# Examples 10-5 to 10-9

September 11, 2020

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

      library(spData)
      install.packages("spDataLarge")
      library("pder")
      library("plm")
      library("splm")
      library("spdep")
```

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

      #### Example 10-5 ####

      ## -----------------------------------------------------------------------
      data("RiceFarms", package = "splm")
      data("riceww", package = "splm")
      ricelw <- mat2listw(riceww)
      Rice <- pdata.frame(RiceFarms, index = "id")

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

      # SEM model with village and time fixed effects with the spatial error reported
      riceprod <- log(goutput) ~ log(seed) + log(totlabor) +
          log(size) + region + time

      rice.sem <- spreml(riceprod, data = Rice, w = riceww,
                      lag = FALSE, errors = "sem")

      summary(rice.sem)
```

ML panel with , spatial error correlation

Call:
spreml(formula = riceprod, data = Rice, w = riceww, lag = FALSE,
    errors = "sem")

```
Residuals:
      Min.    1st Qu.     Median    3rd Qu.        Max.
-1.0685835 -0.2329965  0.0058127  0.2348086  1.4896241

Error variance parameters:
    Estimate Std. Error t-value  Pr(>|t|)
rho 0.562689   0.051777  10.867 < 2.2e-16 ***

Coefficients:
                   Estimate Std. Error t-value  Pr(>|t|)
(Intercept)       5.8541287  0.1946926 30.0686 < 2.2e-16 ***
log(seed)         0.1662622  0.0247465  6.7186 1.835e-11 ***
log(totlabor)     0.2482188  0.0275843  8.9985 < 2.2e-16 ***
log(size)         0.5977627  0.0279975 21.3505 < 2.2e-16 ***
regionlangan     -0.0977908  0.0913709 -1.0703   0.28450
regiongunungwangi -0.1404809  0.0842233 -1.6680   0.09532 .
regionmalausma   -0.1186456  0.0865045 -1.3716   0.17020
regionsukaambit   0.0072316  0.0937222  0.0772   0.93850
regionciwangi    -0.0138065  0.0846467 -0.1631   0.87043
time2            -0.0474541  0.0788454 -0.6019   0.54727
time3            -0.1855069  0.0788642 -2.3522   0.01866 *
time4            -0.3472240  0.0788324 -4.4046 1.060e-05 ***
time5             0.1581838  0.0788594  2.0059   0.04487 *
time6             0.1380488  0.0788065  1.7517   0.07982 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[6]:
```r
##------------------------------Block 2-------------------------------

#### Example 10-6 ####

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

# spatial fixed effects
riceprod0 <- update(riceprod, . ~ . - region - time)
semfemod <- spml(riceprod0, Rice, listw = ricelw,
             lag = FALSE, spatial.error = "b")
summary(semfemod)

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

# Hausman test for spatial models
Rice <- pdata.frame(RiceFarms, index = "id")
sphtest(riceprod0, Rice, listw = ricelw)
```

Spatial panel fixed effects error model


Call:
spml(formula = riceprod0, data = Rice, listw = ricelw, lag = FALSE,
    spatial.error = "b")

Residuals:
    Min.  1st Qu.   Median  3rd Qu.     Max.
-1.01951 -0.21054  0.02219  0.21266  1.32984

Spatial error parameter:
    Estimate Std. Error t-value  Pr(>|t|)
rho 0.791315    0.024853   31.84 < 2.2e-16 ***

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
log(seed)     0.134219   0.022591  5.9412  2.83e-09 ***
log(totlabor) 0.250542   0.026724  9.3752 < 2.2e-16 ***
log(size)     0.541947   0.027322 19.8355 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Hausman test for spatial models

data:  x
chisq = 0.63485, df = 3, p-value = 0.8884
alternative hypothesis: one model is inconsistent


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

#### Example 10-7 ####

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

# SAR random effects model
sarremod.ml <- spml(riceprod0, Rice, listw = ricelw,
                 model = "random", lag = TRUE, spatial.error = "none")
summary(sarremod.ml)
```

ML panel with spatial lag, random effects

Call:
spreml(formula = formula, data = data, index = index, w = listw2mat(listw),

```
      w2 = listw2mat(listw2), lag = lag, errors = errors, cl = cl)

Residuals:
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   1.59    2.52    2.81    2.78    3.05    4.02

Error variance parameters:
    Estimate Std. Error t-value  Pr(>|t|)
phi 0.368962   0.070065   5.266 1.394e-07 ***

Spatial autoregressive coefficient:
       Estimate Std. Error t-value  Pr(>|t|)
lambda 0.413202   0.026788  15.425 < 2.2e-16 ***

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)   2.773148   0.183388 15.1218 < 2.2e-16 ***
log(seed)     0.141452   0.025346  5.5808 2.394e-08 ***
log(totlabor) 0.274046   0.028032  9.7763 < 2.2e-16 ***
log(size)     0.523056   0.029512 17.7238 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

      #### Example 10-8 ####

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

      # SEM with Baltagi random effects
      semremod.ml <- spml(riceprod0, Rice, listw = ricelw,
                     model = "random", lag = FALSE, spatial.error = "b")
      summary(semremod.ml)
```

```
ML panel with , random effects, spatial error correlation

Call:
spreml(formula = formula, data = data, index = index, w = listw2mat(listw),
    w2 = listw2mat(listw2), lag = lag, errors = errors, cl = cl)

Residuals:
      Min.   1st Qu.    Median  3rd Qu.      Max.
 -1.185821 -0.256250  0.011895  0.247642  1.368257

Error variance parameters:
    Estimate Std. Error t-value  Pr(>|t|)
```

```
phi 0.295535    0.056493  5.2314 1.682e-07 ***
rho 0.774782    0.027119 28.5695 < 2.2e-16 ***

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)   5.698277   0.179734 31.7039 < 2.2e-16 ***
log(seed)     0.152042   0.023501  6.4696 9.824e-11 ***
log(totlabor) 0.256220   0.027206  9.4179 < 2.2e-16 ***
log(size)     0.575668   0.027469 20.9573 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

[10]:
```
##--------------------------------Block 5--------------------------------

# SEM with KKP random effects
sem2remod.ml <- spml(riceprod0, Rice, listw = ricelw,
                model = "random", lag = FALSE, spatial.error = "kkp")
summary(sem2remod.ml)
```

```
ML panel with , spatial RE (KKP), spatial error correlation

Call:
spreml(formula = formula, data = data, index = index, w = listw2mat(listw),
    w2 = listw2mat(listw2), lag = lag, errors = errors, cl = cl)

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-1.185509 -0.256295  0.011926  0.247770  1.370322

Error variance parameters:
    Estimate Std. Error t-value  Pr(>|t|)
phi 0.295941   0.056967  5.1949 2.048e-07 ***
rho 0.768628   0.027666 27.7822 < 2.2e-16 ***

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
(Intercept)   5.698576   0.186435 30.5659 < 2.2e-16 ***
log(seed)     0.151806   0.023579  6.4382 1.209e-10 ***
log(totlabor) 0.256425   0.027258  9.4074 < 2.2e-16 ***
log(size)     0.576344   0.027518 20.9442 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

#### Example 10-9 ####

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

# Spatial GM with KKP random effects
semremod.gm <- spgm(riceprod0, Rice, listw = ricelw,
                    lag = FALSE, spatial.error = TRUE)
summary(semremod.gm)
```

Spatial panel fixed effects GM model


Call:
spgm(formula = riceprod0, data = Rice, listw = ricelw, lag = FALSE,
    spatial.error = TRUE)

Residuals:
        Min.      1st Qu.       Median      3rd Qu.         Max.
-0.84157506  -0.16314696   0.00052671   0.16752296   1.35504888

Estimated spatial coefficient, variance components and theta:
          Estimate
rho       0.780663
sigma^2_v 0.080088

Coefficients:
              Estimate Std. Error t-value  Pr(>|t|)
log(seed)     0.134607   0.022662  5.9398 2.853e-09 ***
log(totlabor) 0.250784   0.026799  9.3579 < 2.2e-16 ***
log(size)     0.541751   0.027406 19.7679 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1