Homework 4

Subrata Paul

9/16/2020

Problem 1

Describe `UN11` data in the `alr4` package in your own words. You can get details using `?UN11` and googling things. Provide descriptive statistics and plots with your description.

Problem 2

Using the `UN11` data set in the `alr4` package:

a. Fit a simple linear regression of $y = \log(\text{fertility})$ on x=`pctUrban`.

```
data(UN11, package = 'alr4')
lm(log(fertility) ~ pctUrban, data = UN11)
```

```
##
## Call:
## lm(formula = log(fertility) ~ pctUrban, data = UN11)
##
## Coefficients:
## (Intercept)     pctUrban
##     1.50096     -0.01016
```

b. Provide the equation for the fitted model.

$$\hat{E}(\log(\text{fertility})|\text{pctUrban}) = 1.5 - 0.01\text{pctUrban}$$

c. Use the model fit in a. to provide an interpretation of the association between `pctUrban` and `fertility` in the context of the problem.

For members of the United Nations, a 1 percent increase in the percentage of the population living in Urban regions is associated with an expected decrease in the number of children per woman by about 1% [the multiplicative effect is about $\exp(-0.01) \approx 0.99$].

Problem 3

Fit the regression of $y = \log(\text{fertility})$ on $x_1 = \log(\text{ppgdp})$ and $x_2 = \text{lifeExpF}$.

```
lm(log(fertility) ~ log(ppgdp) + lifeExpF, data = UN11)
```

```
##
## Call:
## lm(formula = log(fertility) ~ log(ppgdp) + lifeExpF, data = UN11)
##
## Coefficients:
## (Intercept)   log(ppgdp)     lifeExpF
##     3.50736     -0.06544     -0.02824
```

a. What is the equation for the fitted model?

$$\hat{E}\left[\log(\text{fertility})|\text{ppgdp, lifeExpF}\right] = 3.5 - 0.065\log(\text{ppgdp}) - 0.03(\text{lifeExpF})$$

b. If we increase `ppgdp` by 25%, what is the expected decrease in fertility?

The mean response should change by approximately a multiplicative effect of $\exp[-0.065 \log 1.25] = 1.25^{-0.065} = 0.986$. Thus, the fertility changes by about 100(0.986-1) = -1.4%.

c. Using your computation from part b (i.e., for a 25% increase in `ppgdp`), provide an interpretation of the association between `ppgdp` and `fertility` in the context of the problem.

For members of the United Nations, a 25% increase in the per capita gross domestic product in US dollars is associated with an expected decrease in the number of children per woman of about 1.4%, assuming average life expectancy doesn't change.