
COVARIANCE AND CORRELATION

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3.0 What We Need to Know When We Finish This Chapter

This chapter develops simple ways to measure the *direction of the association* and the *reliability of the association* between two variables in a sample. Here are the essentials.

1. **Equation (3.7), section 3.2:** The sample covariance is

$$\text{COV}(X, Y) = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{n-1}.$$

It is symmetric with regard to X and Y .

2. **Exercise 3.2:** The sample covariance is not invariant to scale:

$$\text{COV}(aX, bY) = ab \text{COV}(X, Y).$$

3. **Section 3.3:** A *derivation* begins with an accepted definition and concludes with an implication that is usually not obvious and is often very useful.

4. **Equation (3.13), section 3.4:** The sample correlation coefficient is

$$\text{CORR}(X, Y) = \frac{\text{COV}(X, Y)}{\text{SD}(X)\text{SD}(Y)}.$$

It is symmetric with regard to X and Y .

5. **Exercise 3.4:** The sample correlation is invariant to scale.

$$\text{CORR}(aX, bY) = \text{CORR}(X, Y).$$