Answer Key   Exam #2

1.

i) Interpret coefficients

(2) β ln(sales) : sales ↑1%   salary ↑ .1917% (positive effect)

(2) β ln(mktval): mktval ↑ 1%   salary ↑ .0940 % (positive effect)

(2) β ceoten : ↑ tenure as CEO by another year   salary ↑ (100)(1)(.0168)

1.68%

(positive effect)

2. ii) Compute & comment on marginal effects w/ interaction term ln(sales) · ceoten in model 1

$$\ln(salary) = \beta_0 + \beta_1 \cdot \ln(sales) + \cdots + \beta_5\, ceoten + \beta_6 \ln(sales)\cdot ceoten$$

(2) $$\frac{\partial \ln(salary)}{\partial \ln(sales)} = \beta_1 + \beta_6\, ceoten = .1917 + .012\, ceoten$$

(2) $$\frac{\partial \ln(salary)}{\partial\, ceoten} = \beta_5 + \beta_6 \ln(sales) = .0168 + .012 \ln(sales)$$

Both marginal effects are positive on ln(salary)

2. $H_0: \beta_{age} = 0$

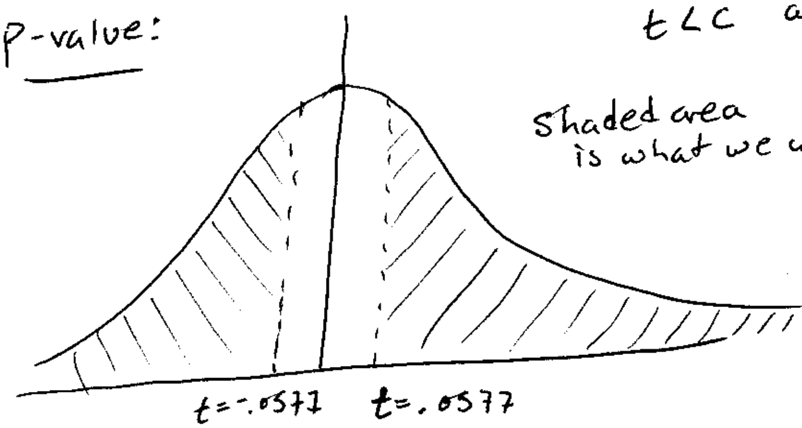
(2) $H_1: \beta_{age} \neq 0$

$$t = \frac{\hat{\beta}_{age}}{s.e.(\hat{\beta}_{age})} = \frac{.0003}{.0052} = .0577 \quad (4)$$

$C = 1.96$ @ 5%

$t < C$ accept null

p-value:



Shaded area is what we want

From z-table

$z = .5239$

$1 - .5239 = .4761$

$p = 2 * .4761 = .9522$ (2)

3. $H_0: \beta_{comten} = 0$

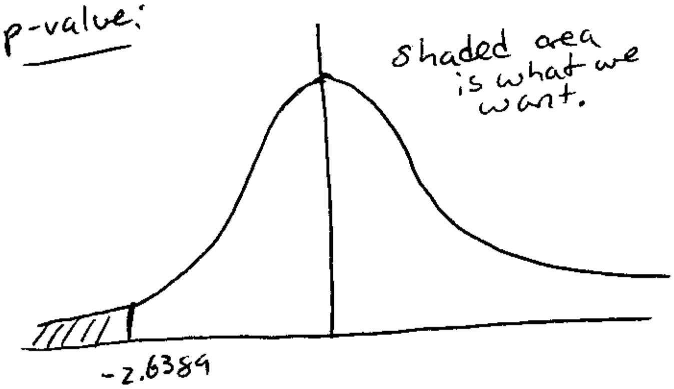
(2) $H_1: \beta_{comten} < 0$

(4)

$$t = \frac{\hat{\beta}_{comten}}{s.e.(\hat{\beta}_{comten})} = \frac{-.0095}{.0036} = -2.6389$$

1-tailed test @ 5% $c = -1.645$ $-t < -c$ so reject null

p-value:



shaded area is what we want.

From z-table (2)

$p = .0041$

4. Compute 95% CI for $\beta_{ln(sales)}$

(10) $\hat{\beta}_{ln(sales)} = .1917$

$s.e.(\hat{\beta}_{lnsales}) = .04$

95% CI: $\hat{\beta}_{lnsales} \pm c \cdot s.e.(\hat{\beta}_{lnsales})$

$.1917 \pm 1.96 \cdot .04$

$CI = (.1133, .2701)$

0 is not in this CI so $\beta_{ln\,sales}$ is statistically signifigant @ 5% signifigance level.

5. $H_0: \beta_{\ln(mktra)} = \beta_{age} = 0$ (4)

$H_1: H_0$ is not true

F-Test using Model 1 & Model 2 (4)

$$F = \frac{(R^2_U - R^2_R)/q}{(1-R^2_U)/(n-k-1)}$$

$q = 2$

$R^2_U = .3484$

$R^2_R = .3343$

$n = 177$

$k = 5$

$$F = \frac{.0141/2}{.6516/171} = \frac{.00705}{.003811}$$ $F = 1.85014$ (4)

$c = 2.99$ cannot reject null @ 5%

6. Test on no regression in Models 1 & 2

Model 1: $$F = \frac{R^2/q}{(1-R^2)/(n-k-1)} = \frac{.3484/5}{.6517/171} = 18.2834$$ (4)

Fail to accept H_0 @ 5% level

H_0: no regression (2)

H_1: H_0 is false

Model 2: $$F = \frac{R^2/q}{(1-R^2)/(n-k-1)} = \frac{.3343/3}{.6657/173} = 28.9589$$ (4)

Fail to accept H_0 @ 5% level

H_0: no regression

H_1: H_0 is false (2)

7. $H_0: \beta_{comten} + \beta_{ceoten} = 0$

let $\beta_{comten} = -\beta_{ceoten}$ and rewrite regression as (6)

$$\ln(salary) = \beta_0 + \beta_1 \ln(sales) + \beta_3(X_{ceoten} - X_{comten})$$

There is 1 restriction Use F-test

$H_0: \beta_{comten} + \beta_{ceoten} = 0$ (2) $R^2_U = .3343$

$H_1: \beta_{comten} + \beta_{ceoten} \neq 0$ $R^2_R = .3280$

$$F = \frac{(R^2_U - R^2_R)/q}{(1-R^2_U)/(n-k-1)} = \frac{(.3343 - .3280)/1}{(1-.3343)/(177-4)} = \frac{.0063}{.6657/173}$$

$F = 1.63722$ accept @ 5% level
(2)

8. Compute $\bar{R}^2$ & RSS for models 1 through 3

<u>Model 1</u>: $\bar{R}^2 = 1 - \frac{(1-R^2)(n-1)}{n-k-1} = 1 - \frac{(.6516)(176)}{171} = .3293$ (2)

$RSS = (1-R^2)\,TSS$

$TSS = \sigma_y^2(n-1) \Rightarrow \frac{TSS}{n-1} = \sigma_y^2$

$TSS = .6^2(176)$
$= 63.36$

$RSS = (1-.3484)(63.36) = 41.29$ (2)

<u>Model 2</u>: $\bar{R}^2 = 1 - \frac{(.6657)(176)}{173} = .3228$ (2)

$RSS = (.6657)(63.36) = 42.19$ (2)

<u>Model 3</u>: $\bar{R}^2 = 1 - \frac{(.672)(176)}{174} = .3203$ (2)

$RSS = (.672)(63.36) = 42.58$ (2)

9. Calculate beta coefficients & S.E. for model 2

- $b_{\ln(sales)} = \frac{\sigma_x}{\sigma_y} \beta_{\ln sales} = \frac{1.43}{.6}(.2481) = .5913$ (2)

$s.e.(b_{\ln sales}) = .064826$ (2)

- $b_{comten} = \frac{12.29}{.6}(-.01) = -.2048$ (2)

$s.e.(b_{comten}) = .0676$ (2)

- $b_{ceo} = \frac{7.15}{.6}(.017) = .2026$ (2)

$s.e.(b_{ceo}) = .0667$ (2)

10. Use model 4 to predict mean ln(salary) and construct a 95% CI

predicted mean ln(salary) = intercept of model 4
$= 6.551$ (3)

95% CI is $\hat{\beta}_0 \pm c \cdot s.e.(\hat{\beta}_0)$

$6.551 \pm 1.96 \cdot .0386$

CI is $(6.47534, 6.62666)$ (3)