



# MEASURES OF VARIATION FOR UNGROUPED DATA

**Relative Dispersion**



# MEASURES OF RELATIVE DISPERSION

✓ It is unitless and are used when one wishes to compare the scatter of one distribution with another distribution.

Types of Measures of Relative Dispersion

1. Coefficient of Variation
2. Standard Score (Z-Score)

# COEFFICIENT OF VARIATION

The coefficient of variation (CV), is the ratio of the standard deviation to the mean

and is usually expressed in percentage.

It is computed as

$$CV = \frac{\sigma}{\mu} \times 100\%$$

and its sample counterpart is

$$CV = \frac{s}{\bar{X}} \times 100\%$$

## EXAMPLE 1 :

The foreign exchange rate is an indicator of the stability of the peso and is also an indicator of the economic performance. In 1992 Bangko Sentral ng Pilipinas put the peso on the floating rate basis. Market forces and not government policy have determined the level of the peso since. Government intervenes through the BSP, only when there are speculative elements in the market. Given below are the means and standard deviations of the quarterly ₱\$ exchange rate for the periods 1989 to 1991 and 1992 to 1994. Which of the two periods is more stable?

Year	Mean	SD
1989-1991	22.4	1.84
1992-1994	26.4	1.15

## EXAMPLE 1:

**SOLUTION:**

$$CV_{89-91} = \frac{s}{\bar{X}} \times 100\%$$

$$CV_{89-91} = \frac{1.84}{22.4} \times 100\%$$

$$CV_{89-91} = 0.0821 \times 100\%$$

$$CV_{89-91} = 8.21\%$$

**SOLUTION:**

$$CV_{92-94} = \frac{s}{\bar{X}} \times 100\%$$

$$CV_{92-94} = \frac{1.15}{26.4} \times 100\%$$

$$CV_{92-94} = 0.0436 \times 100\%$$

$$CV_{92-94} = 4.36\%$$

**The 1992-1994 period is when the quarterly peso-dollar exchange happened to become more stable**

## EXAMPLE 2:

Two of quality of the criteria in processing butter cookies are the weight and color development in the final stage of oven browning. Individual pieces of cookies are scanned by a spectrophotometer calibrated to reflect yellow brown light. The readout is expressed in per cent of a standard yellow-brown reference plate and a value of 41 is considered optimal (golden-yellow). The cookies were also weighted in grams at this stage. The means and standard deviations of 30 sample cookies are presented below. Which of the two quality criteria is more varied?

Criteria	Mean	SD
Color	41.1	10
Weight	17.7	3.2

## EXAMPLE 2:

**SOLUTION:**

$$CV_{color} = \frac{s}{\bar{X}} \times 100\%$$

$$CV_{color} = \frac{10}{41.1} \times 100\%$$

$$CV_{color} = 0.2433 \times 100\%$$

$$CV_{color} = 24.33\%$$

**SOLUTION:**

$$CV_{weight} = \frac{s}{\bar{X}} \times 100\%$$

$$CV_{weight} = \frac{3.2}{17.7} \times 100\%$$

$$CV_{weight} = 0.1808 \times 100\%$$

$$CV_{weight} = 18.08\%$$

**The more varied criteria is the color.**

# STANDARD SCORE OR Z-SCORE

The **standard score** measures how many standard deviations an observation is above or below the mean. It is computed as

$$Z = \frac{X - \mu}{\sigma}$$

and the sample counterpart is

$$Z = \frac{X - \bar{X}}{s}$$



## EXAMPLE 1 :

Robert got a grade of 75% in Stat 101 and a grade of 90% in Econ 11. The mean grade in Stat 101 is 70% and the standard deviation is 10% whereas in Econ 11, the mean grade is 80% and the standard deviation is 20%. Relative to the other students, where did he perform better?

## EXAMPLE 1 :

Subject	Grade	Mean	Standard Deviation
STAT 101	75	70	10
ECON 11	90	80	20

**SOLUTION:**

$$Z_{stat} = \frac{X - \bar{X}}{s}$$

$$Z_{stat} = \frac{75 - 70}{10}$$

$$Z_{stat} = \frac{5}{10} = 0.5$$

**SOLUTION:**

$$Z_{econ} = \frac{X - \bar{X}}{s}$$

$$Z_{econ} = \frac{90 - 80}{20}$$

$$Z_{econ} = \frac{10}{20} = 0.5$$

**Robert performance in the two subject is the same.**

## EXAMPLE 1:

In problem 1, if the mean grade in Stat 101 is 65% in which subject did Robert perform better?

### SOLUTION:

$$Z_{stat} = \frac{X - \bar{X}}{s}$$

$$Z_{stat} = \frac{75 - 65}{10}$$

$$Z_{stat} = \frac{10}{10} = 1$$

**In this case, Robert performed better in  
STAT 101 compared to ECON 11.**

**END OF DISCUSSION**