

# Correlation

LECTURE 18

## Objectives

- ▶ Define terms.
- ▶ Explain the difference between regression and correlation.
- ▶ Explain a bivariate normal distribution.
- ▶ Perform simple correlation analysis.
- ▶ Interpret a correlation.

# Overview

- ▶ Correlation is functionally similar to regression.
- ▶ Correlation measures the degree to which variables vary together -- the intensity of association between the variables.

# Overview

- ▶ With correlation there is no distinction between independent and dependent variables -- One variable is not described as a function of the other variable.
  - ▶ Frequently one cause will affect both of the variables that we have measured.

## Correlation coefficient ( $r$ )

- ▶ Has no units of measurement
- ▶ Can range from -1 to 1
  - ▶ -1 indicates a perfect negative correlation. As the value of one variable increases the value of the other variable decreases
  - ▶ 0 indicates no correlation
  - ▶ 1 indicates a perfect positive correlation. As the value of one variable increases the value of the other variable also increases.

## Coefficient of determination ( $r^2$ )

- ▶ A measure of the amount of variation of one variable determined by the variation of the other variable.
- ▶ Is a measure of the strength of the relationship between the two variables.
  - ▶ Ranges from 0 (no variation determined) to 1 (all variation determined)

# Pearson product-moment correlation

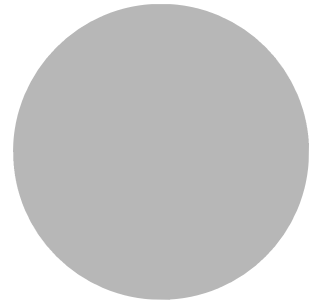
- ▶ Assumptions
  - ▶ Random samples
  - ▶ Independent samples
  - ▶ Bivariate Normal Distribution
    - ▶ Y-values are normally distributed with respect to X, and X-values are normally distributed with respect to Y.
    - ▶ Increasing sample size does correct for non-normality. (Central limit theorem)
  - ▶ The relationship between the two variables is linear.

## Example

- ▶ Example 22

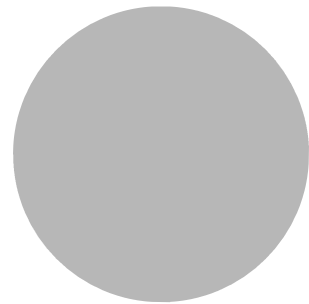
# Spearman correlation (nonparametric correlation)

- ▶ Advantages and disadvantages
  - ▶ No assumption of bivariate normality
  - ▶ Use more types of data (interval, ratio, and ordinal)
  - ▶ Less power than the parametric test



# Spearman correlation

- ▶ Assumptions
  - ▶ Random sample
  - ▶ Independent sample



# Example

▶ Example 23

