IEBE Assignment

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Question 1

#First, the author imports three R packages.

library(sjPlot)

library(see)

library(performance)

#Then, the author creates a dataframe based on the NervloveData

Data = as.data.frame(NervloveData)

#The author create the model of q1 by the following code

logTC=log(Data$totcost)

logQ=log(Data$output)

logPL=log(Data$plabor)

logPF=log(Data$pfuel)

logPK=log(Data$pkap)

q1model = lm(logTC ~ logQ + logPL + logPF + logPK)

#Then, the author use "tab_model" to make a table of the model

tab_model(q1model)

	costs in 1970, MM USD		
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-3.53	-7.03 – -0.02	**0.049**
log(Data$output)	0.72	0.69 – 0.75	**<0.001**
log(Data$plabor)	0.44	-0.14 – 1.01	0.136
log(Data$pfuel)	0.43	0.23 – 0.62	**<0.001**
log(Data$pkap)	-0.22	-0.89 – 0.45	0.518
Observations	145		
R^2 / R^2 adjusted	0.926 / 0.924		

#Interpret the estimated coefficients in the log-log equation.

#Xi increase by 1 %, Yi change by β1%, coefficients are elasticities

#Output increase by 1 %, Cost change by 0.72%

#Labour increase by 1 %, Cost change by 0.44%

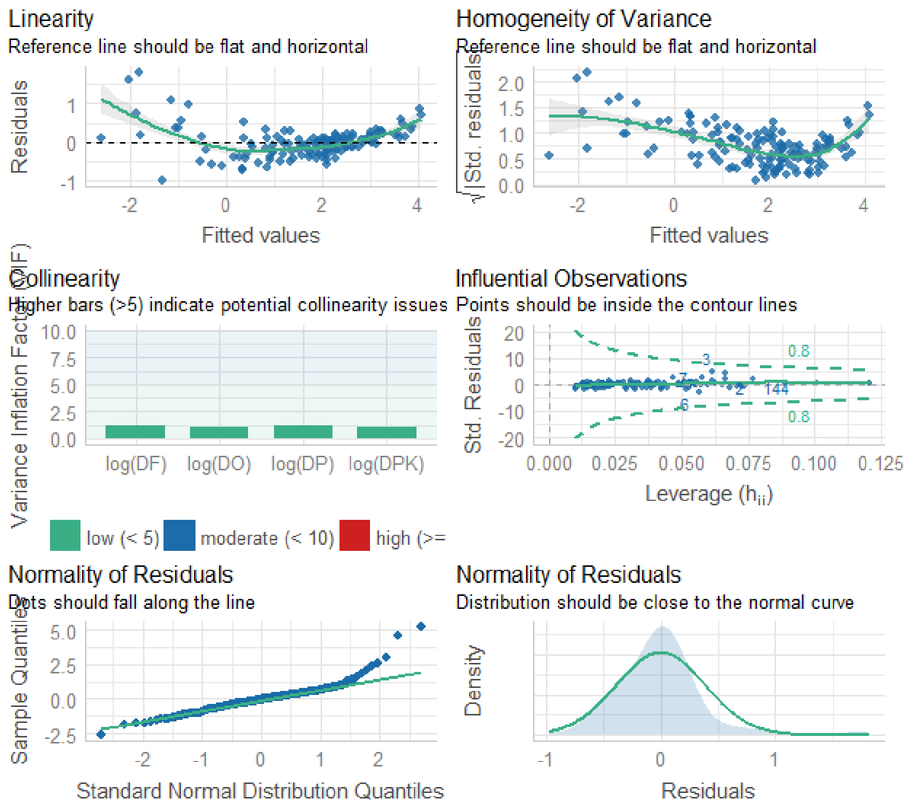
#Fuel increase by 1 %, Cost change by 0.43%

#Capital increase by 1 %, Cost change by -0.22%

#Is the OLS coefficient unbiased?

#Use "check_model" to check its obey to the assumptions

check_model(q1model)



#There are three assumptions needed to be fulfilled for unbias:

#No multicollinearity: fulfilled as no bars higher than 5

#Strict exogeneity: Not fulfilled, the variance of residuals change with the regressors

#Linearity: Not fulfilled as the reference line is not flat nor horizontal.

#Hence, as two out of three assumptions are not fulfilled, this model is biased.

#What they do represent in practice?

#They are elasticities that shows the percentage reaction of the Y to the regressors

Test the coefficients and comment on the obtained results

tab_model(q1model)

#In the output diagram, two predictors statistical meaningfully positive affect the cost

#that logged output ($p < 0.001$) and logged fuel price ($p<0.001$)

#Labor and Capital has a high p-value, hence no evidence to reject the null hypothesis

#that they have no meaningful effect on the dependent variable.

Question 2

#Check the correlations

cor(Data[,2:5])

#Inspecting the correlation between variables

#there are no linear relationships among the variables

#Hence, the model is unlikely to be affected by multicollinearity

vif(q1model)

#The author further verifies this conclusion by this function. As no value is higher than 5, the author concludes that no multiple colinearities

#What does multicollinearity do to your regression?

#Multicollinearity disobeys the assumption that "No linear relationships among the variables". Hence the regressor matrix does not have full ranks. As the calculation of the OLS estimator needs to use X'X, the multicollinearity prevent us from calculating the OLS estimator. However, Multicolinearly does not affect the overall fit.

3.Test again the coefficients by using heteroskedasticity-robust standard errors

4. Test also the homogeneity restriction

linearHypothesis(q1model,"log(DP)+log(DF)+log(DPK)=1")

5.In particular, write the hypothesis in the form Rβ = r and calculate the F-statistics

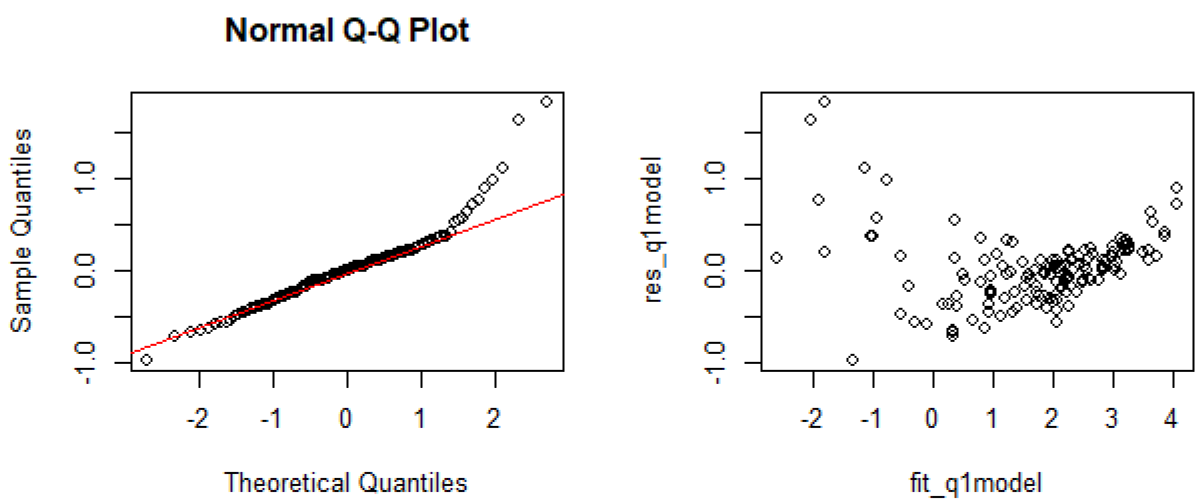
Question 3

 # No linear relationships among the variables:

par(mfrow = c(2 , 2))

fit_q1model <- fitted(q1model)

res_q1model <- residuals(q1model)



What can we learn from these two graphs? Are the OLS assumptions satisfied? In particular, verify the following assumptions:

Strict exogeneity?

Spherical error variance is disobeyed due to the disobey to the homoskedasticity

Fourth moments conditions (no outliers) - (How to check outliers)

Question 4

library(ggplot2)

ggplot(data= NULL, aes(x = logQ, y = res_q1model)) +

geom_point(color = "darkred")

Question 5

q5model = lm(logTC~logQ+I(logQ*logQ)+logPL+logPF+logPK,data=data)

summary(q5model)

fit_q5model = fitted(q5model)

res_q5model = residuals(q5model)

qqnorm(scale(res_q5model, center = TRUE, scale = TRUE)) # are the residuals approximatively Gaussian?

qqline(scale(res_q5model, center = TRUE, scale = TRUE), col="red")

plot(fit_q5model, res_q5model, pch=c(16), lwd=2, # Residuals Vs Fitted

    col=c("black"), xlab="Fitted values", ylab="Residuals",

    main="Residuals Vs Fitted")

abline(0,1, col="red")

Question 6

#first, the author extract the data of five quantiles

q1data = subset(Data, Data$output<quantile(Data$output,0.2))

q2data = subset(Data, Data$output>quantile(Data$output,0.2)&Data$output<quantile(Data$output,0.4))

q3data = subset(Data, Data$output>quantile(Data$output,0.4)&Data$output<quantile(Data$output,0.6))

q4data = subset(Data, Data$output>quantile(Data$output,0.4)&Data$output<quantile(Data$output,0.6))

q5data = subset(Data, Data$output>quantile(Data$output,0.8)&Data$output<quantile(Data$output,1.0))

```
install.packages("stargazer")
library(stargazer)

stargazer(q1data, type = "text", title="Descriptive statistics", digits=1)
stargazer(q2data, type = "text", title="Descriptive statistics", digits=1)
stargazer(q3data, type = "text", title="Descriptive statistics", digits=1)
stargazer(q4data, type = "text", title="Descriptive statistics", digits=1)
stargazer(q5data, type = "text", title="Descriptive statistics", digits=1)
```

Question 7

#Based on the five quantiles, the author constructed five models

```
q7fit1 = lm(log(totcost)~log(output) + I(log(output)*log(output)) + log(plabor) + log(pfuel) + log(pkap), data=q1data)
summary(q7fit1)
q7fit2 = lm(log(totcost)~log(output) + I(log(output)*log(output)) + log(plabor) + log(pfuel) + log(pkap), data=q2data)
summary(q7fit2)
q7fit3 = lm(log(totcost)~log(output) + I(log(output)*log(output)) + log(plabor) + log(pfuel) + log(pkap), data=q3data)
summary(q7fit3)
q7fit4 = lm(log(totcost)~log(output) + I(log(output)*log(output)) + log(plabor) + log(pfuel) + log(pkap), data=q4data)
summary(q7fit4)
q7fit5 = lm(log(totcost)~log(output) + I(log(output)*log(output)) + log(plabor) + log(pfuel) + log(pkap), data=q5data)
summary(q7fit5)
plot(compare_performance(q7fit1, q7fit2, q7fit3, q7fit4,q7fit5))
```