

## Examples 10-10 to 10-13

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")

# import the data and run the following models

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

riceprod <- log(goutput) ~ log(seed) + log(totlabor) +
  log(size) + region + time
```

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

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

# Baltagi, Song, and Koh (BSK) LM Tests

## -----
# Joint test
bsktest(riceprod, data = Rice, listw = ricelw, test = "LMH")

## -----
# Conditional test
bsktest(riceprod, data = Rice, listw = ricelw, test = "CLMmu")
```

```
## -----
# Conditional spatial test
bsktest(riceprod, data = Rice, listw = ricelw, test = "CLMlambda")
```

Baltagi, Song and Koh LM-H one-sided joint test

```
data: log(goutput) ~ log(seed) + log(totlabor) + log(size) + region + time
LM-H = 305.52, p-value < 2.2e-16
alternative hypothesis: Random Regional Effects and Spatial autocorrelation
```

Baltagi, Song and Koh LM\*-mu conditional LM test (assuming lambda may or may not be = 0)

```
data: log(goutput) ~ log(seed) + log(totlabor) + log(size) + region + time
LM*-mu = 10.991, p-value < 2.2e-16
alternative hypothesis: Random regional effects
```

Baltagi, Song and Koh LM\*-lambda conditional LM test (assuming  $\sigma^2_{\mu} \geq 0$ )

```
data: log(goutput) ~ log(seed) + log(totlabor) + log(size) + region + time
LM*-lambda = 21.248, p-value < 2.2e-16
alternative hypothesis: Spatial autocorrelation
```

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

#### Example 10-11 ####

## -----

# LM Test for SAR (SEM), pooled default
local.rob.LM <- matrix(ncol = 4, nrow = 2)
tests <- c("lml", "lme", "rlml", "rlme")
dimnames(local.rob.LM) <- list(c("LM test", "p-value"),
                               tests)

for(i in tests) {
  local.rob.LM[1, i] <- slmtest(riceprod, data = Rice,
                                listw=ricelw, test = i)$statistic
  local.rob.LM[2, i] <- slmtest(riceprod, data = Rice,
                                listw=ricelw, test = i)$p.value
}
round(local.rob.LM, 4)
```

	lml	lme	rlml	rlme
LM test	39.2837	244.8318	0.1654	205.7135
p-value	0.0000	0.0000	0.6842	0.0000

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

# LM Test for SAR (SEM), within option
local.rob.LMw <- matrix(ncol = 4, nrow = 2)
wriceprod <- Within(log(goutput)) ~ Within(log(seed)) +
  Within(log(totlabor)) + Within(log(size)) +
  region + time
dimnames(local.rob.LMw) <- list(c("LM test", "p-value"),
  c("lml", "lme", "rlml", "rlme"))
for(i in c("lml", "lme", "rlml", "rlme")) {
  local.rob.LMw[1, i] <- slmtest(wriceprod, data = Rice,
    listw=ricelw, test = i)$statistic
  local.rob.LMw[2, i] <- slmtest(wriceprod, data = Rice,
    listw=ricelw, test = i)$p.value
}
round(local.rob.LMw, 4)
```

	lml	lme	rlml	rlme
LM test	125.2209	604.2516	1.5377	480.5684
p-value	0.0000	0.0000	0.2150	0.0000

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

#### Example 10-12 ####

## -----

# SEM with Baltagi random effects
# tests whether the spatial autoregressive coefficient is significant
saremremod <- spml(riceprod, data = Rice, listw = ricelw, lag = TRUE,
  model = "random", spatial.error = "b")
summary(saremremod)
```

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

Call:

```
sprem1(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.
-1.1538	-0.3212	-0.0761	-0.0901	0.1488	1.3509

Error variance parameters:

	Estimate	Std. Error	t-value	Pr(> t )
phi	0.296707	0.056633	5.2391	1.614e-07 ***
rho	0.628120	0.054702	11.4825	< 2.2e-16 ***

Spatial autoregressive coefficient:

	Estimate	Std. Error	t-value	Pr(> t )
lambda	-0.013376	0.085743	-0.156	0.876

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
(Intercept)	5.968368	0.195713	30.4954	< 2.2e-16 ***
log(seed)	0.153081	0.023523	6.5077	7.633e-11 ***
log(totlabor)	0.249157	0.027118	9.1881	< 2.2e-16 ***
log(size)	0.578366	0.027442	21.0759	< 2.2e-16 ***
regionlangan	-0.092650	0.105149	-0.8811	0.37825
regiongunungwangi	-0.156652	0.096860	-1.6173	0.10581
regionmalausma	-0.157226	0.099477	-1.5805	0.11399
regionsukaambit	-0.024266	0.107806	-0.2251	0.82191
regionciwangi	-0.026744	0.097344	-0.2747	0.78352
time2	-0.061195	0.081322	-0.7525	0.45175
time3	-0.191069	0.081306	-2.3500	0.01877 *
time4	-0.365013	0.081308	-4.4892	7.148e-06 ***
time5	0.162601	0.081299	2.0000	0.04550 *
time6	0.132488	0.081261	1.6304	0.10302

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

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

#### Example 10-13 ####

## -----

# restriction test for the SAR term. pLR is the p-value for the LR spatial lag
  ↳ test
l11 <- saremremod$logLik
l10 <- spml(riceprod, data = Rice, listw = ricelw, lag = FALSE,
           model = "random", spatial.error = "b")$logLik
LR <- 2 * (l11 - l10)
pLR <- pchisq(LR, df = 1, lower.tail = FALSE)
pLR
```

0.912074721405181