

# Coefficient of Variation - Relative Variability

## Detailed Study Notes

The Coefficient of Variation (CV) expresses standard deviation as a percentage of the mean. It's a standardized measure that allows comparison of variability between datasets with different units or scales.

Definition:

CV is the ratio of the standard deviation to the mean, expressed as a percentage.

Formula:

$$CV = (\sigma / \mu) \times 100\%$$

where  $\sigma$  = standard deviation,  $\mu$  = mean

Detailed Example:

Dataset A: Heights in cm

Values: 150, 160, 170, 180, 190

Mean = 170 cm

SD = 15.81 cm

$$CV = (15.81 / 170) \times 100 = 9.3\%$$

Dataset B: Weights in kg

Values: 50, 60, 70, 80, 90

Mean = 70 kg

SD = 15.81 kg

$$CV = (15.81 / 70) \times 100 = 22.6\%$$

Interpretation:

Weight (22.6%) shows more relative variability than height (9.3%), even though both have the same absolute standard deviation.

Why Use CV?

1. Unitless measure - allows comparison across different units
2. Accounts for scale differences
3. Useful when comparing datasets with different means
4. Standard measure in quality control

**When to Use CV:**

- Comparing variability of different measurements (e.g., height vs. weight)
- Comparing different populations or samples
- When mean is not close to zero
- In laboratory work to compare precision of different methods

**Limitations:**

- Not meaningful when mean is close to zero
- Can be misleading with negative values
- Less useful for data with mean near zero

**Applications:**

- Finance: comparing volatility of stocks with different prices
- Quality control: comparing precision of different instruments
- Biology: comparing variability in different species
- Manufacturing: assessing consistency across production lines

**Example in Business:**

Company A: Average sales = \$1M, SD = \$100K, CV = 10%

Company B: Average sales = \$100K, SD = \$20K, CV = 20%

Company B has more relative variability despite smaller absolute variation.