EE 325

Hypothesis Testing

There are 5 steps
Step 1 Define the null hypothesis and alternative hypothesis

Null Hypothesis (H_0)
Alternative Hypothesis (H_1)

Two tail Test	One tail test	
$H_0 : \beta_2 = 0$ $H_1 : \beta_2 \neq 0$	$H_0 : \beta_2 \geq 0$ $H_1 : \beta_2 < 0$	$H_0 : \beta_2 \leq 0$ $H_1 : \beta_2 > 0$

Step 2 Testing methods

- **The confidence interval approach**

$$\Pr[-t_{\alpha/2} \leq \frac{\hat{\beta}_2 - \beta_2}{se(\hat{\beta}_2)} \leq t_{\alpha/2}] = 1 - \alpha$$

$$\Pr[\hat{\beta}_2 - t_{\alpha/2} se(\hat{\beta}_2) \leq \beta_2 \leq \hat{\beta}_2 + t_{\alpha/2} se(\hat{\beta}_2)] = 1 - \alpha$$

- **Test of significant**

$$t = \frac{\hat{\beta}_2 - \beta_2}{se(\hat{\beta}_2)}$$

$$= \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum x_i^2}}{\hat{\sigma}} = \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum (X_i - \bar{X})^2}}{\hat{\sigma}}$$

Step 3, 4, 5 Making decision and Conclusion

- **The confidence interval approach**

If you confidence interval include the value from the null hypothesis, you cannot reject the null hypothesis.

If you confidence interval does not include the value from the null hypothesis, you can reject the null hypothesis.

- **Test of significant**

Find the critical t value from t-table

- Two tails test

If $|t|$ > Critical value $(t_{\alpha/2})$ Reject the null hypothesis

- One tail test (Right tail)

If t > Critical value (t_{α}) Reject the null hypothesis

- One tail test (Left tail)

If t < - Critical value (t_{α}) Reject the null hypothesis

If you can reject the null hypothesis, a statistic is said to be statistically significant if the value of the test statistic lies in the critical region.

If you cannot reject the null hypothesis, a test is said to be statistically insignificant if the value of the test statistic lies in the acceptance region.

Two tailed test

Example: Wage- Education

$$\hat{\beta}_2 = 0.7240$$
$$se(\hat{\beta}_2) = 0.0700$$
$$df = 11, \alpha = 0.05, t_{\alpha/2} = 2.201$$

$$H_0 : \beta_2 = 0.5$$
$$H_1 : \beta_2 \neq 0.5$$

Confidence Interval method

$$\Pr[-t_{\alpha/2} \le \frac{\hat{\beta}_2 - \beta_2}{se(\hat{\beta}_2)} \le t_{\alpha/2}] = 1 - \alpha$$

$$0.5700 \le \beta_2 \le 0.8780$$
$$or$$
$$0.7240 \pm 2.201(0.0700)$$

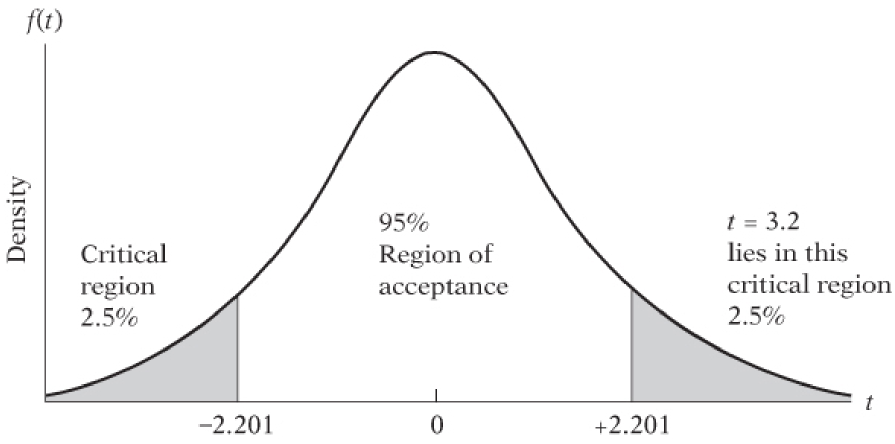
If you confidence interval does not include the value from the null hypothesis, you can reject the null hypothesis. There is enough evidence to said that β_2 is difference from 0.5.

$$\hat{\beta}_2 = 0.7240$$
$$se(\hat{\beta}_2) = 0.0700$$
$$df = 11, \alpha = 0.05, t_{\alpha/2} = 2.201$$

$$H_0 : \beta_2 = 0.5$$
$$H_1 : \beta_2 \neq 0.5$$

Test of significant

$$t = \frac{\hat{\beta}_2 - \beta_2}{se(\hat{\beta}_2)}$$
$$= \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum x_i^2}}{\hat{\sigma}} = \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum (X_i - \bar{X})^2}}{\hat{\sigma}} \qquad t = \frac{0.7240 - 0.5}{0.0700} = 3.2$$



If $|t| > \text{critical}(t_{\alpha/2})$ reject the null hypothesis. There is enough evidence to said that β_2 is difference from 0.5.

One tailed test

$\hat{\beta}_2 = 0.7240$

$se(\hat{\beta}_2) = 0.0700$

$df = 11, \alpha = 0.05, t_\alpha = 1.796$

$$H_0 : \beta_2 \geq 0.5$$
$$H_1 : \beta_2 < 0.5$$

Test of significant

$$t = \frac{\hat{\beta}_2 - \beta_2}{se(\hat{\beta}_2)}$$

$$= \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum x_i^2}}{\hat{\sigma}} = \frac{(\hat{\beta}_2 - \beta_2)\sqrt{\sum (X_i - \bar{X})^2}}{\hat{\sigma}}$$

$$t = \frac{0.7240 - 0.5}{0.0700} = 3.2$$

If t > critical value $-t_\alpha$ (1.796) Not reject the null hypothesis. There is enough evidence to said that β_2 is equal or more than 0.5.