

True Model: $Y_i = \alpha + \beta X_i + u_i$

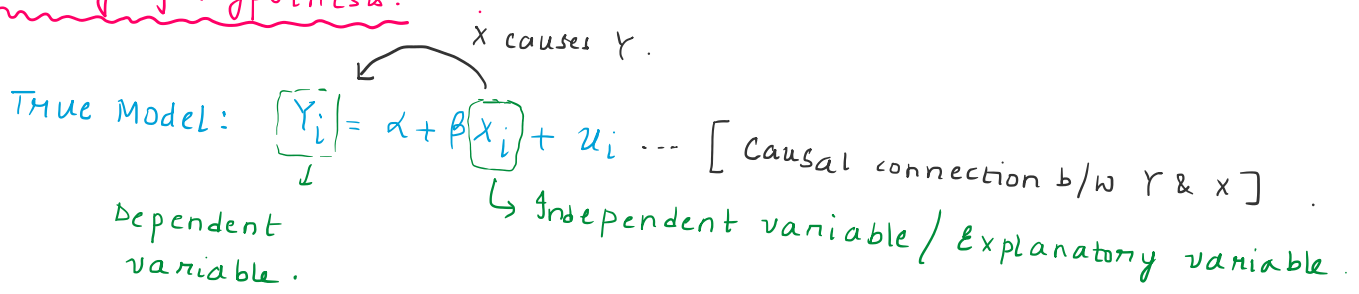
Estimated Model: $\hat{Y}_i = \hat{\alpha} + \hat{\beta} X_i$

where $\hat{\beta} = \frac{\sum (Y_i - \bar{Y})(X_i - \bar{X})}{\sum (X_i - \bar{X})^2}$ and $\hat{\alpha} = \bar{Y} - \hat{\beta} \bar{X}$

Already shown: $E(\hat{\beta}) = \beta$, $\widehat{\text{var}}(\hat{\beta}) = \frac{\hat{\sigma}^2}{\sum (X_i - \bar{X})^2}$, where $\hat{\sigma}^2 = \frac{RSS}{(n-2)}$

H₀ Check: $E(\hat{\alpha}) = \alpha$, $\widehat{\text{var}}(\hat{\alpha}) = \frac{\hat{\sigma}^2 \sum X_i^2}{n \sum (X_i - \bar{X})^2}$

Testing of Hypothesis:



∴ We use X_i to explain variations in Y_i through the regression model.

If the explanatory variable chosen is significant, then $\beta \neq 0$.

If the explanatory variable chosen is insignificant, $\beta = 0$.

To test: $H_0: \beta = 0$ vs $H_1: \beta \neq 0$.

This test is performed to check if the explanatory variable used is a meaningful (significant) variable or not.

Steps:

- (i) Construct a test statistic.
- (ii) Check the distribution of test-statistic under H_0 [χ^2 / t / F]
- (iii) Fix a level of significance (5% / 1%) and get the corresponding critical value.
- (iv) Frame the test...

$\sqrt{1 - (1/n)}$

$$\frac{(\hat{\beta} - \beta)^2}{\sigma^2 / \sum (x_i - \bar{x})^2} \sim \chi^2_{(1)}$$

Result: $\frac{\sum e_i^2}{\sigma^2} \sim \chi^2_{(n-2)}$

$\sqrt{2(n-x)}$

As σ is unknown, this cannot be used as a test-statistic.

$$\chi^2 = \sum_{i=1}^n \tau_i^2 \sim \chi^2_{(n)}$$

$\tau, \chi^2, t, F ?$