6204641713

①

1.1) From $\ln C_1 = \overset{\beta_1}{4.30} - \overset{\beta_2}{1.34} \ln P_1 + \overset{\beta_3}{0.17} \ln Y_1$

$\beta_2 = -1.34$, tells us that P_1 has negitive relationship with C_1 which follows the law of demand that says Cigarrette consumption has negative relationship with the price e.g. Price increase, Cigarrette consumption decreases.

1.2) Test the significant level of β_2 from the model

$\ln C_1 = 4.30 - 1.34 \ln P_1 + 0.17 \ln Y_1$

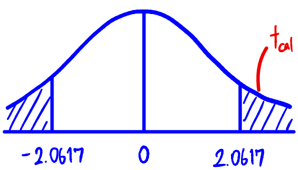
Suppost we test with level of significant $\alpha = 0.05$

Test if $\beta_2 = 0$

$H_0: \beta_2 = 0$

$H_1: \beta_2 \neq 0$

$$t_{cal}(\beta_2) = \frac{\hat{\beta}_2 - \beta_2}{\sigma_{\hat{\beta}_2}} = \frac{-1.34 - 0}{0.32} = 4.1875 \sim t_{46-3}$$



$t_{lower} = -2.0617$

$t_{upper} = 2.0617$

Reject H_0

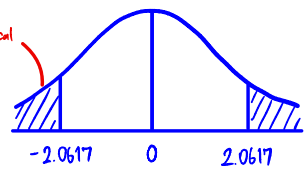
$\therefore$ We can say that 95% of the time β_2 is not 0

Test if $\beta_2 = 1$

$H_0: \beta_2 = 1$

$H_1: \beta_2 \neq 1$

$$t_{cal}(\beta_2) = \frac{\hat{\beta}_2 - \beta_2}{\sigma_{\hat{\beta}_2}} = \frac{-1.34 - 1}{0.32} = -7.3125 \sim t_{46-3}$$



$t_{lower} = -2.0617$

$t_{upper} = 2.0617$

Reject H_0

$\therefore$ We can say that 95% of the time β_2 is not 1

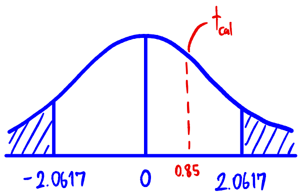
1.3) For Income elasticity, we test the significance of β_3

$H_0: \beta_3 = 0$

$H_1: \beta_3 \neq 0$

Suppose we test with significant level $\alpha = 0.05$

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



$t_{lower} = -2.0617$

$t_{upper} = 2.0617$

Fail to reject H_0

$\therefore$ We can say that 95% of the time, β_3 is equal to zero which implies that β_3 is not statistically significant

The reason:

I think the reason that the income does not significantly affect the consumption because the time frame of Income variable is just one week compared to the whole year survey, one week consumption won't have much effect on the consumption.

2.1) Test the coefficient in the first model if $\beta_3 < 1$ or not

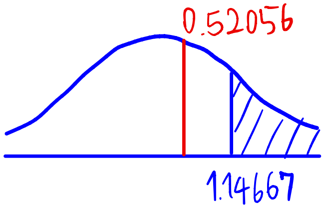
$H_0 : \beta_3 \geq 1$

$H_1 : \beta_3 < 1$

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

95% Coefficient interval

(0.9148838, 1.14667)



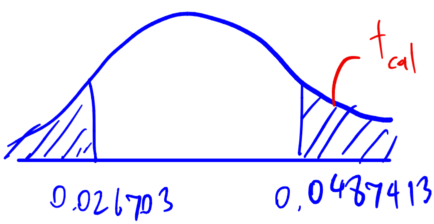
We cannot reject H_0, β_3 is not less than 1 in the first model

2.2) t- test

$H_0 : \beta_4 = 0$

$H_a : \beta_4 \neq 0$

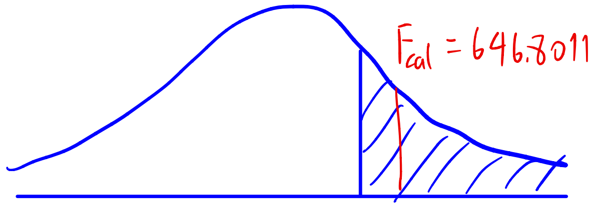
$$t_{cal} = \frac{0.0377221 - 0}{0.0056214} = 6.710446$$ (95% Coef Interval)



F - test

$$F_{cal} = \frac{ESS/d.f.}{RSS/d.f.} = \frac{6567017.15/3}{31376372.3/9271} = \frac{2189005.72}{3384.35685}$$

$$\approx 646.8011$$



F(3, 9271)

= 646.80

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

We can reject H_0

β_4 is statistically significant

③

3.1) • 11.08 constant value

• $-0.9585\ln(nox)$ = nox increases by 1%, P decreases by 0.9585%

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

• $-0.2545\ ROOM_i$ = ROOM increases by 1 unit, P decreases by 0.2545%

• -0.05245 STRAT = STRAT increases by 1 unit, P decreases by 0.05245%

3.2) Test the slope coefficient for ln(NOx)

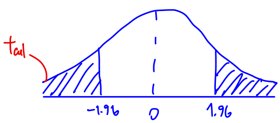
$H_0: \beta_2 = 0$

$H_1: \beta_2 \neq 0$

$$t_{cal} = \frac{-0.9535-0}{0.1167} = -8.171 \sim t_{506-5} \sim t_{501}$$

$t_{\frac{0.05}{2}} = 1.9647$ Upper

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



Reject H_0

Slope of coefficient of ln(NOx) is statistically significant

Test the slope coefficient for ln(NOx)

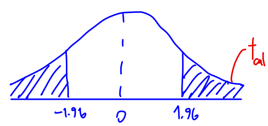
$H_0: \beta_5 = 0$

$H_1: \beta_5 \neq 0$

$$t_{cal} = \frac{0.2545-0}{0.01853} = 13.73 \sim t_{506-5} \sim t_{501}$$

$t_{\frac{0.05}{2}} = 1.9647$ Upper

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



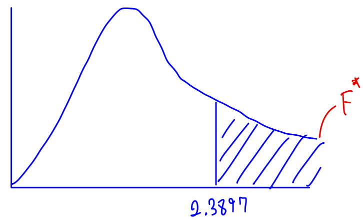
Reject H_0

Slope of coefficient of $ROOM_i$ is statistically significant

3.3) $R^{\alpha} = 1 - \frac{RSS}{TSS} = 1 - \frac{35.1836}{84.5822} = 0.5840$

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

Test joint significance of all the slope



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

H_a: Not all slope coefficiant are simultanously zero

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

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

$\therefore F_{cal} > F(3,501)$

Reject H_0 and we conclude that not all slope are simultanously zero

3.4) $H_0: \beta_2 = \beta_3 \;/\; \beta \ln(NOX) - \beta \ln(DIST) = 0$

$H_1: \beta_2 \neq \beta_3$

Unrestricted model: $\ln(P_i) = 11.08 - 0.9536 \ln(NOX) - 0.1343 \ln(DIST) + 0.2546 ROOM - 0.052455 STRAT$

Restricted model: $\ln(P_i) = 11.08 - 6.1343 \ln(NOX \cdot DIST) + 0.2545 ROOM_i - 0.0525 STRAT$

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

$H_1: \beta_2 \neq \beta_3$ or the restriction is invalid

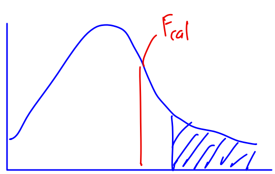
$F_{cal} = \frac{RSS_R - RSS_{UR}/m}{RSS_{UR}(n-k_{UR})} = \frac{41.4532 - 35.1835/1}{35.1835(506-5)} = 0.0003841$

$\alpha = 0.05$

$F(1,501) = 3.8600$

$\therefore F_{cal} < F_{table}$

Fail to reject H_0



The restriction is imposed valid meaning β_2 equals to β_3

4.1) Model 1

- 18.27 ⇒ constant
- increased 1 labor ⇒ Y increased 0.536
- increased 1 capital ⇒ Y increased 0.024

Model 2

- 2.13 ⇒ constant
- instead 1 $\frac{K}{L}$, Y increased 1.12

4.2) F test

$H_0 : \beta_2 + \beta_3 = 1$

$H_1 : \beta_2 + \beta_3 \neq 1$

$$F_{cal} = \frac{(RSS_R - RSS_{ur}) / (K_{ur} - K_r)}{RSS_{ur} / n \cdot K_{ur}}$$

$= 6.548$

$F_{cal} > F_{table}$

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

4.3) We cannot compare the R^2 value b/c the variable Y did not same both model

Model 1 $\ln Y_t$

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