HW0310 111700027 林育忻

3.1

(a) $H_0: \beta_2 = 0$

$H_1: \beta_2 > 0$

(b) $t = \frac{\hat{\beta}_2 - 0}{se(\hat{\beta}_2)} = \frac{0.01309 - 0}{0.00215} = \frac{0.01309}{0.00215} \approx 6.09$

if H_0 is true $\Rightarrow df = 64 - 2 = 62$

t統計量應服從 $df = 62$ 的 t 分佈

(c) if H_1 is true ($\beta_2 > 0$) $\Rightarrow$ t統計量期望值↑

$t = \frac{\hat{\beta}_2}{se(\hat{\beta}_2)}$, if $\beta_2 > 0$ then $\hat{\beta}_2$ tend to $> 0 \Rightarrow$ t統計量右移

(比t分佈均值↑更大)

(d) 單尾檢定 $t_{0.01, 62} \approx 2.39$ (查表)

if $t > 2.39 \Rightarrow$ reject H_0

if $t \leq 2.39 \Rightarrow$ don't reject H_0

(e)

$t \approx 6.09$, greater than $2.39 \Rightarrow$ reject H_0

it means there is enough evidence to prove that GDP positively affects the number of models.

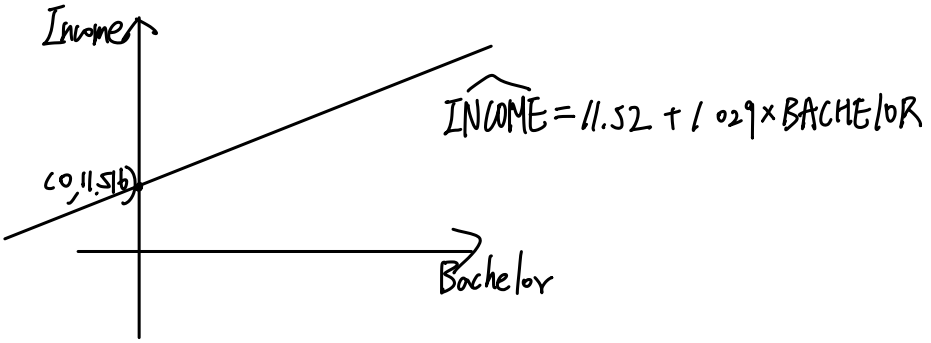
1% level of significance means that we are willing to accept 1% probability of rejecting H_0 mistakenly when H_0 is true (Type I error).

3.7

(a) $t = \dfrac{\hat{\beta}_0}{se(\hat{\beta}_0)} \Rightarrow 4.31 = \dfrac{\hat{\beta}_0}{2.672} \Rightarrow \hat{\beta}_0 = 4.31 \times 2.672 = 11.52$ #

(b) $\widehat{INCOME} = 11.52 + 1.029 \times BACHELOR$

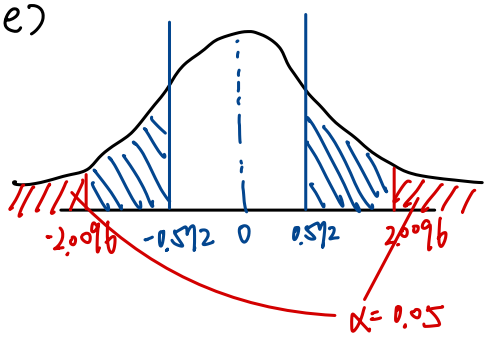
It's increasing and has positive relationship, also the increase is at a constant rate (∵ linear equation)



(c) $10.75 = \dfrac{1.029}{se(\hat{\beta}_1)} \Rightarrow se(\hat{\beta}_1) = \dfrac{1.029}{10.75} = 0.0958$ #

(d) $H_0: \beta_0 = 10$
$H_1: \beta_0 \neq 10$
$t = \dfrac{11.52 - 10}{2.672} \approx 0.572$

(e)



$2.009b = t_{0.025,50}$ $P = 0.572$ ⇒ 雙尾區域總合為 57.2%

$RR: \{t: t \leq -2.009b \text{ or } t \geq 2.009b\}$

$t = 0.572$ isn't in RR ⇒ don't reject H_0

(f) $CI = 1.029 \pm (2.68 \times 0.00215) = 1.029 \pm 0.0958 \Rightarrow (0.172, 1.286)$ # (查表 $t_{0.005,49}$)

(g) ① $H_0: \beta_2 = 1$
$H_1: \beta_2 \neq 1$

② $\alpha = 0.05$

③ $t = \dfrac{1.029 - 1}{0.0958} = 0.303$ ($t_{0.025,49} = 2.01$)

④ $RR: \{t: t \geq 2.01 \text{ or } t \leq -2.01\}$

⑤ t & RR ⇒ do not reject H_0

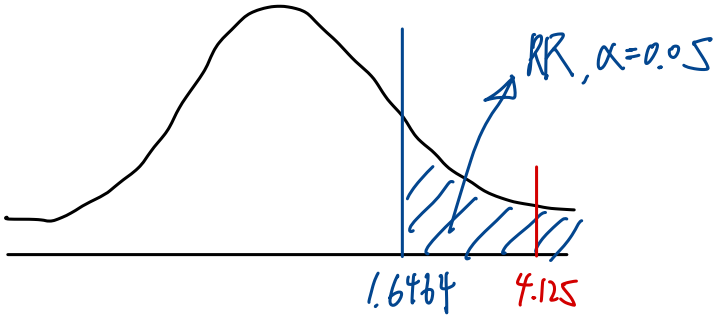
Statistics: There is suffient evidence to show that the proportion of bachelor's degree on income may be = 1

Economic result: for every 1% increase in the proportion of the population with bachelor's degree, the increase in per capita income is likely to be about $1,000.

3.17

(a) ① $H_0: \beta_2 = 1.8$

$H_1: \beta_2 > 1.8$



② $\alpha = 0.05$

③ $t = \frac{2.46 - 1.80}{0.16} = 4.125$

④ RR: $\{t : t \geq 1.645\}$ ($t_{0.05,\infty}^{查表} = 1.645$)

⑤ $t \in RR \Rightarrow$ reject H_0

⑥ 在5%顯著水準下，有足夠證據表明 Urban 區迴歸斜率顯著 > 1.8

$\Rightarrow$ 教育對薪資的影響在都市地區較強

(b) $\widehat{WAGE} = -4.88 + (1.80 \times 16) = -4.88 + 28.8 = 23.92$

CI: $23.92 \pm (\underbrace{1.96}_{t_{0.05,212} \approx} \times 0.833) = 23.92 \pm 1.63 \Rightarrow (22.29, 25.55)$

$\Rightarrow$ 當教育年限 $= 16$，有 95% 信心，農村平均時薪在 22.29 ~ 25.55 之間

(c) $\widehat{WAGE} = -10.96 + (2.46 \times 16) = 28.60$

$se(\widehat{WAGE}) = \sqrt{2.29^2 + 16^2 \cdot 0.16^2 + 2 \cdot 16 \cdot (-0.345)} = 0.8164$

CI: $28.6 \pm 1.96 \times 0.8164 \Rightarrow (27.00, 30.20)$

Comparing to Rural (22.29, 25.55), CI of urban is narrower, because the sample size of urban is bigger, se will be smaller $\Rightarrow$ plausible.

(d) ① $H_0: \beta_0 = 4$

$H_1: \beta_0 < 4$

② $\alpha = 0.05$

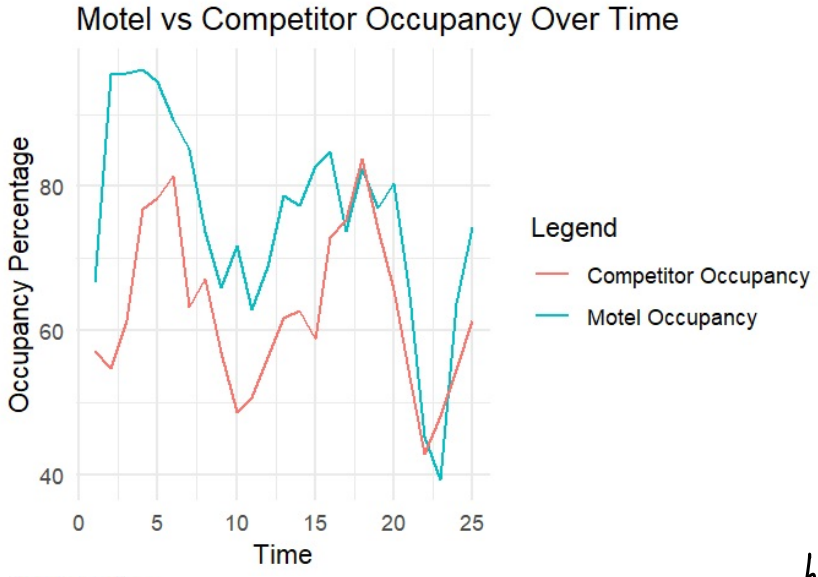
③ $t = \frac{-4.88 - 4}{3.29} = -2.70$

④ RR: $\{t : t \leq \underbrace{-2.33}_{t_{0.01,212}}\} \Rightarrow t \in RR \Rightarrow$ reject H_0

⑤ 在 1% 顯著水準下，有足夠證據表示農村區截距 < 4

3.19

(a)



大多數時間 motel 比較高，且兩者幾乎一起上升或下降

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Residuals:
    Min      1Q  Median      3Q     Max
-23.876  -4.909  -1.193   5.312  26.818

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  21.4000    12.9069   1.658 0.110889
comp_pct      0.8646     0.2027   4.265 0.000291 ***
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$\widehat{motel\_pct} = 21.4 + 0.8648 \times comp\_pct$

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                  2.5 %    97.5 %
(Intercept) -5.2998960 48.099873
comp_pct     0.4452978  1.283981
```

95% CI = (0.4452978, 1.283981)

(b)

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       fit      lwr      upr
1 81.92474 77.38223 86.46725
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90% CI: (77.38223, 86.46725)

(c) ① $H_0: \beta_2 \le 0$

$H_1: \beta_2 > 0$

② $\alpha = 0.01$ 單尾

③ $t = \frac{0.8646}{0.2027} = 4.2654$

④ RR: $\{t : t \ge 2.5\}$ $t_{0.01, 23}$

⑤ $t \in RR \Rightarrow$ reject H_0

(d) ① $H_0: \beta_2 = 1$

$H_1: \beta_2 \ne 1$

② $\alpha = 0.01$ 雙尾

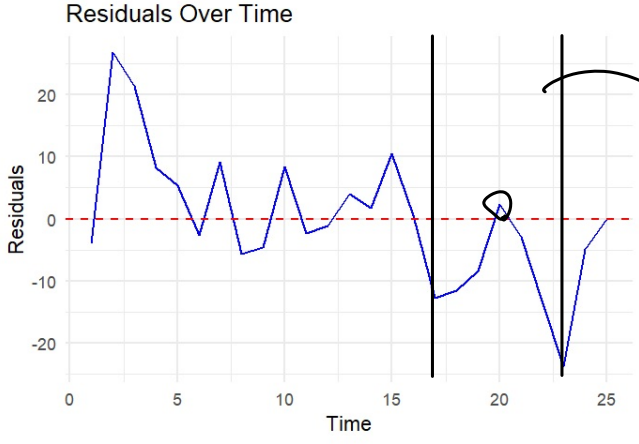
③ $t = \frac{0.8646 - 1}{0.2027} = -0.668$

④ RR: $\{t : t \ge 2.8073$ or $t \le -2.8073\}$

⑤ $t \notin RR \Rightarrow$ do not reject H_0

$\Rightarrow$ comp_pct 對 motel_pct 的影響接近 1

(e)



In this period, residuals are mostly negative

$\Rightarrow$ 這模型高估了 motel_pct

Maybe due to the construction time.