Maria Lashina BEC192

Problem 1

$\beta_1 = 2\beta_4$

$\beta_2 = \beta_3$

$Metrics_i = \beta_0 + \beta_1 Maths_i + \beta_2 Linear_i + \beta_3 Prob_i + \beta_4 Stati + \varepsilon_i$

~~HR~~: Unrestricted – that in the problem

Restricted: $Metrics_i = \beta_0 + 2\beta_4 Maths_i + \beta_2 Linear Algebra_i + \beta_2 Prob Theory_i + 2\beta_4 Statistics + \varepsilon_i =$

$= \beta_0 + 2\beta_4 (Maths_i + Stat_i) + \beta_2 (Linear_i + Prob_i) + \varepsilon_i$

H_0: $\beta_1 - 2\beta_4 = 0$ and $\beta_2 - \beta_3 = 0$

H_1: either $\beta_1 - 2\beta_4$ or $\beta_2 - \beta_3 \neq 0$, or both $\neq 0$

$$F(2, N-5) = \frac{(RSS_R - RSS_{UR})/2}{RSS_U/(N-5)}$$

2 – num of restrictions; $N-5$ – num of coef in unrestricted model

Problem 2.

these two are equivalent (where SPRING, SUMMER, AUTUMN are dummies for the season)

$COFFEE = \beta_0 + \beta_1 \cdot SEASON \cdot INCOME$ ← (RSS_2)

$COFFEE = \beta_0 + \beta_1 \cdot INCOME + \beta_1 SPRING\ INCOME + 2\beta_1 SUMMER \cdot INCOME + 3\beta_1 \cdot AUTUMN \cdot INCOME$

β_0 – expenditures on COFFEE if INCOME = 0 (implausible if INCOME = 0 is not included in the sample)

β_1 – ~~added~~ how much more will be spent on COFFEE if INCOME increases for 1 ~~for~~, ~~correcting for SEASON (Example: if SEASON = 2, $\beta_1 = 4$~~

~~$\beta_1 \cdot SEASON$~~ Consequently, COFFEE increases by β_1 if SEASON = 1 (winter), by $\beta_1 \cdot 2$ in spring, $\beta_1 \cdot 3$ in summer and by $\beta_1 \cdot 4$ in autumn for each 1 point increase in INCOME.

Same linear relationship for all seasons: $COFFEE = \beta_0 + \beta_1 INCOME$ (RSS_1)

H_0: SEASON = 1

H_1: SEASON ≠ 1

$$F(3, N-5) = \frac{(RSS_1 - RSS_2)/3}{RSS_2/(N-5)}$$

RSS_1 – without dummies; RSS_2 – with dummies

3 – num of coefs for the dummies; $N-5$ – num of coefs in the model with dummies

Problem 3.

Both mistakes are misspecifying the model: the first model's mistake - omitting a crucial variable, the second one's - adding an unnecessary one. The consequences ~~of~~ the 1st mistake - coefficients will be biased and standard errors are invalid (as well as t, F-tests). The consequences ~~of~~ the 2nd mistake - coefs are not biased but inefficient ($\hat{\sigma}^2$ is larger because of corr between the regressors), st. errors are valid, as well as tests. All in all, the 1st mistake is more dangerous, as the relationship predicted is wrong (coefs are biased), while the 2nd mistake gives that the true relationship, but ~~with pred~~ gives bigger st. errors.

Problem 4.

"Teacher Quality and Learning Outcomes in Kindergarten"

Research question is to determine the effect of the quality of teachers (several observable and unobservable characteristics were used) on the ~~level of education~~, performance in school.

Data: 24 000 students ~~from~~ studying in ~~specific~~ certain schools with certain classes structure in Ecuador