Econ 418 prequisite and recommended tools: review notes

Required Econ 339/Econ 276 tools

Let X be a normally distributed random variable such that $E(X) = u_x$ and $E(X - u_x)^2 = \sigma_x^2$ (variance).

Let $X_1, ..., X_T$ denote a random sample of size T.

Estimator of the mean of X: $\hat{u}_x = \bar{X} = \frac{\sum_{t=1}^{T} X_t}{T}$.

Unbiased estimator: $E(\bar{X}) = u_x$

Estimator of the variance: $\hat{\sigma}_x^2 = \frac{\sum_{t=1}^{T} \left(X_t - \bar{X}\right)^2}{T-1}$

Standard error of $\bar{X}$: $\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{T}}$

Estimated standard error of $\bar{X}$: $\hat{\sigma}_{\bar{x}} = \frac{\hat{\sigma}_x}{\sqrt{T}}$

t statistic: $\frac{\bar{X}}{\hat{\sigma}_{\bar{x}}} \sim t_{T-1}$

Hypothesis testing: H_0: $u_x = c$, H_1: $u_x \neq c$

$\left|\frac{\bar{X} - c}{\hat{\sigma}_{\bar{x}}}\right| > t_{T-1}^{0.975} \Rightarrow$ reject H_0 at the 5% level of significance for a two-tailed test

Useful or recommended math tools

$\ell n\,(zx) = \ell n(z) + \ell n(x)$ and $\ell n\left(\frac{z}{x}\right) = \ell n(z) - \ell n(x)$

$\ell n(x^b) = b\ \ell n(x)$

Let $y = ax^n$, then $\frac{dy}{dx} = nax^{n-1}$

Let $y = a$, then $\frac{dy}{dx} = 0$

Let $y = a\ell n\,(x)$, then $\frac{dy}{dx} = \frac{a}{x}$

Let $y = zx$, then $\frac{dy}{dx} = z + x\left(\frac{dz}{dx}\right)$

Let $y = ae^{bx}$, then $\frac{dy}{dx} = bae^{bx}$