Example 1-3

September 12, 2020

```
[ ]: # install the following packages and library (if not already installed)
     install.packages("AER")
     install.packages("zoo")
     install.packages("plm")
     library("plm")

     # import the data (if not already imported)
     data("Fatalities", package="AER")

     # add the fatality rate (frate) to the data set (if not already done)
     # create the following formula (if not already created)
     Fatalities$frate <- with(Fatalities, fatal / pop * 10000)
     fm <- frate ~ beertax
```

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

     #### Example 1-3 ####

     ## ----------------------------------------------------------------------
     # create your "y" vector
     y <- Fatalities$frate

     # create your "X" matrix
     X <- cbind(1, Fatalities$beertax)

     # set beta hat = (X'X)^-1 X'y
     beta.hat <- solve(crossprod(X), crossprod(X,y))

     ## ----------------------------------------------------------------------
     # display the beta hat vector
     beta.hat
```

    1.8533079
    0.3646054

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

     # mod is the linear model of frate on beertax
```

```
mod <- lm(frate ~ beertax, Fatalities)
coef(mod)
```

(Intercept) 1.85330786038773 **beertax** 0.364605440367742

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

# least squares dummy variable model
LSDVmod <- lm(frate ~ beertax + state - 1, Fatalities)
coef(LSDVmod)["beertax"]
```

beertax: -0.65587372215043

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

# attach() brings the data to the user level.
attach(Fatalities)

#frate.tilde and beertax.tilde are time-demeaned measures for frate and beertax
frate.tilde <- frate - rep(tapply(frate, state, mean),
                           each = length(unique(year)))
beertax.tilde <- beertax - rep(tapply(beertax, state, mean),
                               each = length(unique(year)))

# linear model for the time-demeaned frate on the time-demeaned beertax
lm(frate.tilde ~ beertax.tilde - 1)

# detach() reverses the attach() function
detach(Fatalities)

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

# summary returns the residuals, coefficients, and significance level of the↲
 ↪coefficients
summary(plm(fm, Fatalities))
```

```
Call:
lm(formula = frate.tilde ~ beertax.tilde - 1)

Coefficients:
beertax.tilde
      -0.6559



Oneway (individual) effect Within Model

Call:
```

```
plm(formula = fm, data = Fatalities)

Balanced Panel: n = 48, T = 7, N = 336

Residuals:
      Min.    1st Qu.     Median    3rd Qu.       Max.
-0.5869619 -0.0828376 -0.0012701  0.0795454  0.8977960

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

Total Sum of Squares:    10.785
Residual Sum of Squares: 10.345
R-Squared:      0.040745
Adj. R-Squared: -0.11969
F-statistic: 12.1904 on 1 and 287 DF, p-value: 0.00055597
```