**QUESTION 1: The Long-Term Impact of the Slave Trade**

a) Begin by examining the relevance of Nunn’s instruments:

1. Replicate the first stage results from the first column of Table IV on p.162. Report how you estimated them, and your results

Solution-

First stage. Dependent variable is slave exports, ln(exports/area)

|  |  |  |
| --- | --- | --- |
| **Variable** | **Coefficient** | **Standard error** |
| Atlantic distance | -1.313 | 0.356 |
| Indian distance | -1.095 | 0.379 |
| Saharan distance | -2.434 | 0.823 |
| Red Sea distance | -0.00186 | 0.71 |

The results are produced using linear regression method in R

1. Conduct a statistical test to replicate the reported F statistic of 4.55 for these first-stage results, shown in Table IV

Solution-

The F-statistic is calculated by –

Mean sum of square explained divided by Mean residual sum of square i.e F –test

1. Using the results from (i) and (ii), how relevant do you think that the instruments are? Explain your answer

Solution- The instruments in the model have significant contribution. Also, instruments such as Atlantic distance, Indian distance, Saharan distance are significant excluding Red Sea distance

b) Do you think that the instruments can be considered to be as-if randomly assigned? Explain your answer:

Solution-

c) Replicate the second-stage coefficients and standard errors for ln(exports/area) in columns (1), (2) and (3) of Table IV on p.162. Report how you estimated them, and your results.

Solution-

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Column (1) | Column (2) | Column (3) |
| ln(exports/area) | -0.208 (0.0485) | -0.247 (0.051) | -0.2137 (0.0915) |
| Colonizer effect | No | Yes | Yes |
| Geography control | No | No | Yes |
| Restricted sample | No | No | No |

d) Why do you think that Nunn estimated the additional models in columns (2) and (3) of Table IV that include colonizer fixed effects and geographic controls?

Solution- Nunn estimated the additional models to include control variables such as colonizer and geographic controls in the model. The export areas are impacted by the colonizer fixed effects, which are indicator variables for the identity of the colonizer at the time of independence

e) Now, you will re-do Nunn’s analysis of the impact of slavery on GDP with the Wald

Estimator and binary variables. Use the single binary instrumental variable **low\_distance**, the

binary treatment variable **high\_slavery**, and the outcome variable ln\_realgdp2000

1. Explain, in this case, what type of country is a complier and what type of country is an always-taker

Solution-

Countries with low\_distance value as 1 and high\_slavery as 0 are compliers. Countries with low\_distance value as 1 and high\_slavery as 1 are compliers

Solution-

**QUESTION 2: An Experiment with Missing Data**

a) Using two t-tests, assess whether units in the experiment can be considered to be

missing at random. Explain your answer.

Solution-

Two sample t-test was conducted to assess whether units in the experiment can be considered missing at random. Here for this, ‘Potential outcome under treatment’ variable was considered with ‘Missing’ and ‘Otherwise’ as two groups.

Therefore, the t-test thus conducted, concluded that experiment can be considered to be missing at random since there is a significant difference between the two groups

b) Calculate the true average treatment effect for all units regardless of missingness, and the average treatment effect for always-reporters. Do these two treatment effects differ?

Solution-

The true average treatment effect is – 7.8253

And average treatment effect for always reporters is – 6.89

Yes, there is difference in the two treatment effects

c) Using appropriate tests, assess whether the units in this experiment can be considered

to be missing independently of potential outcomes given *x*. Explain your answer

Solution-

Chi-square test is used to test the units missing in the experiment is independent of potential outcomes given x.

This test resulted in p-value of 2.545e-12, which is significantly less than 0.05. Therefore, we conclude that units missing in the experiment are not independent of potential outcomes given x

d) Using only non-missing data, calculate a weighted average treatment effect that reweights missing units appropriately, given their value of *x.* How does it compare to the two average treatment effects that you calculated in (b)?

Solution-

Weighted average treatment effects- 6.096

The true average treatment effect is – 7.8253

And average treatment effect for always reporters is – 6.89

Here, weighted average treatment effect is close to average treatment effect for always reporters

**Annexure**

**R Code**

library(dplyr)

load('D:\\Assignment\\Kjno\\nunn.Rda')

nunn$colonial\_power<- factor(nunn$colonial\_power)

#Question 1

#a) Examining Nunn's instrument

#1) Replicate the first stage results from the first column of Table IV on p.162. Report how you estimated them, and your results

model\_1<-lm(ln\_export\_area~atlantic\_dist+indian\_dist+saharan\_dist+redsea\_dist,data=nunn)

summary(model\_1)

#Fitted values for ln\_export\_area

exports\_area\_hat<- fitted.values(model\_1)

#c) Replicate the second-stage coefficients and standard errors for ln(exports/area) in

#columns (1), (2) and (3) of Table IV on p.162. Report how you estimated them, and your results

model2<- lm(ln\_realgdp2000~exports\_area\_hat,data=nunn)

summary(model2)

model\_col<- lm(ln\_realgdp2000~exports\_area\_hat+colonial\_power,data=nunn)

summary(model\_col)

model\_geo<- lm(ln\_realgdp2000~exports\_area\_hat+colonial\_power+equator\_dist+longitude+

rain\_min+humid\_max+low\_temp+ln\_coastline\_area,data=nunn)

summary(model\_geo)

#e) Now, you will re-do Nunn’s analysis of the impact of slavery on GDP with the Wald

#Estimator and binary variables. Use the single binary instrumental variable low\_distance, the

#binary treatment variable high\_slavery, and the outcome variable ln\_realgdp2000.

#i) Explain, in this case, what type of country is a complier and what type of country is an always-taker

nunn$cat<- with(nunn,ifelse(low\_distance==1 & high\_slavery==0, 'Complier',

ifelse(low\_distance==1 & high\_slavery==1, 'Always taker', 'other')))

itt\_w\_sum <- nunn%>%filter(cat %in% c('Complier','Always taker'))%>%summarise(n=n())

itt\_w\_num <- nunn%>%filter(cat %in% c('Complier','Always taker') & low\_distance==1 )%>%summarise(n=n())

#Question 2 : An Experiment with Missing Data

load('D:\\Assignment\\Kjno\\experiment\_essay2.Rda')

#Answer a

t.test(subset(e,r==1)[,1],subset(e,r==0)[,1], paired = F,var.equal = F)

t.test(subset(e,r==1)[,2],subset(e,r==0)[,2], paired = F,var.equal = F)

#Answer b

average\_treatment\_effect<- mean(e[,1])-mean(e[,2])

average\_treatment\_always<- mean(subset(e,r==0)[,1])-mean(subset(e,r==0)[,2])

#Answer c

chisq.test(e$r,e$x)

table(e$r,e$x)

#Answer d

weighted\_mean<- weighted.mean(subset(e,r==0)[,1]-subset(e,r==0)[,2],subset(e,r==0)[,4])

weighted\_mean