Example 5-3

September 12, 2020

[ ]:
```
# install the following package and libraries
install.packages("plm")

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

# import the data, create the following formula, and run the pooled OLS model
data("Produc", package = "plm")
fm <- log(gsp) ~ log(pcap) + log(pc) + log(emp) + unemp
plmmod <- plm(fm, Produc, model = "pooling")
```

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

#### Example 5-3 ####

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

# vcovSCC accounts for both spatial correlation in the same time period and
# serial correlation within the same state and across different states as well
coeftest(plmmod, vcov=vcovSCC)
```

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)
(Intercept)  1.6433023  0.1503485 10.9300 < 2.2e-16 ***
log(pcap)    0.1550070  0.0369734  4.1924 3.064e-05 ***
log(pc)      0.3091902  0.0076442 40.4479 < 2.2e-16 ***
log(emp)     0.5939349  0.0387024 15.3462 < 2.2e-16 ***
unemp       -0.0067330  0.0025389 -2.6520  0.008159 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

# vcov allows for double clustering
```

```
coeftest(plmmod, vcov=vcovDC)
```

```
t test of coefficients:

             Estimate Std. Error t value  Pr(>|t|)
(Intercept)  1.643302   0.252047  6.5198 1.237e-10 ***
log(pcap)    0.155007   0.061718  2.5115   0.01221 *
log(pc)      0.309190   0.044957  6.8774 1.217e-11 ***
log(emp)     0.593935   0.070203  8.4603 < 2.2e-16 ***
unemp       -0.006733   0.003330 -2.0219   0.04351 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[5]:
```
##---------------------------------Block 3---------------------------------

# example of double clustering (Thompson 2011) with 4 periods of unweighted␣
 ↪shocks
myvcovDCS <- function(x, maxlag = NULL, ...) {
    w1 <- function(j, maxlag) 1
    VsccL.1 <- vcovSCC(x, maxlag = maxlag, wj = w1, ...)
    Vcx <- vcovHC(x, cluster = "group", method = "arellano", ...)
    VnwL.1 <- vcovSCC(x, maxlag = maxlag, inner = "white", wj = w1, ...)
    return(VsccL.1 + Vcx - VnwL.1)
}
coeftest(plmmod, vcov=function(x) myvcovDCS(x, maxlag = 4))
```

```
t test of coefficients:

              Estimate Std. Error t value  Pr(>|t|)
(Intercept)  1.6433023  0.2769429  5.9337 4.385e-09 ***
log(pcap)    0.1550070  0.0661161  2.3445   0.01929 *
log(pc)      0.3091902  0.0326540  9.4687 < 2.2e-16 ***
log(emp)     0.5939349  0.0724442  8.1985 9.480e-16 ***
unemp       -0.0067330  0.0037458 -1.7975   0.07263 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```