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①

$$\begin{array}{llll} & \hat{\beta}_1 & \hat{\beta}_2 & \hat{\beta}_3 \\ \ln C_i = & 4.30 & -\,1.34 \ln P_i & +\,0.17 \ln Y_i \\ se = & (0.91) & (0.32) & (0.20) \end{array}$$

$\bar{R}^2 = 0.27$

1.1) Do the estimation results follow the law of demand?

Ans : If the price of product increases, the demand will fall.
As a result, the equation follows the law of demand because there is a negative effect to consumption.

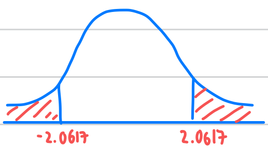
1.2) What is the elasticity of demand for cigarettes with respect to price? Is it statistically significant? If so, is it statistically different from 1?

$H_0: \beta_2 = 0$

$H_a: \beta_2 \neq 0$

$\alpha = 0.05$

$t_{cal}(\beta_2) = \dfrac{\hat{\beta}_2 - \beta_2}{\sigma \hat{\beta}_2} = \dfrac{-1.34 - 0}{0.32} = 4.1875$



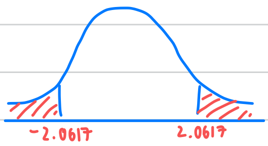
So, we can reject Ho. We can make sure that 95% of β_2 will not equal to 0

$H_0: \beta_2 = 1$

$H_a: \beta_2 \neq 1$

$\alpha = 0.05$

$t_{cal} = \dfrac{\hat{\beta}_2 - \beta_2}{\beta_2} = \dfrac{-1.34 - 1}{0.32} = -7.3125$



So, we can reject Ho. We can make sure that 95% of β_2 will not equal to 1.

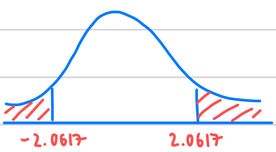
1.3) What is the income elasticity of demand for cigarettes? Is it statistically significant? If not, what might be the reasons for it?

$H_0: \beta_3 = 0$

$H_a: \beta_3 \neq 0$

$\alpha = 0.05$

$t_{cal}(\beta_3) = \dfrac{\hat{\beta}_3 - \beta_3}{\beta_3} = \dfrac{0.17 - 0}{0.2} = 0.85$



∴ So, we cannot reject Ho. We can make sure that 95% of the time β_3 will equal to 0 which means it is not statistically significant.

2. From estimating the regression equation on net financial wealth (nettfa), age of the survey respondent (age), and annual family income (inc) for people in the United States. The wealth and income variables are both recorded in thousands of dollars. The OLS estimation results for the model are given by

$$nettfa_i = \beta_1 + \beta_2 inc_i + \beta_3 age_i + u_i$$

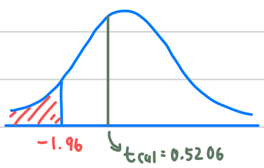
2.1) Test the coefficient, in the first model, $\beta_3 < 1$ in the first model or not?

$H_0: \beta_3 \geq 1$

$H_a: \beta_3 < 1$

d.f. = 9.275 − 3 = 9.272 , α = 0.05

$$t_{cal} = \frac{\hat{\beta}_3 - \beta_3}{\beta_3} = \frac{1.030777 - 1}{0.0591226} = 0.5206 \sim t_{9.272}$$



∴ We cannot reject H_0.

Therefore, we can make sure that β_3 is less than 1, at α = 0.05

2.2) Due to estimation result by adding the age^2 variable or agesq. Perform the test whether we should include the quadratic term of the age variable or not? (Test for both t-test and F-test.) Also, interpret the meaning of this coefficient.

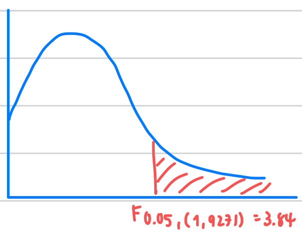
F - test

$H_0: \beta_4 = 0$

$H_a: \beta_4 \neq 0$

$$F_{cal} = \frac{RSS_R - RSS_{UR}/m}{RSS_{UR}/n-k} = \frac{(315280770.7 - 31376372.3)/7}{31376372.3/9275-4}$$

$$= 45.03024$$



∴ We reject H_0. we can make sure that 95% of the time that β_4 is not equal to 0. Thus, we have enough evidence to say that we should add age^2 to model.

③

$$ln(P_i) = 11.08 - 0.9535\, ln(NOX_i) - 0.1343\, ln(DIST_i) + 0.2545 ROOM_i - 0.05245 STRAT_i$$

$$se \quad = (0.3181)\ (0.1167) \qquad (0.04310) \qquad (0.01853) \qquad (0.005897)$$

$RSS = 35.1835 \quad TSS = 84.5822$

3.1) Interpret each of the coefficient estimates in regression equation.

$\hat{\beta}_1$; if $\ln(NOX_i) = 0$, $\ln(DIST_i) = 0$, and $STRAT_i = 0$, on average, the median house price $= e^{11.08} \approx 64{,}860.88349$ dollars.

$\hat{\beta}_2 = -0.9535$; if the level of nitrous oxide increase 1 unit, on average, medium house decrease by 0.9535, keeping other variable constant.

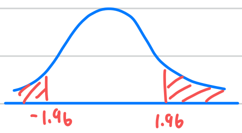
3.2) $\ln(NOX_i)$

$H_0 : \beta_2 = 0$

$H_a : \beta_2 \neq 0$

$t_{cal} = -8.1705$

$\alpha = 0.05$, d.f. = 501



∴ We can reject H_0 and make sure that β_3 is not equal to 0 with 95% confident and β_2 is significant.

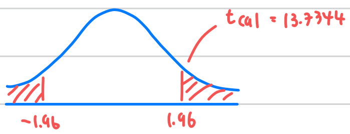
ROOM;

$H_0 : \beta_5 = 0$

$H_a : \beta_5 \neq 0$

$t_{cal} = 13.7344$

$\alpha = 0.05$, d.f. = 501



∴ We can reject H_0 and make sure that β_5 is not 0 with $\alpha = 0.05$

④

4.2) Model 1

$\ln Y_t = \beta_1 + \beta_2 \ln L_t + \beta_3 \ln K_t + u_t$ → unrestricted regression

Model 2

$\ln Y_t = \beta_1 + \beta_3 \ln\left(\frac{K}{L}\right) + V_t$ ⇒ Unrestricted regression

test that $\beta_2 + \beta_3 = 1$