18 January 2024 10:40 PM

Hypothesis testing (Multiple Regression)

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u_i$$

ovs ⇒ $\beta_1 \to 0$

$\beta_2 \to 0$

H_0: there is no relation b/w Y_i and x_1

$\beta_1 \neq 0$

v/s H_1: $\beta_1 \neq 0$ (two-tail test)

$\alpha \to$ level of significance

$\leftarrow \alpha/2 \to$

H_0 true → accept H_0 → β_1 → insignificant (unimportant)

H_0 false → reject H_0 → β_1 → significant.

Z-statistic

- μ, σ known
- t-statistic: μ, σ unknown
- σ, μ known
- σ, μ unknown

β

test statistics → t statistics

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} \quad (SE)$$

$\bar{x}$ → sample mean | σ = pop var

μ → pop mean | s = samp var

$\text{var}\,\hat{\beta} = \hat{\sigma}$

$\sqrt{\ }$

Σe^2

α → sign

$$t = \frac{\hat{\beta} - \beta}{SE(\hat{\beta})} = \frac{\hat{\beta}_1}{SE(\hat{\beta}_1)}$$

critical

tabulated

with degree of freedom $(n-1)$

(critical) tabulated

two tail : $t^{c}_{\frac{\alpha}{2},(n-1)}$ with degree of freedom $(n-1)$

$P[\hat{\theta} \le \mu \le \hat{\theta}] = 1-\alpha$

β

10

$\alpha = 5\%$ level of significance.

$\alpha = 0.05$

$\alpha/2 = \frac{0.05}{2} = 0.025$

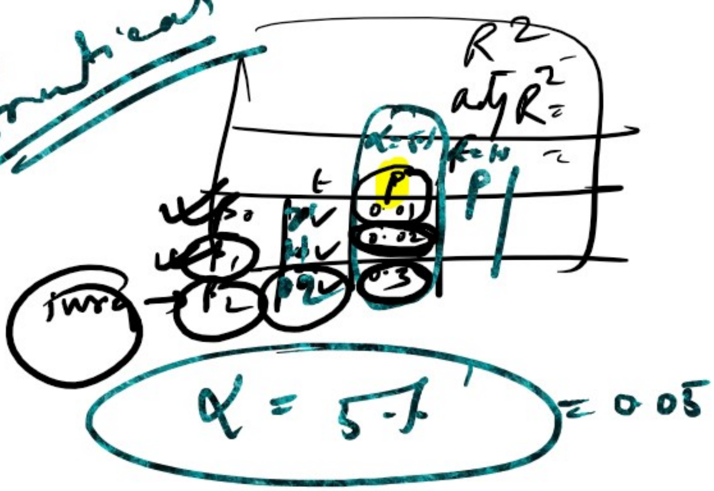
$n-1 = 9$

$\boxed{t_{0.025,9}} = \square$

Conclusion: if $|t| > t^{c}$ → reject H_0 ⇒ accept H_1 at α level of significance

(regress β) ⇒ (significant)

Practical



$\boxed{\text{p value} \le \alpha}$ → β → t
↓
significant
↓
→ H_0 reject

$\bar{x}$ → statistic μ → parameter.

BLUE → Gauss-Markov Theorem

(Best Linear Unbiased Estimator)

β_1, β_2

$(\beta_1), \beta_2$

(1) (Straight line) Linearity $\Rightarrow$ $\beta_1, \beta_2, \beta_3 \ldots\ldots \beta_i$ $\rightarrow$ linearly dependently

(2) Unbiasedness $\Rightarrow$ $E(\hat{\beta}) = \beta$
(mean of sample estimator = population parameter)

(3) Minimum variance.