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1.1) By law of demand when price increase, the consumption will be decrease which shown by the equation.

1.2) test β_2 which $\ln C_i = 4.30 - \underbrace{1.34}_{\beta_2} \ln P_i + 0.17 \ln Y_i$

$H_0 : \beta_2 = 0$

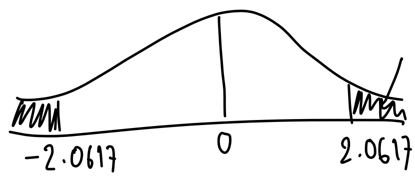
$H_a : \beta_1 \neq 0$

$$t_{cal}(\beta_2) = \frac{\hat{\beta}_2 - \beta_2}{\sigma_{\hat{\beta}_2}}$$

$$= \frac{-134 - 0}{0.32} = 4.1875$$

$\alpha = 0.05$ $\quad t_{lower} = -2.0617$

$t_{upper} = 2.0617$



$\therefore$ Reject H_0. 95% of times β_2 will not equal to 0

$H_0 : \beta_2 = 1$

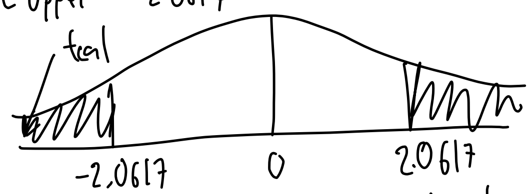
$H_a : \beta_2 \neq 1$

$$t_{cal}(\beta_2) = \frac{\hat{\beta}_2 - \beta_2}{\sigma_{\hat{\beta}_2}} = \frac{-1.34 - 1}{0.32} = -7.3125$$

$\alpha = 0.05$

$t_{lower} = -2.0617$

$t_{upper} = 2.0617$



$\therefore$ Reject H_0. 95% of the times β_2 will not equal to 1

1.3) We tested β_3 which $\beta_3 = 0.17$

$H_0 : \beta_3 = 0$

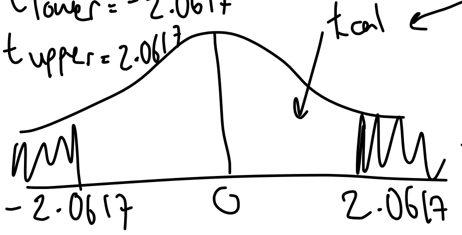
$H_0 : \beta_3 \neq 0$

$$t_{cal}(\beta_3) = \frac{\hat{\beta}_3 - \beta_3}{\sigma_{\hat{\beta}_3}} = \frac{0.17 - 0}{0.20} = 0.85$$

$\alpha = 0.05$

$t_{lower} = -2.0617$

$t_{upper} = 2.0617$



$\therefore$ Fail to Reject H_0. 95% of the time β_2 will equal to 0 which not statically significant

Becaues Income per week not effect consumption per years.

2.1) test coefficient, $\beta_3 < 1$ or not.

$H_0 : \beta_3 \geq 1$

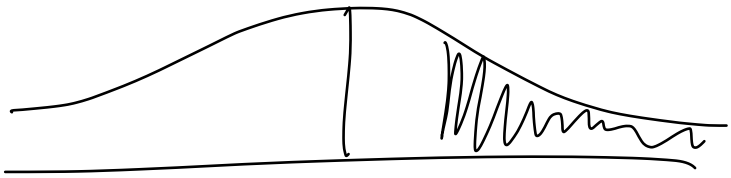
$H_a : \beta_3 < 1$

$t_{cal} = \frac{1.030777 - 1}{0.0591226} \approx 0.52056$

0.52056

95% CI

$(0.9148838, 1.19667)$



∴ Fail to reject H_0. β_3 is not less than 1 in first model.

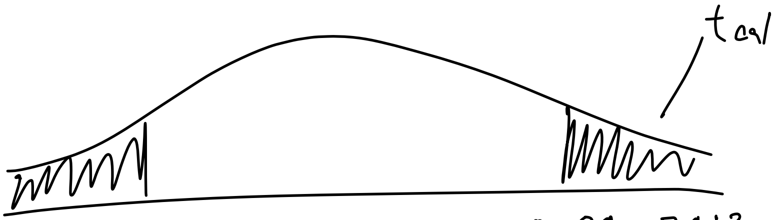
2.2) t-test

$H_0 : \beta_4 = 0$

$H_a : \beta_4 \neq 0$

$t_{cal} = \frac{0.0377221 - 0}{0.0056214} \approx 6.710446$

95% CI



∴ Reject H_0. so 95% of the times $\beta_1 \neq 0$

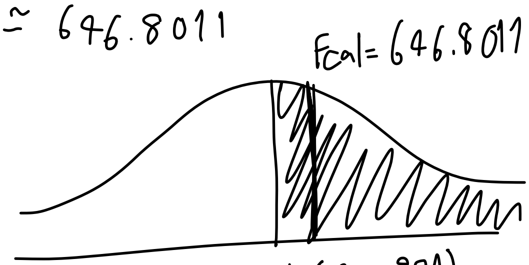
∴ β_4 is statically significant

f-test

$F_{cal} = \frac{ESS/d.f.}{RSS/d.f.} = \frac{6567017.15/3}{31376372.3/9271}$

$= \frac{2189005.72}{3384.35685}$

≈ 646.8011



$F_{cal} > F(3, 9271)$

we can reject H_0

3.1) 11.08 = constant value

$-0.9535 \ln(NOX)$ = Nox increases by 1% , P decrease by 0.9535 %

$-0.1343 \ln(DIST_i)$ = DIST increases by 1% , P decrease by 0.1343 %

$0.2545\ ROOM_i$ = ROOM increases by 1 unit , P decrease by 0.2545 %

$-0.05245\ START$ = START increases by 1 unit , P decrease by 0.05245%

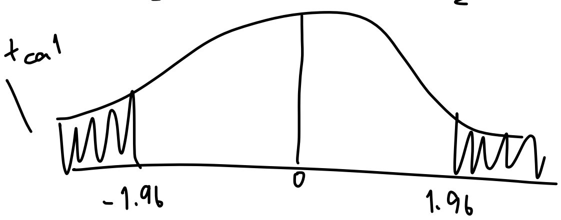
3.2) Test slope coefficient ln(NOX)

$H_0 : \beta_2 = 0$

$H_a : \beta_2 \neq 0$

$t_{cal} = \dfrac{-0.9535 - 0}{0.1167} = -8.171 \sim t_{506-5}$

$t_{\frac{0.05}{2}} = 1.9647 \qquad t_{\frac{-0.05}{2}} = 1.9647$



∴ Reject H_0 . so slope coeffient is statiscally significant from 0

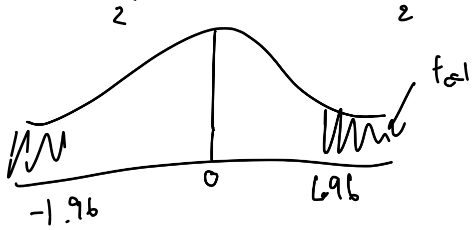
Test slope coefficient ROOM

$H_0 : \beta_5 = 0$

$H_a : \beta_5 \neq 0$

$t_{cal} = \dfrac{0.2545 - 0}{0.01853} = 13.73$

$t_{\frac{0.05}{2}} = 1.9647 \qquad t_{-\frac{0.05}{2}} = -1.9647$



∴ Reject H_0 , so slope coefficient is statiscally significant from 0

3.3) $R^2 = \dfrac{1 - RSS}{TSS} = 1 - \dfrac{35.1835}{84.5822} = 0.5840$

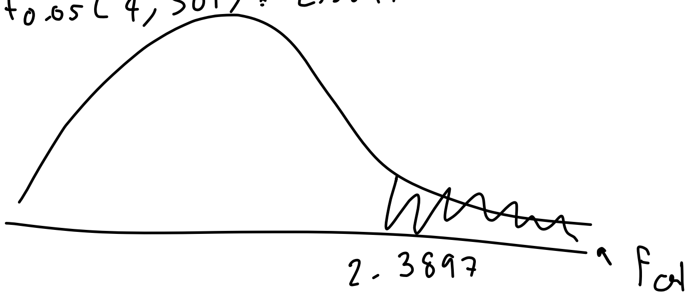
Adjusted $R^2 / \bar{R}^2 = 1 - (1 - R^2)\dfrac{n-1}{n-n} = 1 - \left[(1 - 0.5840)\dfrac{505}{501}\right] = 0.5807$

$H_0 : \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_a : Not all slope coefficient are 0

$F_{cal} = \dfrac{ESS/(k-1)}{RSS/(n-k)} = \dfrac{(49.3987)/4}{35.1835/501} = 175.8$

$f_{0.05}(4, 501) = 2.3897$



∴ Reject H_0 and not all slope are 0

3.a) $H_0: \beta_2 = \beta_3 / \beta \ln(NOX) - \beta \ln(DIST) = 0$

$H_a: \beta_2 \neq \beta_3$

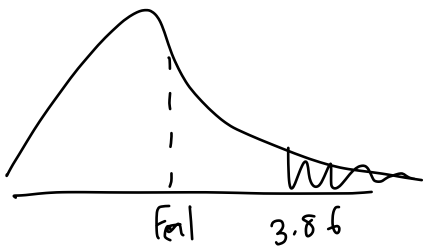
$H_0: \beta_2 = \beta_3 / \beta_2 - \beta_3 = 0$ or the restriction is valid

$H_a: \beta_2 \neq \beta_3$ or the restriction is not valid

$$F_{cal} = \frac{RSS_R - RSS_{ur} / m}{RSSUR} = \frac{41.9532 - 35.1835/1}{35.1835(506-5)} = 0.0009841$$

$\alpha = 0.05$

$F_{(1, 501)} = 3.8600$



$\therefore$ Fail to reject H_0

4.1) Model 1

18.27 ⇒ constant

Increased 1 labor factor, Y increase 0.536

Increased 1 capitor, Y increase 0.024

Model 2

2.13 ⇒ constant

Increased 1 $\frac{K}{L}$, Y increase 1.12

4.2) F-test

$H_0 : \beta_2 + \beta_3 = 1$

$H_a : \beta_2 + \beta_3 \neq 1$

$$F_{cal} \frac{(RSS_R - RSS_{UR})/(k_{ur} - k_R)}{RSS_{UR}/(n - k_{UR})} = \frac{(0.0153 - 0.0124)/(3 \cdot 2)}{0.0124/(31-3)}$$

$= 6.598$

$F_{table} = 4.23$

$F_{cal} > F_{table}$

$\therefore$ Reject H_0, $\beta_2 + \beta_3 = 1$

4.3) We cannot compare the R^2 value because Y not same

Model 1 $\ln Y_2$

Model 2 $\ln\left(\frac{Y}{L}\right)_t$