

Lecture Note 1: Parameters & Estimators

Population parameters: properties of rand. vars. $X, \mu_X = E(X), \sigma_X^2 = V(X)$
central tendency dispersion

Statistics: properties of samples

Sample N obs of RV X : X_1, X_2, \dots, X_N

"iid" \rightarrow independent and identically distributed

"Estimators" are statistics that approximate parameters

Greek letters for parameters: β, θ

Greek letters w/ hats for estimators: $\hat{\beta}, \hat{\theta}$

Desirable properties for $\hat{\theta}$:

① Unbiasedness: $E[\hat{\theta}] = \theta$

② Consistency: as $N \rightarrow \infty$, $\Pr[|\hat{\theta} - \theta| > \varepsilon] \rightarrow 0$ for any ε
 $\hat{\theta} \xrightarrow{p} \theta$

③ Efficiency: $\hat{\theta}$ has smallest possible $V[\hat{\theta}]$

$\hat{\theta}$ has a distribution

"Variance"

$\rightarrow V[X] \rightarrow \text{std. dev. of } X = \sqrt{V[X]}$

$\rightarrow V[\hat{\theta}] \rightarrow \text{std. error of } \hat{\theta} = \sqrt{V[\hat{\theta}]}$