# Example 5-15

September 12, 2020

[ ]:
```
# install the following packages and library
install.packages("pder")
install.packages("plm")

library("plm")
library("lmtest")

# import the data
data("RDSpillovers", package = "pder")
```

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

#### Example 5-15 ####

## ------------------------------------------------------------------------
fm <- lny ~ lnl + lnk + lnrd

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

# generalized GLS model
gglsmodehs <- pggls(fm, RDSpillovers, model = "pooling")
coeftest(gglsmodehs)
```

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept) 1.0458937  0.0641596  16.301 < 2.2e-16 ***
lnl         0.5482522  0.0111804  49.037 < 2.2e-16 ***
lnk         0.4376211  0.0138437  31.611 < 2.2e-16 ***
lnrd        0.0854838  0.0054816  15.595 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

# fixed effects generalized GLS model
```

```
feglsmodehs <- pggls(fm, RDSpillovers, model = "within")
coeftest(feglsmodehs)
```

```
t test of coefficients:

     Estimate Std. Error t value  Pr(>|t|)
lnl  0.494234   0.020439 24.1809 < 2.2e-16 ***
lnk  0.492175   0.030748 16.0068 < 2.2e-16 ***
lnrd 0.048952   0.014672  3.3364 0.0008605 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[6]:
```
## ------------------------------------------------------------------------

# Hausman test
phtest(gglsmodehs, feglsmodehs)
```

```
Hausman Test

data:  fm
chisq = 17.685, df = 3, p-value = 0.0005107
alternative hypothesis: one model is inconsistent
```

[7]:
```
##---------------------------------Block 3---------------------------------

# first differenced generalized GLS
fdglsmodehs <- pggls(fm, RDSpillovers, model = "fd")

## ------------------------------------------------------------------------
fee <- resid(feglsmodehs)
dbfee <- data.frame(fee=fee, id=attr(fee, "index")[[1]])
coeftest(plm(fee~lag(fee)+lag(fee,2), dbfee, model = "p", index="id"))
```

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.0109569  0.0012322  8.8920 < 2.2e-16 ***
lag(fee)     1.0774098  0.0192558 55.9524 < 2.2e-16 ***
lag(fee, 2) -0.1451155  0.0188614 -7.6938 2.072e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[8]:
```
##---------------------------------Block 4---------------------------------

# make a data frame of the residuals and then estimate the pooled␣
 ↪autoregressive model
fde <- resid(fdglsmodehs)
dbfde <- data.frame(fde=fde, id=attr(fde, "index")[[1]])
coeftest(plm(fde~lag(fde)+lag(fde,2), dbfde, model = "p", index="id"))
```

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)
(Intercept) 0.00029484 0.00124442  0.2369   0.81273
lag(fde)    0.10233093 0.02085230  4.9074 9.882e-07 ***
lag(fde, 2) 0.04146215 0.01964401  2.1107   0.03491 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[9]:
```
##---------------------------------Block 5---------------------------------

coeftest(fdglsmodehs)
```

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept) 0.0228799  0.0018762 12.1945 < 2.2e-16 ***
lnl         0.6711903  0.0222208 30.2055 < 2.2e-16 ***
lnk         0.1623170  0.0336245  4.8273 1.467e-06 ***
lnrd        0.0096523  0.0156470  0.6169    0.5374
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```