provides a unit of measurement.

Limitations of Standard Deviation:

1. It can't be used for comparing the variability of two or more series of observations given in different units. A coefficient of Standard deviation is to be calculated for this purpose.
2. It is difficult to compute and compared.
3. It is very much affected by the extreme values.
4. The standard deviation can not be computed for a distribution with open-end classes.

Comparison of the variation of two series using standard deviation: The Coefficient of Variation

The values of the standard deviations cannot be used as the basis of the comparison mainly because units of measurements of the two distributions may be different. The correct measure that should be used for comparison purposes is the Coefficient of Variation (C.V.) given by Karl Pearson:

$$c.v. = \frac{\sigma}{\bar{X}} * 100$$

