2018

EX 1

1

* 1 pcent increase in income $\Rightarrow$ $\boxed{0,92}$ percent increase in the demand for beer 0,5 point

1 pc. increase in all prices

$$\Rightarrow \alpha_1 + \alpha_2 + \alpha_3 = -1.02 - 0.58 + 0.21$$

$$= \boxed{-1,39\,\%} \quad \text{0,5 point}$$

2 No money illusion if $\alpha_4 = \alpha_1 + \alpha_2 + \alpha_3$.

$$\Leftrightarrow LBeer_t = \alpha_0 + \alpha_1 LPb_t + \alpha_2 LPc_t + \alpha_3 LPa_t + (\alpha_1 + \alpha_2 + \alpha_3) LRD_t + \varepsilon_t .$$

$$\Leftrightarrow LBeer_t = \alpha_0 + (\alpha_1) \times (LPb_t + LRD_t) + \alpha_2 (LPc_t + LRD_t) + \alpha_3 (LPb_t + LRD_t) + \varepsilon_t = \text{model 2}.$$

H_0 : $\alpha_4 = \alpha_1 + \alpha_2 + \alpha_3$

we compare restricted model (model 2) and unrestricted model (model 1).

$$F^* = \frac{(RRSS - URSS)/1}{\dfrac{URSS}{n-k-1}} = \frac{0.0989 - 0.0899}{\dfrac{0.0899}{30-4-1}} = 2.497$$

F^* to be compared to $F^{\alpha}(1, n-k-1) = F^{0,05}(1,25) = 4,24$

2018 ②

$$F^* = \boxed{\overset{2,503.}{2,497} > 4,24} \rightarrow H_0 \text{ is rejected}$$

There is money illusion.

3 points

③ Chow F-test

2 points

$$F^* = \frac{\left[RRSS - (RSS^1 + RSS^2)\right] / k+1}{\dfrac{RSS^1 + RSS^2}{n - 2k - 2}} \longrightarrow F(k+1, n-2k-2)$$

$$F^* = \frac{\left[0.0899 - (0.00889 + 0.04317)\right] / 5}{\dfrac{0.00889 + 0.04317}{30 - 2\times4 - 2}}$$

$F^* = \boxed{2,90}$ to be compared to $\boxed{F^{0,05}(5,20) = 2,71}$

$F^* = 2,90 > 2,71 \rightarrow H_0$ is $\boxed{\text{rejected}}$

The model is unstable.

Ex II ① – x is significant in explaining Y
– regression is globally significant.
– DW cannot be interpreted because we do not know whether the data has been sorted –

1 point
0 if DW

2018 (3)

(2) Only the DW statistic is different.

2 Points

meaning that the data has been sorted differently as the numerator $= \sum (e_t - e_{t-1})^2$

Diff. to interpret the stat bcs there is no info about data sorting.

If data sorted in an appropriate way, $DW = 1{,}18$

$n = 92,\ k = 1,\ \Rightarrow \begin{cases} d_1 \approx 1{,}63 \\ d_2 \approx 1{,}68 \end{cases}$

$DW < 1{,}63 = d_1 \Rightarrow \rho > 0$ there is autocorrelation

(3) $df = 92 - 2 - 1 = 89 > 30$.

the t^0 have to be compared to $1{,}96$.

$\ddagger$ Both 2.21 and $4{,}09 > 1{,}96$ meaning that X and X^2 are significant

$\exists$ a relationship between these residuals in squares and these variables, meaning that $\exists$ heteroscedasticity.

The initial model must be transformed by dividing all variables by $\sqrt{\text{the square}}$ root of the most significant variable that is X^2, we then divide Y, 1 and X by X and the following model is estimated

$$\frac{Y}{X} = a_0 \times \frac{1}{X} + a_1 \frac{X}{X} + \frac{\varepsilon}{X}$$

2018 4

Ex III

1 $y = Xa + \varepsilon$

$$ct = m + \alpha_1 l + \alpha_2 k + \alpha_3 f + \alpha_4 y + \varepsilon$$

$$y = \begin{pmatrix} CT_1 \\ CT_2 \\ \vdots \\ CT_{29} \end{pmatrix} = \begin{pmatrix} 1 & l_1 & k_1 & f_1 & y_1 \\ 1 & l_2 & k_2 & f_2 & y_2 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & l_{29} & k_{29} & f_{29} & y_{29} \end{pmatrix} \begin{pmatrix} m \\ \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_{29} \end{pmatrix}$$

$y = (29 \times 1)$

$X = (29 \times 5)$

$a = (5 \times 1)$

$\varepsilon = (29 \times 1)$.

1 point — matrices : 0.5 — taille : 0.5

2 /1

$$t^*_{\hat{\alpha}_2} = \frac{\hat{\alpha}_2 - 0}{\hat{\sigma}_{\hat{\alpha}_2}} = \frac{\hat{\alpha}_2}{\sqrt{\frac{0.34}{29-5} \times 0.0893}}$$

$$\hat{\sigma}^2_\varepsilon = \frac{0.34}{29-5} = \boxed{0.0142}$$ (0,5 point)

$$t^*_{\hat{\alpha}_2} = \frac{0.26}{\sqrt{0.0142 \times 0.0893}} = \frac{0,26}{\sqrt{0.00127}} = \frac{0,26}{0,03561} = 7,3$$

to be compared $t^{\alpha}_{24} = 2,064$ Ho is rejected 0.5 point

2018 (5)

(3) $\begin{cases} H_0 : \alpha_1 + \alpha_2 + \alpha_3 = 1 \\ H_1 : \alpha_1 + \alpha_2 + \alpha_3 \neq 1 \end{cases}$

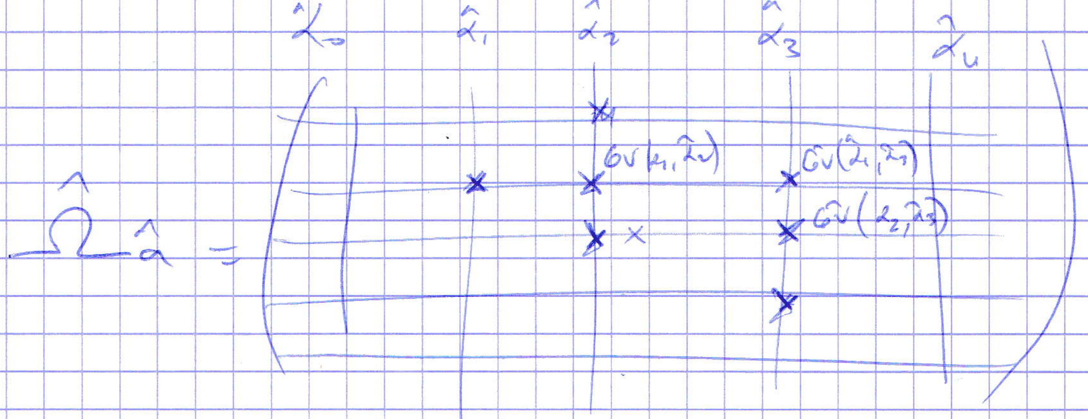
$$t^* = \frac{|\hat{\alpha}_1 + \hat{\alpha}_2 + \hat{\alpha}_3|}{\hat{\sigma}_{\hat{\alpha}_1 + \hat{\alpha}_2 + \hat{\alpha}_3}} \rightarrow t\,(n-k-1).$$

1 point.

$$\hat{var}(\hat{\alpha}_1 + \hat{\alpha}_2 + \hat{\alpha}_3) = \hat{v}(\hat{\alpha}_1) + \hat{v}(\hat{\alpha}_2) + \hat{v}(\hat{\alpha}_3) + 2\,\hat{cov}(\hat{\alpha}_1, \hat{\alpha}_2) + 2\,\hat{cov}(\hat{\alpha}_1, \hat{\alpha}_3) + 2\,\hat{cov}(\hat{\alpha}_2, \hat{\alpha}_3)$$

$$= \frac{0.34}{29-4-1}\Big[0{,}0512 + 0{,}0893 + 0{,}0044 + 2 \times 0{,}0171 + 2 \times (-0{,}0033) + 2 \times 0{,}0058\Big]$$

$$= 0{,}01417\,\big[0{,}14450 + 2 \times 0{,}0396\big]$$



$\hat{v}(\hat{\alpha}_1) = 0.01417 \times 0{,}0512 = 0{,}00073$ $\quad \hat{cov}(\hat{\alpha}_1, \hat{\alpha}_2) = 0{,}00024$

$\hat{v}(\hat{\alpha}_2) = 0{,}00127$ $\quad \hat{cov}(\hat{\alpha}_1, \hat{\alpha}_3) = -0{,}00005$

$\hat{v}(\hat{\alpha}_3) = 0{,}00006$ $\quad \hat{cov}(\hat{\alpha}_2, \hat{\alpha}_3) = 0{,}00008$

$\hat{v}(\;\;) = 0{,}0026 + 2 \times 0{,}00027 = 0{,}00314$

$\simeq 0{,}0026.$

2018 6

$$t^* = \frac{|0{,}41 + 0{,}26 + 0{,}44 - 1|}{\sqrt{0{,}0026}}$$

$$t^* = \frac{-0{,}11}{0{,}05099} = \boxed{-2{,}15}$$ to be compared to

$$t^{2\alpha}_{n-k-1} = t^{0{,}05}_{24} = \boxed{1{,}711}$$

$|t^*| > 1{,}711 \rightarrow H_0$ is rejected

1 point

Returns to scale are increasing.

P_value : $n-k-1 = 24$, $t^* \in [2{,}064 ; 2{,}492]$

$\boxed{\text{p\_value}} \in [1\%, 2{,}5\%]$.

4 $$F^* = \frac{RSS^2 / n^2-k-1}{RSS^1 / n^1-k-1} \rightarrow F(n_2-k-1, n_1-k-1)$$

$F^* = 2{,}29$ to be compared with $F^{0{,}05}(8,8) = 3{,}44$

$F^* < 3{,}44 \rightarrow$ no heteroscedasticity.

2018 (7)

(5) $H_0 = \begin{pmatrix} \alpha_1 \\ \alpha_3 \end{pmatrix} = \begin{pmatrix} 0,5 \\ 0,5 \end{pmatrix}$

$$F^k = \frac{1}{q} (\hat{a}_q - \bar{a}_q) \hat{\Omega}^{-1}_{\hat{a}_{q}} (\hat{a}_q - \bar{a}_q) \to F(q, n-k-1)$$

0,5 pt formule

$$H_1 = \begin{cases} a_1 = 0,5 \text{ and } a_3 \neq 0,5 \\ a_1 \neq 0,5 \text{ and } a_3 = 0,5 \\ a_1 \neq 0,5 \text{ and } a_3 \neq 0,5. \end{cases}$$

0,5 pour H_1

$$\hat{\Omega}_{\hat{a}_q} = \begin{pmatrix} 0,00073 & -0,00005 \\ -0,00005 & 0,00006 \end{pmatrix}$$

$$\hat{\Omega}^{-1}_{\hat{a}_q} = \frac{1}{0,00073 \times 0,00006 - (0,00005)^2} \begin{pmatrix} 0,0006 & 0,00005 \\ +0,00005 & 0,00073 \end{pmatrix}$$

$$\hat{\Omega}^{-1}_{\hat{a}_q} = \begin{pmatrix} 1448,7 & 1086,5 \\ 1086,5 & 16857,7 \end{pmatrix}$$

Sous H_0 : $(\hat{a}_q - \bar{a}_q) = \begin{pmatrix} 0,41 - 0,5 \\ 0,44 - 0,5 \end{pmatrix} = \begin{pmatrix} -0,09 \\ -0,06 \end{pmatrix}$

2018 (8)

$$F^{*} = \frac{1}{2} \begin{pmatrix} -0{,}09 & -0{,}06 \end{pmatrix} \hat{\Omega}^{-1}_{a_4} \begin{pmatrix} -0{,}09 \\ -0{,}06 \end{pmatrix}$$

$F^{*} = 42{,}07 > F^{0{,}05}(2,24) = 3{,}4 \rightarrow H_0$ is rejected

1 point