Example 1-1

September 12, 2020

[ ]:
```
# First we need to install the following packages and libraries
install.packages("AER")
install.packages("zoo")
install.packages("plm")

# "plm" stands for pooled linear model and "lmtest" stands for linear model test
library("plm")
library("lmtest")
```

[2]:
```
##---------------------------------Block 1---------------------------------

#### Example 1-1 ####

## ------------------------------------------------------------------------

# Load the data
data("Fatalities", package="AER")

# add the fatality rate (frate) to the data set
# frate is definited as the number of traffic accidents per 10,000 people␣
 ↪living in a state in a specific year
Fatalities$frate <- with(Fatalities, fatal / pop * 10000)

# create a formula (fm) to be used in our linear model.
# formula takes on the format Y~X, where Y is the dependent variable and X is␣
 ↪the independent variable
fm <- frate ~ beertax

## ------------------------------------------------------------------------

# mod82 is the linear model of frate on beertax for the year of 1982
mod82 <- lm(fm, Fatalities, subset = year == 1982)

# summarizes the residuals of our linear model and reports the coefficients,␣
 ↪standard errors, etc.
summary(mod82)
```

```
Call:
```

```
lm(formula = fm, data = Fatalities, subset = year == 1982)

Residuals:
    Min      1Q  Median      3Q     Max
-0.9356 -0.4480 -0.1068  0.2295  2.1716

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   2.0104     0.1391  14.455   <2e-16 ***
beertax       0.1485     0.1884   0.788    0.435
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.6705 on 46 degrees of freedom
Multiple R-squared:  0.01332,Adjusted R-squared:  -0.008126
F-statistic: 0.6212 on 1 and 46 DF,  p-value: 0.4347
```

[3]:
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##---------------------------------Block 2---------------------------------

# mod88 is the linear model of frate on beertax for the year of 1988
mod88 <- update(mod82, subset = year == 1988)

# coeftest reports the coefficients, standard errors, etc. of the linear model
# and also reports the significance levels of the coefficients
coeftest(mod88)
```

```
t test of coefficients:

            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.85907    0.10599  17.540   <2e-16 ***
beertax      0.43875    0.16445   2.668   0.0105 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[4]:
```
##---------------------------------Block 3---------------------------------

#poolmod is the pooled linear model specification of frate on beertax
poolmod <- plm(fm, Fatalities, model="pooling")
coeftest(poolmod)
```

```
t test of coefficients:

            Estimate Std. Error t value  Pr(>|t|)
(Intercept) 1.853308   0.043567 42.5391 < 2.2e-16 ***
```

```
beertax     0.364605   0.062170  5.8647 1.082e-08 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[5]:
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##---------------------------------Block 4---------------------------------

# dmod is the differenced linear model of frate on beertax (5 year differences)
dmod <- plm(diff(frate, 5) ~ diff(beertax, 5), Fatalities, model="pooling")

# coef() reports the coefficients of interest, but does not test for␣
 ↪significance
coef(dmod)
```

(Intercept) -0.025242482061173 **diff(beertax, 5)** -0.955543848978433

[6]:
```
##---------------------------------Block 5---------------------------------

# ldsvmod is the least squares dummy variable model.
lsdv.fm <- update(fm, . ~ . + state - 1)
lsdvmod <- lm(lsdv.fm, Fatalities)
coef(lsdvmod)[1]
```

beertax: -0.655873722150432

[7]:
```
##---------------------------------Block 6---------------------------------

# femod is the fixed effects model. (Fixed effects is the default of the plm␣
 ↪function)
femod <- plm(fm, Fatalities)
coeftest(femod)
```

```
t test of coefficients:

        Estimate Std. Error t value Pr(>|t|)
beertax -0.65587    0.18785 -3.4915 0.000556 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```