Question 1

a.) $\beta_1 = 0.9571917$ (logsales → logsalary)

: If sales increase 1 %, salary increase 0.9572 %.

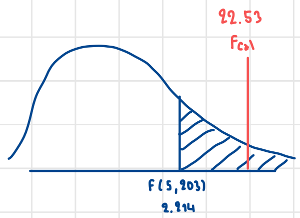
b.) Over All test = F - test

: $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_0 : $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_1 : at least one parameter not equal 0

$\alpha = 0.05$



F_{cri} : 5, 203 = 2.214

F_{cal} : 22.53

∴ The critical F Value of 5 df in the numerator and 203 df in the denominator is 2.214 at 5% level of significance.

$F_{cal} > F_{cri}$: $22.53 > 2.214$

So, reject null hypothesis. There is enough evidence to said that not all parameter is equal to zero or at least one parameter not equal to zero.

b.) Cont.

T-test : sales

$H_0 : \beta_1 = 0$

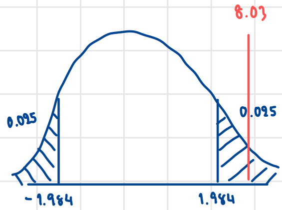
$H_1 : \beta_1 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 209 - 6 = 203$

$t_{cri} = 203$ and $0.025 \rightarrow 1.984$



$$t_{cal} = \frac{\hat{\beta}_1 - \beta_1}{Se_{\beta_1}}$$

$= 8.03$

$\therefore |t_{cal}| > |t_{cri}| : |8.03| > |1.984|$

So, reject null hypothesis that enough evidence to said that logarithm of firms' sale in 1 million USD significant impact to salary at 95% confidence level.

T-test : ROE

$H_0 : \beta_2 = 0$

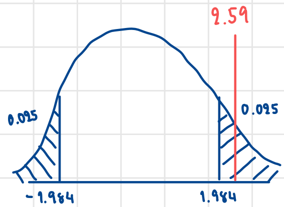
$H_1 : \beta_2 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 209 - 6 = 203$

$t_{cri} = 203$ and $0.025 \rightarrow 1.984$



$$t_{cal} = \frac{\hat{\beta}_2 - \beta_2}{Se_{\beta_2}}$$

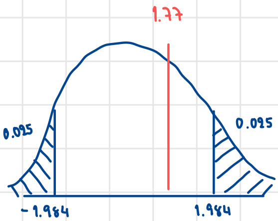
$= 2.59$

$\therefore |t_{cal}| > |t_{cri}| : |2.59| > |1.984|$

So, reject null hypothesis that enough evidence to said that average return on equity for the previous three years impact to salary which significant at 95% confidence level.

b.) Cont.

T-test : Finance



$H_0 : \beta_3 = 0$

$H_1 : \beta_3 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 209 - 6 = 203$

$t_{cri} = 203$ and $0.025 \to 1.984$

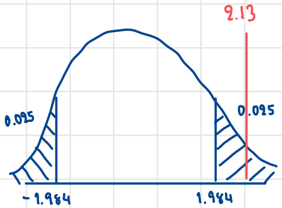
$$t_{cal} = \frac{\hat{\beta}_3 - \beta_3}{Se_{\beta_3}}$$

$= 1.77$

$\therefore |t_{cal}| < |t_{cri}| : |1.77| < |1.984|$

So, fail to reject null hypothesis that enough evidence to said that working in finance sectors have no significant impact on salary with 95% confident level.

T-test : Consprod



$H_0 : \beta_4 = 0$

$H_1 : \beta_4 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 209 - 6 = 203$

$t_{cri} = 203$ and $0.025 \to 1.984$

$$t_{cal} = \frac{\hat{\beta}_4 - \beta_4}{Se_{\beta_4}}$$

$= 2.13$

$\therefore |t_{cal}| > |t_{cri}| : |2.13| > |1.984|$

So, reject null hypothesis that enough evidence to said that the significant impact of consumer product industry to the salary with 95% confidence level.

b.) Cont.

T-test : Utility

$H_0 : \beta_5 = 0$

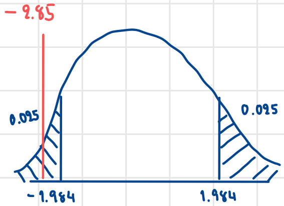
$H_1 : \beta_5 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 209 - 6 = 203$

t_{cri} = 203 and 0.025 → 1.984



$$t_{cal} = \frac{\hat{\beta}_5 - \beta_5}{Se\beta_5}$$

$$= -2.85$$

$\therefore \; |t_{cal}| > |t_{cri}| \; : \; |-2.85| > |1.984|$

So, reject null hypothesis that enough evidence to said that the significant impact of utility industry to the salary with 95% confident level.

c.) $\log(Salary) = \beta_0 + \beta_1 \log(Sales_i) + \beta_2 ROE_i + \beta_3 finance_i + \beta_4 consprod_i + \beta_5 utility + u_i$

$= 4.588107 + 0.2571917 Sales + 0.0111517 ROE + 0.157956 \cancel{finance} + 0.1808917 \cancel{consprod} + (-0.2830015 utility) + \cancel{u_i}$

$\alpha_1 = \alpha_2 = \alpha_3 =$ transport : $\log(Salary) = 4.588107 + 0.2571917 Sales + 0.0111517 ROE$

$\alpha_1 = \alpha_2 = 0$, $\alpha_3 = 1$ = utility : $\log(Salary) = 4.588107 + 0.2571917 Sales + 0.0111517 ROE - 0.2830015 \cancel{utility}$

$= 4.3050995 + 0.2571917 Sales + 0.0111517 ROE$

$\therefore$ Average means of salary transport more than 0.2830015 to utility.

d.) Dummy variable trap happen, We do not fall in to it.
There is no longer perfect Collinerity.

e.) We need to check Dummy variable which that have interaction relationship to each others or not.

Question 2

a.) T-Test

$H_0 : \beta_1 = 0$

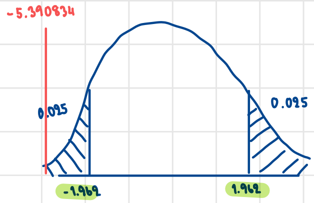
$H_1 : \beta_1 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 1,191 - 3 = 1,188$

$t_{cri} = 1,188$ and $0.025 \rightarrow 1.962$



$$t = \frac{\hat{\beta}_1 - \beta_1}{Se_{\beta_1}}$$

$$= \frac{-0.5876985 - 0}{0.1090181}$$

$$= -5.39083$$

$\therefore \ |t_{cal}| > |t_{cri}| \ : \ |-5.39081| > |1.962|$

So, reject null hypothesis that enough evidence to said that average number of cigarettes the mother smoked per day while pregant impact to infant birth weight at 95% confidence level.

b.) Note : $t_{\frac{\alpha}{2}} = t_{\frac{0.01}{2}} = t_{0.005,\ df = 1188} = 2.581$

$$\hat{\beta}_2 - t_{\frac{\alpha}{2}} Se(\hat{\beta}_2) \leq \beta_2 \leq \hat{\beta}_2 + t_{\frac{\alpha}{2}} Se(\hat{\beta}_2)$$

$$0.0624684 - 2.581(0.0324438) \leq \beta_2 \leq 0.0624684 + 2.581(0.0324438)$$

$$-0.02126905 \leq \beta_2 \leq 0.14620585$$

c.)

T-Test

$H_0 : \beta_1 = 0$

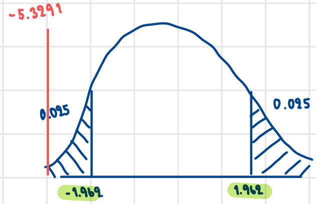
$H_1 : \beta_1 \neq 0$

$\alpha = 0.05$

$df : n - k$

$= 1191 - 5 = 1186$

$t_{cri} = 1,186$ and $0.025 \rightarrow 1.962$



$$t_{cal} = \frac{\hat{\beta}_1 - \beta_1}{Se_{\beta_1}}$$

$$= \frac{-0.5894954 - 0}{0.1106172}$$

$$= -5.329147773 \approx -5.3291$$

$\therefore |t_{cal}| > |t_{cri}| : |5.3291| > |1.962|$

So, reject null hypothesis that enough evidence to said that average number of cigarettes the mother smoked per day while pregnant impact to infant birth weight at 95% confidence level.

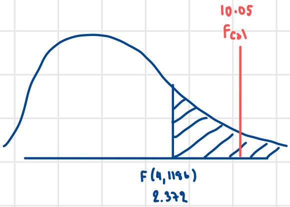
d.) Over All test

$: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

$H_0 : \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

H_1 : at least one parameter not equal 0

$\alpha = 0.05$



$F_{cri} : 4, 1186 = 2.372$

From 2.2 STATA Output

$F_{cal} : 10.05$

∴ The critical F value of 4 df in the numerator and 1186 df in the denominator is 2.372 (5% level of significance)

$F_{cal} > F_{cri}$ $(10.05 > 2.372)$

so reject null hypothesis. There is enough evidence to said that not all parameter is equal to zero.

T-Test from Model 2.2 : cigs

$H_0 : \beta_1 = 0$

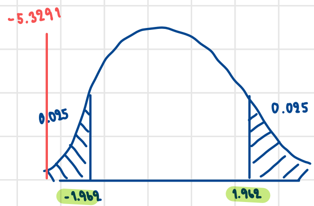
$H_1 : \beta_1 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 1191 - 5 = 1186$

t_{cri} : 1,186 and 0.025 → 1.962



$$t_{cal} = \frac{\hat{\beta}_1 - \beta_1}{se_{\beta_1}}$$

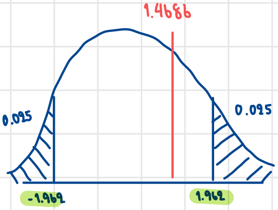
$$= \frac{-0.5894954 - 0}{0.1106172}$$

$$= -5.329147773 \approx -5.3291$$

∴ $|t_{cal}| > |t_{cri}|$: $|5.3291| > |1.962|$

So, reject null hypothesis that enough evidence to said that average number of cigarettes the mother smoked per day while pregnant impact to infant birth weight at 95% confidence level.

T-Test from Model 2.2 : faminc.



$H_0 : \beta_2 = 0$

$H_1 : \beta_2 \neq 0$

$\alpha = 0.05$

df = n - k

= 1,191 - 5 = 1,186

t_{cri} = 1,186 and 0.025 → 1.962

$$t_{cal} = \frac{\hat{\beta}_2 - \beta_2}{se_{\beta_2}}$$

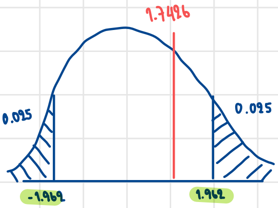
$$= \frac{0.0538254 - 0}{0.0366502}$$

$$= 1.468625001 \approx 1.4686$$

∴ $|t_{cal}| > |t_{cri}|$: $|1.4686| < |1.962|$

So, fail to reject null hypothesis that not enough evidence to said that 1988 family income, $ 1000s impact to birth weight at 95 % confidence level.

T-Test from Model 2.2 : fatheduc.



$H_0 : \beta_3 = 0$

$H_1 : \beta_3 \neq 0$

$\alpha = 0.05$

df = n - k

= 1,191 - 5 = 1,186

t_{cri} = 1,186 and 0.025 → 1.962

$$t_{cal} = \frac{\hat{\beta}_3 - \beta_3}{se_{\beta_3}}$$

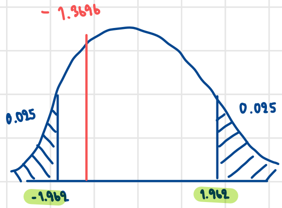
$$= \frac{0.4936695 - 0}{0.2832896}$$

$$= 1.742631922 \approx 1.7426$$

∴ $|t_{cal}| > |t_{cri}|$: $|1.7426| < |1.962|$

So, fail to reject null hypothesis that not enough evidence to said that father's years of education impact to birth weight at 95 % confidence level.

T-Test from Model 2.2 : motheduc



$H_0 : \beta_4 = 0$

$H_1 : \beta_4 \neq 0$

$\alpha = 0.05$

$df = n - k$

$= 1,191 - 5 = 1,186$

$t_{cri} = 1,186$ and $0.025 \rightarrow 1.962$

$$t_{cal} = \frac{\hat{\beta}_4 - \beta_4}{se_{\beta_4}}$$

$$= \frac{-0.4379234 - 0}{0.3197377}$$

$$= -1.369637296 \approx -1.3696$$

$\therefore \ |t_{cal}| < |t_{cri}| \ : \ |-1.3696| < |1.962|$

So, fail to reject null hypothesis that not enough evidence to said that mother's years of education impact to birth weight at 95 % confidence level.

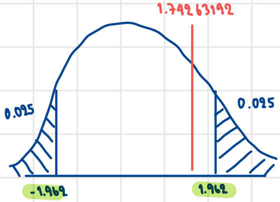
e.)

T-Test : Father

$H_0 : \beta_3 = 0$

$H_1 : \beta_3 \neq 0$

$\alpha = 0.025$



$df = n - k$

$= 1{,}191 - 4 = 1{,}186$

t_{cri} : 1,186 and 0.025 → 1.962

$$t_{cal} = \frac{\hat{\beta}_3 - \beta_3}{se_{\beta_3}}$$

$$= \frac{0.4936695 - 0}{0.2832896} = 1.74263192 \approx 1.7426$$

∴ $|t_{cal}| < |t_{cri}|$: $|1.7426| < |1.962|$

The critical T-Test for 1186 df is -1.962 and 1.962

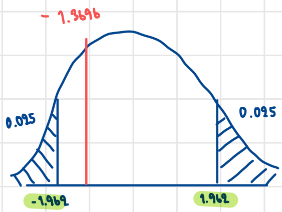
So, fail to reject null hypothesis. There is not enough evidence to said that father's years of education impact to birth weight at 95% confidence level.

T-Test : motheduc

$H_0 : \beta_4 = 0$

$H_1 : \beta_4 \neq 0$

$\alpha = 0.05$



$df = n - k$

$= 1{,}191 - 5 = 1{,}186$

t_{cri} : 1,186 and 0.025 → 1.962

$$t_{cal} = \frac{\hat{\beta}_4 - \beta_4}{se_{\beta_4}}$$

$$= \frac{-0.4379234 - 0}{0.3197377}$$

$$= -1.369637296 \approx -1.3696$$

∴ $|t_{cal}| < |t_{cri}|$: $|-1.3696| < |1.962|$

So, fail to reject null hypothesis that not enough evidence to said that mother's years of education impact to birth weight at 95% confidence level.

Question 3

Source	SS	df	MS
Model	ESS 35.3398	$k-1$ 6	$ESS/(k-1)$ = 5.88997
Residual	RSS 421×0.44... = 187.9876	$n-k$ 421	.446526442 $RSS/(n-k)$
Total	TSS 223.327441	$(k-1)+(n-k)$ 427	6.3365

n , k=7

Number of obs	=	428
F(6 , 421)	=	13.19
Prob > F	=	0.0000
R-squared	=	0.1582 ติดลบไม่ได้
Adj R-squared	=	0.1462 ติดลบได้
Root MSE	=	.66823

lwage	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
exper	.039819	.013393	2.97	0.003	.0134936	.0661444
expersq	-.0007812	.0004022	-1.94	0.053	-.0015718	9.37e-06
educ	.1078319	.0144021	7.49	0.000	.079523	.1361409
age	-.0014653	.0052925	-0.28	0.782	-.0118682	.0089377
kidslt6	-.0607106	.0887626	-0.68	0.494	-.2351836	.1137625
kidsge6	-.014591	.0278981	-0.52	0.601	-.069428	.0402459
_cons	-.4209078	.316905	-1.33	0.185	-1.043821	.2020053

a.) $df_1 = k-1 = 6$

$df_2 = n-k = 421$

b.) $ESS = 35.3398$

$RSS = 421 \times 0.446526442 = 187.9876321$

c.)
$$\bar{R}^2 = 1-(1-R^2)\left(\frac{n-1}{n-k}\right)$$
$$= 1-(1-0.1582)\left(\frac{428-1}{428-7}\right)$$
$$= 1-(0.8418)(1.01425)$$
$$= 0.1462$$

d.) Accept Model when $F_{cal} > F_{cri}$

$$F_{cal} > 3.84$$
$$\frac{R^2/(k-1)}{(1-R^2)/(n-k)} > 3.84$$
$$\frac{R^2/(7-1)}{(1-R^2)/(428-7)} > 3.84$$
$$\frac{R^2/6}{(1-R^2)(421)} > 3.84$$

$$\frac{R^2}{1-R^2} > \frac{3.84(6)}{421}$$
$$\frac{R^2}{1-R^2} > 0.0547268$$
$$R^2 > 0.0547268 - 0.0547268R^2$$
$$1.0547268R^2 > 0.0547268$$
$$R^2 > 0.051887$$

e.) As from the result, It can understand that age of individuals have no longer effect any relationship with the salary since the salary depends on skills. Therefore, all of age have no significant to salary.