Spatial Regression Models, Version 2

Chapter 3

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Introduction

These are lecture/lab notes for Chapter 6 in Spatial Regression Models. You will find all necessary information, including $\mathcal{R}$-code, to replicate the figures and maps found in this chapter. A few of the maps were obtained from public repositories (Wiki and others), but what you find here will allow replication of the bulk of chapter 6. This is intended to provide code as well as a didactic repository.

Code appears below as it is in the unadorned code files. Comments are shown with one poundsign; messages from the execution of this code is flagged with two poundsigns.

There are two goals of this material:

1. Provide replication code for the materials in Spatial Regression Models, version 2. This is hosted on httpps://srmbook.com
2. To elaborate a bit on what the code does to provide instruction on develop code in $\mathcal{R}$ that replications the material in the published volume.

This was developed on the following platform. Earlier (and later) platforms should work (as should windows and linux flavored platforms). However, some libraries may not be available for all platforms. Such is life.

If you have any feature requests or find bugs herein, please do not hesitate to pass them along to the authors (michael.don.ward at gmail.com and ksg at essex.ac.uk).

```
# Chapter 6 Code for Ward & Gleditsch, Spatial Regression Models, Sage, 2018.

# R version 3.4.3 (2017-11-30) -- "Kite-Eating Tree"
# Copyright (C) 2017 The R Foundation for Statistical Computing
# Platform: x86_64-apple-darwin15.6.0 (64-bit)


rm(list = ls())
library(cshapes)
library(wbstats)
p5<-read.csv("rawdata/p5.csv")
wmap <- cshp(date = as.Date("2015-01-01"),useGW=TRUE)  # get map from CSHAPES
wmap$ISO1AL3 <- as.character(wmap$ISO1AL3)
wmap$ISO1AL3[wmap$CNTRY_NAME == "Kosovo"] <- c("RKS")
wmap$ISO1AL3 <- as.factor(wmap$ISO1AL3)
wmap@data$id <- as.character(rownames(wmap@data))
wmap.df <- wmap@data
wmap@data$democ <- p5$democ[match(wmap@data$ISO1AL3, p5$scode)]
wmap@data$autoc <- p5$autoc[match(wmap@data$ISO1AL3, p5$scode)]
wmap@data$polity <- wmap@data$democ - wmap@data$autoc
# for convenience assign 0 to NA
wmap@data$polity[is.na(wmap@data$polity)]<- 0

# now get GDP per capita data
library(wbstats)
gdp <- wb(indicator = c("NY.GDP.PCAP.CD"),
          startdate = 2014, enddate = 2014,country="countries_only")
```

```
gdp$value <- log(gdp$value)
# join the GDP data to the map data.frame
wmap@data$gdp <- gdp$value[match(wmap.df$ISO1AL2, gdp$iso2c)]
wmap@data$gdp[53]<-6.36647
wmap@data$gdp[67]<-11.99541
wmap@data$gdp[134]<-6.920672
wmap@data$gdp[176]<-10.02398
wmap@data$gdp[181]<-9.123365
wmap@data$gdp[184]<-7.438384
wmap@data$gdp[188]<-8.119994
# Hacked from the interwebs
# 53 Eritrea = 582  6.36647
# 67 Monaco = 162009 11.99541
# 134 North Korea = 1013 6.920672
# 176 Taiwan = 22561 10.02398
# 181 Libya = 9167 9.123365
# 184 Syria = 1700 7.438384
# 188 Kosovo = 3661 8.119994

# now get distance matrix
wmap.dist <- distmatrix(date = as.Date("2015-01-01"))

# recode distance data to be binary, for distance < 400km
w.dist<-wmap.dist
w.dist[w.dist<=400]<-1
w.dist[w.dist>400]<-0
# row standardize
w.dist.rstd<-w.dist/rowSums(w.dist)
# 0 on diagonal
diag(w.dist.rstd)<-0

which(rowSums(w.dist.rstd)==0)
```

395 402 590 591 781 920 950 970 971 972 973 983 986 987 990 83 84 129 130 170 184 187 188 189 190 191 192 193 194 195

```
# create spatial lag of polity. round result
wmap@data$sp.lag.polity<- round((w.dist.rstd)%*%(wmap@data$polity))
# create spatial lag of polity. round result
wmap@data$sp.lag.gdp<- round((w.dist.rstd)%*%(wmap@data$gdp))
# for convenience assign 0 to NA
wmap@data$polity[is.na(wmap@data$polity)]<- 0
# order map dataframe on GWCODE
map.df<-wmap@data[order(wmap@data$GWCODE),]

# get rid of isolates
omits<-(which(rowSums(w.dist.rstd)==0))

# get rid of isolates
map.df<-map.df[-omits,]
w.d.rstd<-w.dist.rstd[-omits,-omits]
w.dd.rstd<-w.d.rstd/rowSums(w.d.rstd)
rowSums(w.dd.rstd)
```

2 20 31 40 41 42 51 52 53 54 55 56 57 58 60 70 80 90 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 91 92 93 94 95 100 101 110 115 130 135 140 145 150 155 160 165 200 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 205 210 211 212 220 221 223 225 230 232 235 260 290 305 310 316 317 325 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 331 338 339 340 341 343 344 346 347 349 350 352 355 359 360 365 366 367 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 368 369 370 371 372 373 375 380 385 390 403 404 411 420 432

433 434 435 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 436 437 438 439 450 451 452 461 471 475 481 482 483 484 490 500 501 510 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 516 517 520 522 530 531 540 541 551 552 553 560 565 570 571 572 580 581 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 600 615 616 620 625 626 630 640 645 651 652 660 663 666 670 678 690 692 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 694 696 698 700 701 702 703 704 705 710 712 713 731 732 740 750 760 770 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 771 775 780 790 800 811 812 816 820 830 835 840 850 860 900 910 935 940 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

```
dim(map.df)
```

[1] 180 31

```
library(spdep)
listw.obj<-mat2listw(w.dd.rstd)
ols.fit <- glm(polity ~ gdp + sp.lag.gdp, data=map.df)
#summary(ols.fit)
#moran.test(resid(ols.fit),listw.obj)

sar.fit<-lagsarlm(polity ~ gdp, data=map.df, listw.obj,type="Durbin")
#summary(sar.fit)
#moran.test(resid(sar.fit),listw.obj)


library(stargazer)
stargazer(ols.fit, type = "latex",star.char = NULL,nobs=TRUE,digits=2,
          star.cutoffs = NA,notes.append = FALSE,
          notes        = "OLS",dep.var.caption  = "Polity Score [10 to 10]"
)
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu % Date and time: Mon, Jan 22, 2018 - 07:45:44

Table 1:

	Polity Score [10 to 10]
	polity
gdp	0.86
	(0.32)
sp.lag.gdp	0.23
	(0.21)
Constant	−5.69
	(2.89)
Observations	180
Log Likelihood	−587.86
Akaike Inf. Crit.	1,181.71
Note:	OLS

```
stargazer(sar.fit,  type = "latex",star.char = NULL,nobs=TRUE,digits=2,
          star.cutoffs = NA,notes.append = FALSE,
          notes        = "Spatial Durbin",dep.var.caption  = "Polity Score [10 to 10]"
)
```

% Table created by stargazer v.5.2 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu % Date and time: Mon, Jan 22, 2018 - 07:45:48

This result is not idential to that in the book, owing to imputed values.

Table 2:

	Polity Score [10 to 10]
	polity
gdp	0.64
	(0.47)
lag.gdp	−0.21
	(0.61)
Constant	−2.12
	(3.05)
Observations	180
Log Likelihood	−567.96
σ^2	30.45
Akaike Inf. Crit.	1,145.93
Wald Test	42.95 (df = 1)
LR Test	38.56 (df = 1)
Note:	Spatial Durbin