Example 3-2

September 12, 2020

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

[3]:
```r
##---------------------------------Block 1--------------------------------

#### Example 3-2 ####

## ------------------------------------------------------------------------
data("TexasElectr", package = "pder")

# transform prices into logarithms
TexasElectr <- mutate(TexasElectr,
                      pf = log(pfuel / mean(pfuel)),
                      pl = log(plab / mean(plab)) - pf,
                      pk = log(pcap / mean(pcap)) - pf)

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

# transform output into logarithms
TexasElectr <- mutate(TexasElectr, q = log(output / mean(output)))

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

# calculate the total cost of production and factor shares
TexasElectr <- mutate(TexasElectr,
                      C = expfuel + explab + expcap,
                      sl = explab / C,
                      sk = expcap / C,
                      C = log(C / mean(C)) - pf)

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

# compute the squares and interaction terms
TexasElectr <- mutate(TexasElectr,
```

```
                      pll = 1/2 * pl ^ 2,
                      plk = pl * pk,
                      pkk = 1/2 * pk ^ 2,
                      qq = 1/2 * q ^ 2)

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

# equations for total cost and factor shares
cost <- C ~ pl + pk + q + pll + plk + pkk + qq
shlab <- sl ~ pl + pk
shcap <- sk ~ pl + pk

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

# construct a nxk matrix, where n = # restrictions and k = # coefficients
R <- matrix(0, nrow = 6, ncol = 14)
R[1, 2] <- R[2, 3] <- R[3, 5] <- R[4, 6] <- R[5, 6] <- R[6, 7] <- 1
R[1, 9] <- R[2, 12] <- R[3, 10] <- R[4, 11] <- R[5, 13] <- R[6, 14] <- -1
```

[4]:
```
##---------------------------------Block 2---------------------------------

# seemingly unrelated regression (SUR) model.
# restrict.matrix and restrict.rhs specify the restrictions to the model.
# the vector q are the linear constraints of the model

z <- plm(list(cost = C ~ pl + pk + q + pll + plk + pkk + qq,
              shlab = sl ~ pl + pk,
              shcap = sk ~ pl + pk),
         TexasElectr, model = "random",
         restrict.matrix = R)
summary(z)
```

```
Oneway (individual) effect Random Effect Model
   (Swamy-Arora's transformation)
Call:
plm.list(formula = list(cost = C ~ pl + pk + q + pll + plk +
    pkk + qq, shlab = sl ~ pl + pk, shcap = sk ~ pl + pk), data = TexasElectr,
    model = "random", restrict.matrix = R)

Balanced Panel: n = 10, T = 18, N = 180

Effects:

  Estimated standard deviations of the error
          cost    shlab    shcap
id    0.142916 0.024762 0.027021
idios 0.037658 0.019550 0.017535
```

```
  Estimated correlation matrix of the individual effects
          cost   shlab shcap
cost   1.000000       .     .
shlab -0.692590 1.00000     .
shcap -0.096399 0.21048     1

  Estimated correlation matrix of the idiosyncratic effects
          cost   shlab shcap
cost   1.000000       .     .
shlab  0.281336 1.00000     .
shcap -0.076589 0.20379     1

 - cost
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept) -0.2292436  0.0417503 -5.4908 6.235e-08 ***
pl           0.1248358  0.0061426 20.3231 < 2.2e-16 ***
pk           0.3157271  0.0061197 51.5922 < 2.2e-16 ***
q            0.8545183  0.0120021 71.1972 < 2.2e-16 ***
pll          0.1369827  0.0093118 14.7107 < 2.2e-16 ***
plk         -0.0402539  0.0086695 -4.6431 4.340e-06 ***
pkk          0.1988426  0.0083183 23.9043 < 2.2e-16 ***
qq           0.1982146  0.0115011 17.2344 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

 - shlab
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)  0.1248358  0.0061426 20.3231 < 2.2e-16 ***
pl           0.1369827  0.0093118 14.7107 < 2.2e-16 ***
pk          -0.0402539  0.0086695 -4.6431  4.34e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

 - shcap
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)  0.3157271  0.0061197 51.5922 < 2.2e-16 ***
pl          -0.0402539  0.0086695 -4.6431  4.34e-06 ***
pk           0.1988426  0.0083183 23.9043 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```