# Chapter Five

Measures of Variability

**Summary**

• Measures of variability are numbers that describe how much variation or diversity there is in a distribution.

• The index of qualitative variation (IQV) is used to measure variation in nominal variables. It is based on the ratio of the total number of differences in the distribution to the maximum number of possible differences within the same distribution. IQV can vary from 0.00 to 1.00.

• The range measures variation in interval-ratio variables and is the difference between the highest (maximum) and the lowest (minimum) scores in the distribution. To find the range, subtract the lowest from the highest score in a distribution. For an ordinal variable, just report the lowest and the highest values without subtracting.

• The interquartile range (IQR) measures the width of the middle 50% of the distribution. It is defined as the difference between the lower and upper quartiles (Q1 and Q3). For an ordinal variable, just report Q1 and Q3 without subtracting.

• The box plot is a graphical device that visually presents the range, the IQR, the median, the lowest (minimum) score, and the highest (maximum) score. The box plot provides us with a way to visually examine the center, the variation, and the shape of a distribution.

• The variance and the standard deviation are two closely related measures of variation for interval-ratio variables that increase or decrease based on how closely the scores cluster around the mean. The variance is the average of the squared deviations from the center (mean) of the distribution; the standard deviation is the square root of the variance.

**Outline**

* The Importance of Measuring Variability
  + - Researchers often use measures of central tendency along with measures of variability to describe their data
    - The differences in the experiences of U.S. women
    - The concept of variability has implications not only for describing the diversity of social groups but also for issues that are important in your everyday life
* The Index of Qualitative Variation
* The index of qualitative variation (IQV) is a measure of variability for nominal variables such as race and ethnicity
  + The index can vary from 0.00 to 1.00
* Steps for calculating the IQV
  + Construct a percentage distribution
  + Square the percentages for each category
  + Sum the squared percentages
  + Calculate the IQV using the formula
* A Closer Look 5.1 Statistics in Practice: Diversity at Berkeley Through the Years
* Statistics in Practice
  + - Diversity in U.S. Society
* The Range
  + - The simplest and most straightforward measure of variation is the range, which measures variation in interval-ratio variables
    - It is the difference between the highest (maximum) and the lowest (minimum) scores in the distribution
    - The range can also be calculated on percentages
    - Although the range is simple and quick to calculate, it is a rather crude measure because it is based on only the lowest and the highest scores
* The Interquartile Range
  + - The interquartile range is a measure of variation for interval-ratio variables
    - It is the width of the middle 50% of the distribution
    - Like the range, the IQR is based on only two scores. However, because it is based on intermediate scores, rather than on the extreme scores in the distribution, it avoids some of the instability associated with the range
* The Box Plot
  + - The box plot can visually present the range, the IQR, the median, the lowest (minimum) score, and the highest (maximum) score
    - The box plot provides us with a way to visually examine the center, the variation, and the shape of distributions of interval-ratio variables
    - Box plots are particularly useful for comparing distributions
* The Variance and the Standard Deviation
  + - Changes in the elderly population
    - The variance and the standard deviation are two closely related measures of variation that increase or decrease based on how closely the scores cluster around the mean
    - Both measure variability in interval-ratio variables
    - Calculating the deviation from the mean
    - Calculating the variance and the standard deviation
* Considerations for Choosing a Measure of Variation
  + - As in choosing a measure of central tendency, one of the most basic considerations in choosing a measure of variability is the variable’s level of measurement
    - With nominal variables, your choice is restricted to the IQV as a measure of variability
    - The choice of measure of variation for ordinal variables is more problematic. One compromise is to use the IQR (reporting Q1 and Q3) alongside the median, interpreting the IQR as the range of rank-ordered values that includes the middle 50% of the observations
    - For interval-ratio variables, you can choose the variance (or standard deviation), the range, or the IQR. However, if a distribution is extremely skewed so that the mean is no longer representative of the central tendency in the distribution, the range and the IQR can be used
* Reading the Research Literature
  + - Differences in college aspirations and expectations among Latino adolescents