Econometrics-Damodar N. Gujarati / Chapter 16

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Panel Data Regression Model

$$C_{it} = \beta_1 + \beta_2 Q_{it} + \beta_3 PF_{it} + \beta_4 LF_{it} + u_{it} \quad (16.3.1)$$
$$i = 1, 2 \ldots, 6$$
$$t = 1, 2, \ldots, 15$$

Pooled OLS Regression

```
options(scipen = 999)

library(gujarati)

fix(Table16_1)

library(dynlm)

library(lmtest)

library(sandwich)

library(stargazer)

library(plm)

pdata.frame(Table16_1)

MODEL1 = plm(Table16_1$C ~ Table16_1$Q + Table16_1$PF + Table16_1$LF,data = Table16_1,
             index = c("T"),
                    model = "pooling")

summary(MODEL1)
```

The Fixed Effect Least-Squares Dummy Variable (LSDV) Model

```
library(gplots)

coplot(log(Table16_1$C)~Table16_1$Q|Table16_1$I ,data = Table16_1,xlab = "Output",
       ylab = "Total cost",type ="b")


plotmeans(log(Table16_1$C) ~ Table16_1$I, main="Heterogeineity across Airlines",
          xlab = "Output",
       ylab = "Total cost",data=Table16_1)
```

```
lin = lm(log(Table16_1$C) ~ Table16_1$Q)
quad =  lm(log(Table16_1$C) ~ Table16_1$Q+ I(Table16_1$Q^2))

plot(Table16_1$Q, log(Table16_1$C),
     col  = "steelblue",
     pch = 20,
     xlab = "Output",
     ylab = "Total Cost",
     )


abline(lin, col = "black", lwd = 2)

order_id <- order(Table16_1$Q)

lines(x = Table16_1$Q[order_id],
      y = fitted(quad)[order_id],
      col = "red",
      lwd = 2)
```

```
MODEL2 = plm(Table16_1$C ~ Table16_1$Q + Table16_1$PF + Table16_1$LF +
               factor(Table16_1$I) ,data = Table16_1,
               index = c("T"),
               model = "pooling")
summary(MODEL2)

library(car)

yhat = fitted(MODEL2)

scatterplot(yhat ~ Table16_1$Q|Table16_1$I, boxplots=FALSE, xlab="x1"
            , ylab="yhat",smooth=FALSE)

abline(lm(Table16_1$C ~ Table16_1$Q),lwd=3, col="red")
```

First-Difference Method

```
MODEL3 = plm(Table16_1$C ~ Table16_1$Q + Table16_1$PF + Table16_1$LF +
               factor(Table16_1$I) ,data = Table16_1,
               index = c("T"),
               model = "fd")
summary(MODEL3)
```

$$TC_{it} = \beta_1 + \beta_2 Q_{it} + \beta_3 PF_{it} + \beta_4 LF_{it} + w_{it} \qquad \text{(16.6.3 and 16.6.5)}$$

$$\text{where} \quad w_i = \epsilon_i + u_{it}$$

$$\epsilon \sim \mathcal{N}(0, \sigma_\epsilon^2)$$

$$u_{it} \sim \mathcal{N}(0, \sigma_u^2)$$

The correlation coefficient is: (16.6.8)

$$\rho = \text{corr}(w_{it}, w_{is}) = \frac{\sigma_\epsilon^2}{\sigma_\epsilon^2 + \sigma_u^2} \; ; t \neq s$$

```
MODEL4 = plm(Table16_1$C ~ Table16_1$Q + Table16_1$PF + Table16_1$LF,
                data = Table16_1,
                index = c("T","I"),
                model = "random")
summary(MODEL4)

phtest(MODEL2, MODEL4)

plmtest(MODEL2, c("time"), type=("bp"))
```

A useful website: https://www.princeton.edu/~otorres/Panel101R.pdf