# GeoDa Workshop Part 2

Luc Anselin

GeoDa Center School of Geographical Sciences and Urban Planning Arizona State University

> after July 1, 2016 Center for Spatial Data Science University of Chicago





Acknowledgments

### NSF OCI-1047916

## AHRQ IR01HS021752-01A1





spatial weights

spatial autocorrelation

space-time exploration

averages tool (treatment effect analysis)

spatial regression





# Spatial Weights





creating weights

weights properties

project file





# Creating Weights





Weights Manager   Shape     Weights Manager     Create     Load     Remove	Shape  w	eights Man
Weights Manager		eights Man
Weights Manager		
	Weights Manager	
	Mojahte Managar	
Create Load Remove		
	Create Load Remove	
Weights Name	Weights Name	









weights manager

	Weights	File Creatio	n	
Weights File ID Variat	ole OID_		\$	Add ID Variable
<ul> <li>Queen contiguity</li> </ul>	Order of	contiguity	1	0
Rook contiguity		e lower ord	ers	
Precision threshold			0	
Distance Weight				
	Euclidean Dista	ance	\$	
	<x-centroids></x-centroids>		٢	
	<y-centroids></y-centroids>		$\diamond$	
Threshold distance			0.0	
•				
k-Nearest Neighbor	s Number of		4	٢
	Create	Clos	e	

### contiguity weights





	Weights File Ci	reation		
Weights File ID Variak Contiguity Weight	DIE CODE	<b>`</b>	Add ID Var	iable
<ul> <li>Queen contiguity</li> <li>Rook contiguity</li> <li>Precision threshold</li> </ul>	Order of contig	er orders		
		0.0000		
Distance Weight				
	Euclidean Distance	\$		
	<x-centroids></x-centroids>	\$	2002	\$
	<y-centroids></y-centroids>	\$	2002	\$
<ul> <li>Threshold distance</li> <li>k-Nearest Neighbor</li> </ul>		0.1 bors	4	
	Create	Close		

### precision threshold (NYC example)





	Weights Manager			
	Create	Load	Remove	
Weights Na	ame			
Nepal_q				

Property	Value
type	queen
symmetry	symmetric
file	Nepal_q.gal
id variable	OID_
order	1

Histogram	Connectivity	Мар
-----------	--------------	-----

### weights in weights manager





	Weights File Creation		Weights File Creation
Weights File ID Variable Contiguity Weight	OID_ OID_ Add ID Variable	Weights File ID Variable Contiguity Weight	e OID_ OID_ Add ID Variable
<ul> <li>Queen contiguity</li> <li>Rook contiguity</li> <li>Precision threshold</li> </ul>	Order of contiguity 1	<ul> <li>Queen contiguity</li> <li>Rook contiguity</li> <li>Precision threshold</li> </ul>	Order of contiguity 1
Distance Weight		Distance Weight	
X-coordinate variable	uclidean Distance X-Centroids> Y-Centroids> 0.609171 Number of neighbors 4	X-coordinate variable	Euclidean Distance <x-centroids> <y-centroids> 0.609171 Number of neighbors 6</y-centroids></x-centroids>
	Create Close		Create Close

### distance-based weights





	Weights Manager
	Create Load Remove
Weights Na	ame
Nepal_q	
Nepal_k6	

Property	Value
type	k-NN
symmetry	asymmetric
file	Nepal_k6.gwt
id variable	OID_
distance metric	Euclidean
distance vars	centroids
neighbors	6

Histogram Connectivity Map

### multiple weights in weights manager

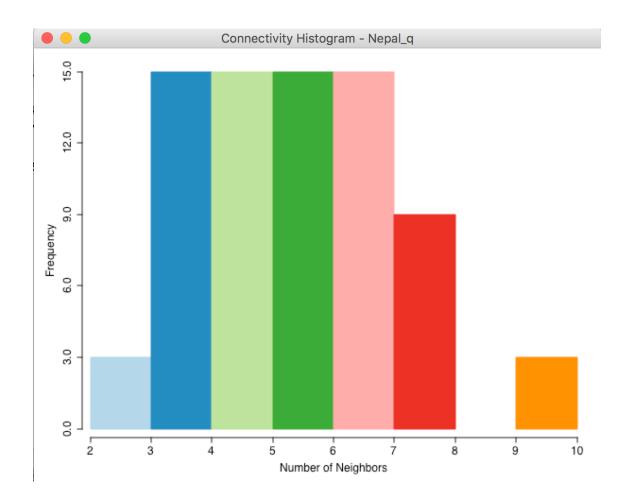




## Weights Properties



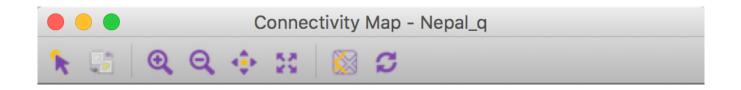


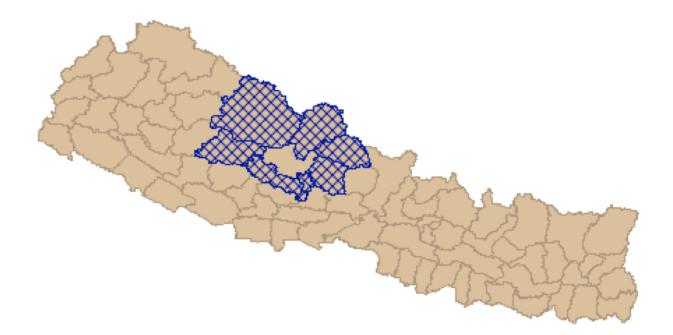


### connectivity histogram









obs 45 has 7 neighbors: 2, 44, 51, 20, 58, 33, 41

### connectivity map





## **Project File**





File	Edit	Tools	Table	Μ
Ne	w Proje	ect From	J	
Ne	w Proje	ect	<del>ال</del> ا	N
Ор	en Proj	ect	<b>೫</b> (	0
Sav	/e Proje	ect		
	/e As	cted As		
Pro	ject In	formatio	n	
Clo	se Proj	ject		

### creating a project file





	Project Information
Project Title: Nepal_Districts2	
Project File: /Users/luc/Desktop	/geoda_workshop/Nepal_Districts2/Nepal1.gda
Data Source Type: ESRI Shapefi	le
Data Source File: /Users/luc/Des	sktop/geoda_workshop/Nepal_Districts2/Nepal_Districts2.shp
Layer Name: Nepal_Districts2	
Number Records/Observations:	75
Number Data Source Fields: 87	
Number Table Columns: 87	
Number Table Groups: 0	
	OK

### project information





```
<weights_entries>
    <weights>
        <title>Nepal_q</title>
        <default/>
        <meta info>
            <weights_type>queen</weights_type>
            <order>1</order>
            <inc_lower_orders>true</inc_lower_orders>
            <path>Nepal_q.gal</path>
            <id_variable>OID_</id_variable>
            <symmetry>symmetric</symmetry>
        </meta_info>
    </weights>
    <weights>
        <title>Nepal_k6</title>
        <meta_info>
            <weights_type>knn</weights_type>
            <dist_metric>euclidean</dist_metric>
            <dist_units>mile</dist_units>
            <dist_values>centroids</dist_values>
            <num_neighbors>6</num_neighbors>
            <path>Nepal_k6.gwt</path>
            <id_variable>OID_</id_variable>
            <symmetry>asymmetric</symmetry>
        </meta info>
    </weights>
</weights_entries>
```

### weights entries in project file





# Spatial Autocorrelation





Moran scatter plot

spatial correlogram

local spatial autocorrelation





## Moran Scatter Plot





Space	Time	Regression	Options	Н
Univa	riate Mo	ran's I		
Differ	ential M	oran's I		
Morar	n's I with	EB Rate		
Differ	ential Lo	cal Moran's I ocal Moran's I I with EB Rate	9	
	G Cluste G* Clus	•		
Nonpa	arametri	c Spatial Auto	correlation	

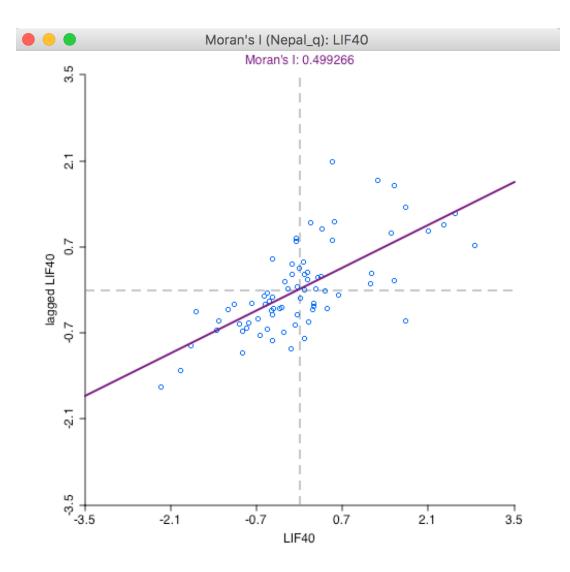


	Variable Settings		
	First Variable (X)		
POVINDE	x		
PCINC			
PCINCPPP			
PCINCMP			
MALKIDS			
LIF40			
NOSAFH2	20		
POPULATION			
BOYG1_5			
GIRLG1_5	j		
Weights	Nepal_q		
	OK Cancel		

### moran scatter plot setup





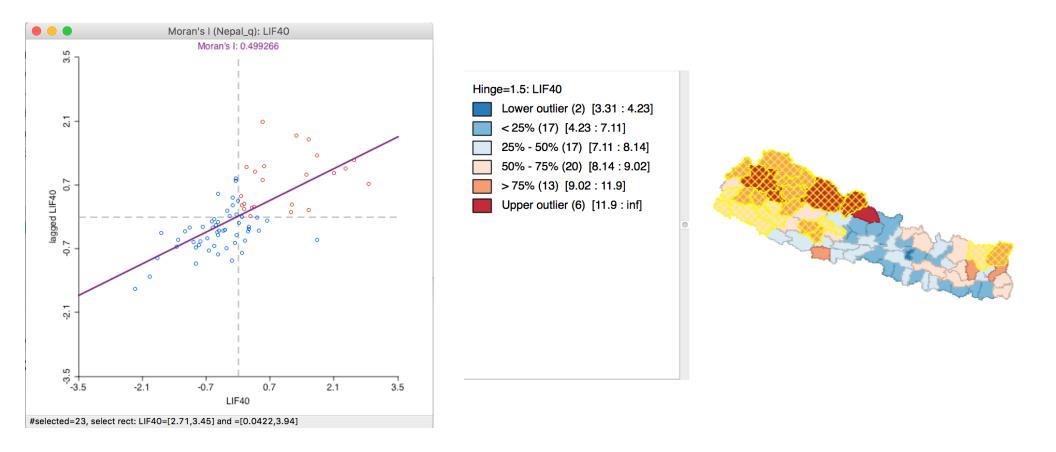


### Moran scatter plot





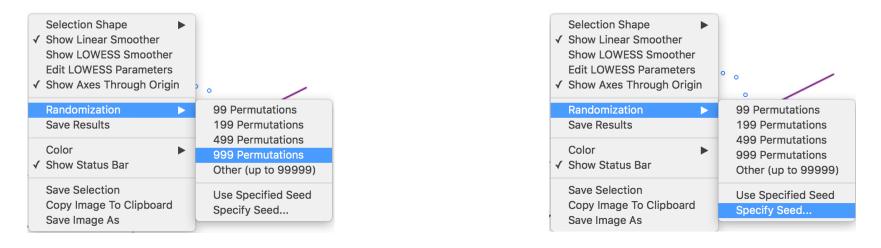
Copyright © 2016 by Luc Anselin, All Rights Reserved

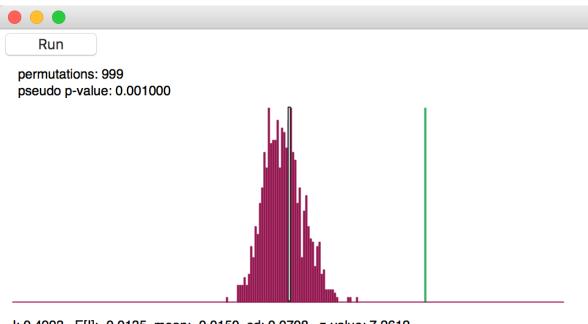


### Moran scatter plot, high-high locations









I: 0.4993 E[I]: -0.0135 mean: -0.0150 sd: 0.0708 z-value: 7.2612



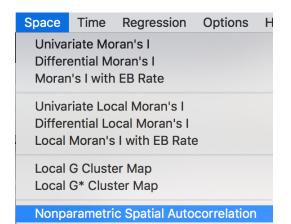


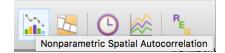
#### permutation inference

## Spatial Correlogram



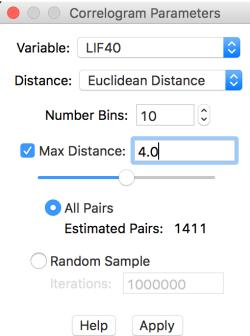






● ○ ○ Correlogram Parameters	
Variable: LIF40	
Distance: Euclidean Distance ᅌ	
Number Bins: 10	
Max Distance:	
<ul> <li>All Pairs</li> </ul>	
Estimated Pairs: 2775	
Random Sample	
Iterations: 1000000	
Help Apply	

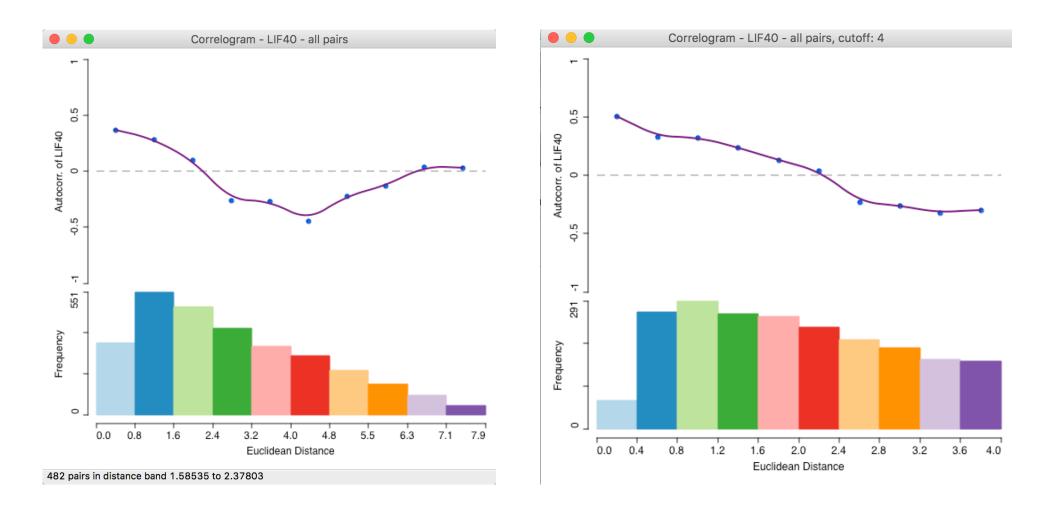
Correlo	gram Parameters	;	
Variable: LIF4	0	0	Va
Distance: Eucl	idean Distance	\$	Di
Number Bir	ns: 10 🗘		
Max Distanc	e:		
All Pairs			
Estimate	ed Pairs: 2775		
📀 Random S	ample		
Iterations:	1000000		
Help	Apply		





### spatial correlogram setup





### spatial correlogram



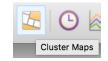


## Local Spatial Autocorrelation

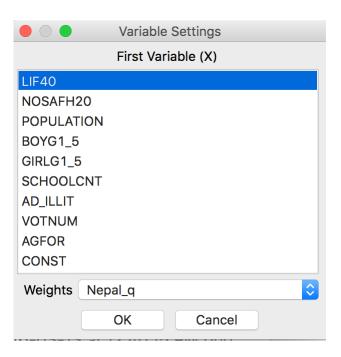




Space	Time	Regression	Options	H
Univariate Moran's I Differential Moran's I Moran's I with EB Rate				
Univariate Local Moran's I				
Differential Local Moran's I Local Moran's I with EB Rate				
Local G Cluster Map Local G* Cluster Map				
Nonparametric Spatial Autocorrelation				



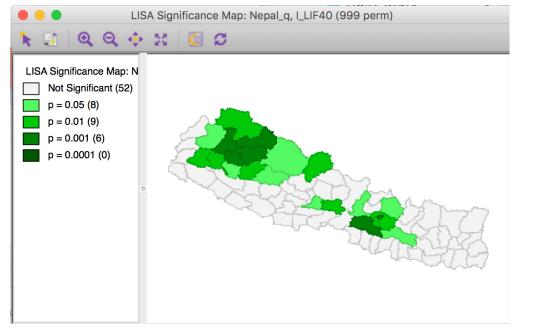
Space	Time	Regression	Options	Н
Univariate Moran's I Differential Moran's I Moran's I with EB Rate				
Univariate Local Moran's I Differential Local Moran's I Local Moran's I with EB Rate				
Local G Cluster Map Local G* Cluster Map				
Nonparametric Spatial Autocorrelation				

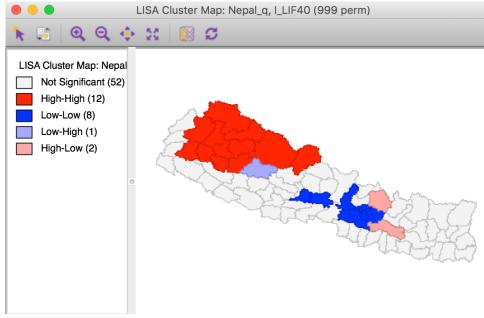




### local spatial autocorrelation setup







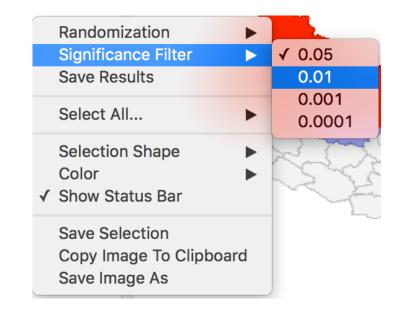


### local moran significance and cluster map



Copyright © 2016 by Luc Anselin, All Rights Reserved

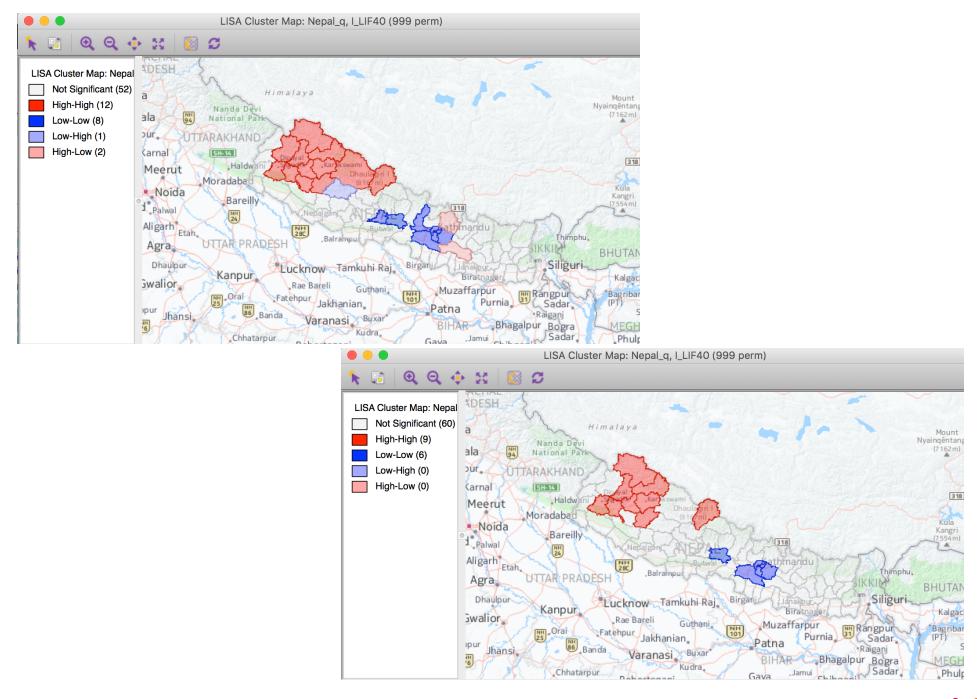
_		_	
	Randomization		99 Permutations
ı	Significance Filter		199 Permutations
1	Save Results		499 Permutations
	Select All		999 Permutations
-			Other (up to 99999)
	Selection Shape		Use Specified Seed
	Color		Specify Seed
✓	Show Status Bar		LITE
	Save Selection		-0-2-2
	Copy Image To Clipboard		
	Save Image As		



### local spatial autocorrelation options



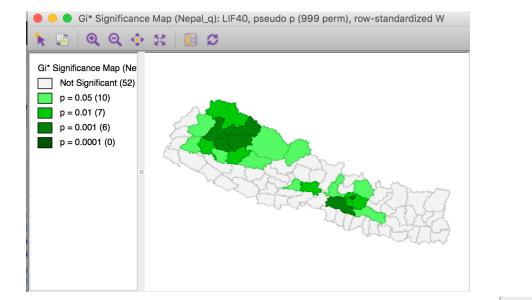


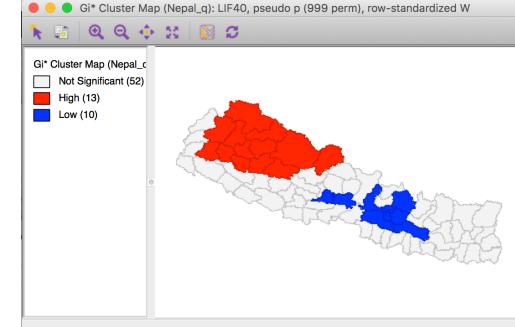




### base map included, p=0.05 and 0.01





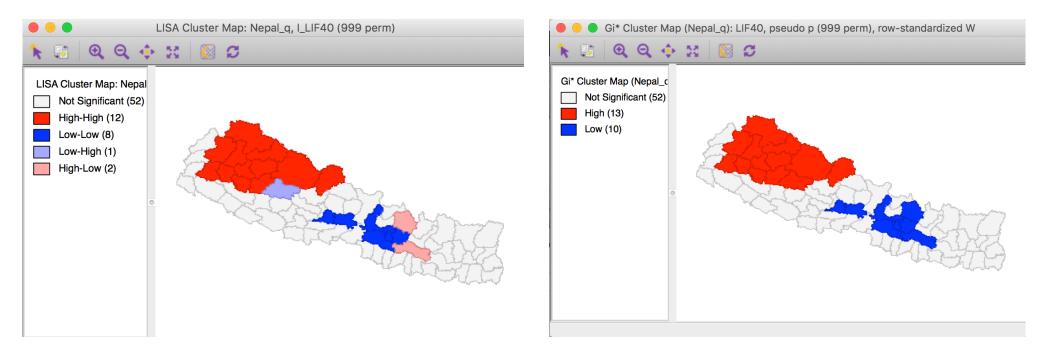








Copyright © 2016 by Luc Anselin, All Rights Reserved



#### local moran vs local G\*





Copyright © 2016 by Luc Anselin, All Rights Reserved

# Space-Time Exploration





time editor

time player

## differential spatial autocorrelation





## **Time Editor**









				Time Editor			
Ungrouped	Variables ?			New Group Details	?	Grouped Variable	es ? 달
Name	Туре		name:				
bor_subb	num						
NAME	str			Overiebles to inclu	da		
CODE	num			0 variables to inclu	ae		
SUBBOROUGH	str		Time	Name			
HHSIZ02	num						
HHSIZ05	num						
HHSIZ08	num						
KIDS2000	num						
KIDS2005	num	>				>	
KIDS2008	num	<				<	
RENT2002	num						
<b>RENT2005</b>	num						
<b>RENT2008</b>	num						
RENTPCT02	num						
RENTPCT05	num						
RENTPCT08	num						
YRHOM02	num						
YRHOM05	num						
YRHOM08	num			Anyo Lin Mayo Do		Cave Cases Time Te	alo/Maish
	nam		ľ	Move Up Move Do	0001	Save Space-Time Ta	bie/weigh

## time editor setup





					Time Editor			
Ungrouped	d Variables	?			New Group Details	?		Grouped Variables  ? 嬞
Name	Туре			name:				
bor_subb	num	- 1						
NAME	str	- 1			0 variables to inclu	do		
CODE	num	- 1				ue		
SUBBOROUGH	str	- 1		Time	Name			
HHSIZ02	num							
HHSIZ05	num	_						
HHSIZ08	num							
KIDS2000	num		>				>	
KIDS2005	num							
KIDS2008	num		<				<	
RENT2002	num							
RENT2005	num							
RENT2008	num							
RENTPCT02	num							
RENTPCT05	num							
RENTPCT08	num							
YRHOM02	num							
YRHOM05	num							
YRHOM08	num				Move Up Move Do	own		Save Space-Time Table/Weights ?

## select variables to be grouped





			Time Editor		
Ungrouped	Variables ?		New Group Details ?		Grouped Variables  ? 嬞
Name	Туре	name:	HHSIZ		
bor_subb	num		numeric		
NAME	str				
CODE	num		3 of 3 variables to include	_	
SUBBOROUGH	str	Time	Name		
KIDS2000	num	2002	HSIZ02		
KIDS2005	num	time 1	HHSIZ05		
KIDS2008	num	time 2	HHSIZ08		
RENT2002	num				
RENT2005	num	•		>	
RENT2008	num	:		<	
RENTPCT02	num				
RENTPCT05	num				
RENTPCT08	num				
YRHOM02	num				
YRHOM05	num				
YRHOM08	num				
noHS00	num				
noHS05	num				
noHS08	num		Move Up Move Down		Save Space-Time Table/Weights ?

## edit variable name and time labels





			Time Editor		
Ungrouped \	Variables ?		New Group Details	?	Grouped Variables  ? 凒
Name	Туре	name:			HHSIZ
bor_subb	num		numeric		
NAME	str		0 of 3 variables to i	naluda	
CODE	num			liciude	
SUBBOROUGH	str	Time	Name	<u> </u>	
KIDS2000	num	2002			
KIDS2005	num	2005			
KIDS2008	num	2008			
RENT2002	num				
RENT2005	num			>	
RENT2008	num <			<	
RENTPCT02	num				
RENTPCT05	num				
RENTPCT08	num				
YRHOM02	num				
YRHOM05	num				
YRHOM08	num				
noHS00	num				
noHS05	num				
noHS08	num		Aava Lin Maya Da		Cove Crosse Time Table (Misishte C
101300	num		Move Up Move Do	wn	Save Space-Time Table/Weights ?

## grouped variable



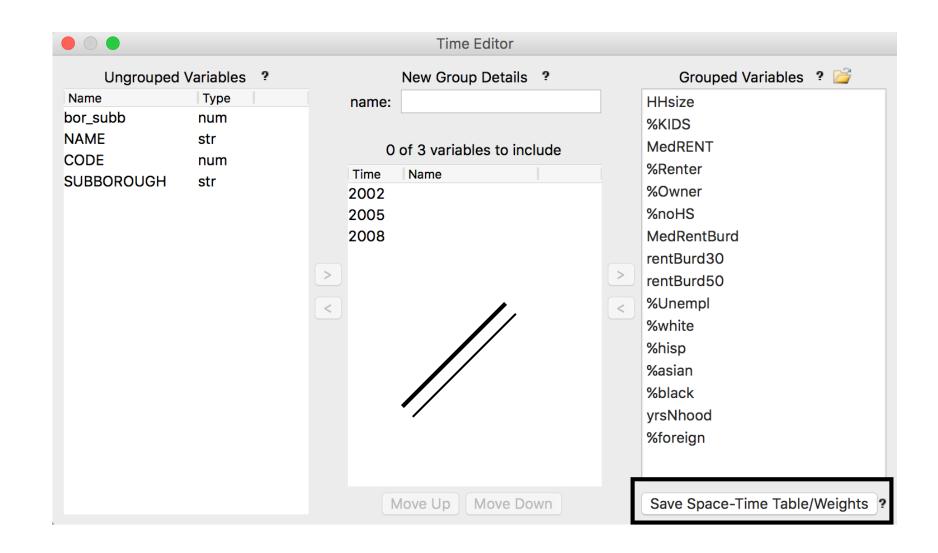


<variable\_order> <time\_ids> <id>2002</id> <id>2005</id> <id>2008</id> </time\_ids> <var>bor\_subb</var> <var>NAME</var> <var>CODE</var> <var>SUBBOROUGH</var> <group> <name>HHsize</name> <var>HHSIZ02</var> <var>HHSIZ05</var> <var>HHSIZ08</var> </group>

#### grouped time variables in project file







## grouped variables from project file





nycvars.csv nycvars.gal

STID,CODE,T	IME,HHsize,%KIDS,MedRENT
1,401,2002,	2.30320000000000,28.45
2,210,2002,	2.30720000000000,26.30
3,411,2002,	2.67080000000000,30.72
4,203,2002,	2.47990000000000,45.03
5,413,2002,	2.88870000000000,42.53
6,211,2002,	2.59570000000000,31.93
7,212,2002,	3.08660000000000,41.13
8,202,2002,	2.02320000000000,24.74
9,216,2002,	2.64640000000000,51.68

space-time ID, space ID, time ID

0	165	nycvars	STID
1	1		
2			
2	2		
3	1		
3	1		
2			
4	2		
6	5		

 $n = 55 \times 3$ , space-time ID

saved space-time table/weights

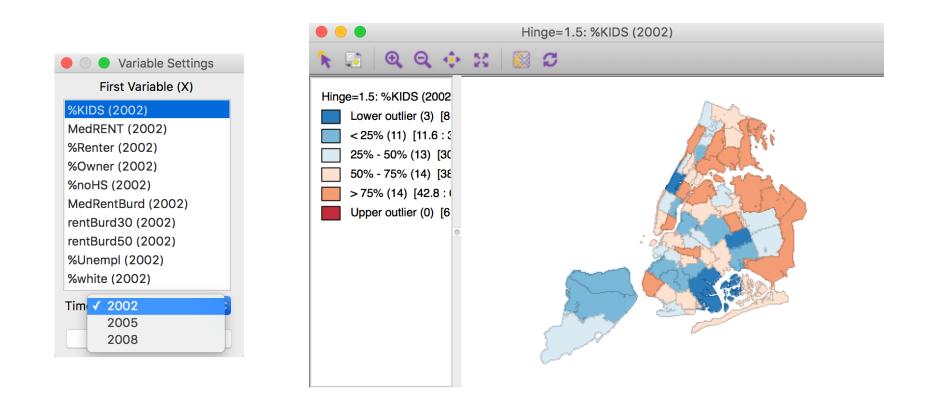




## Time Player



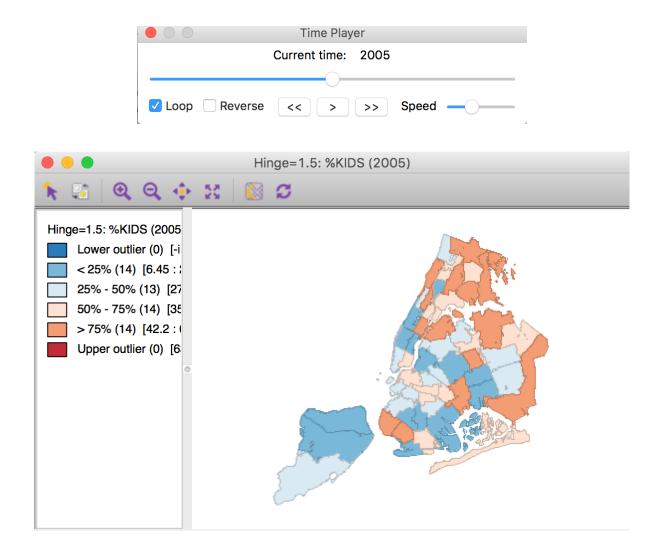




## box map with time variable





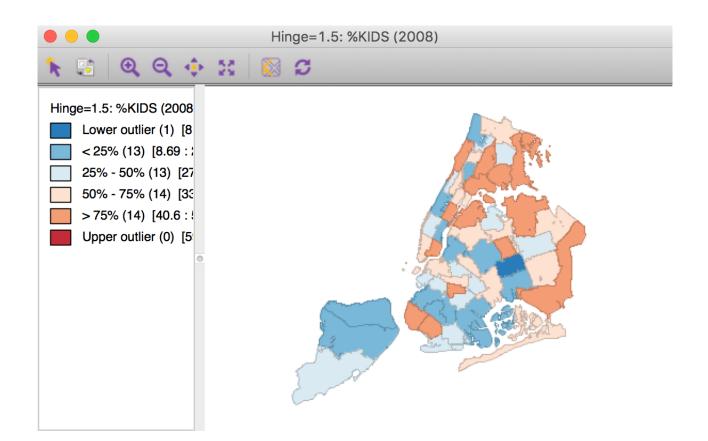


## box map 2005





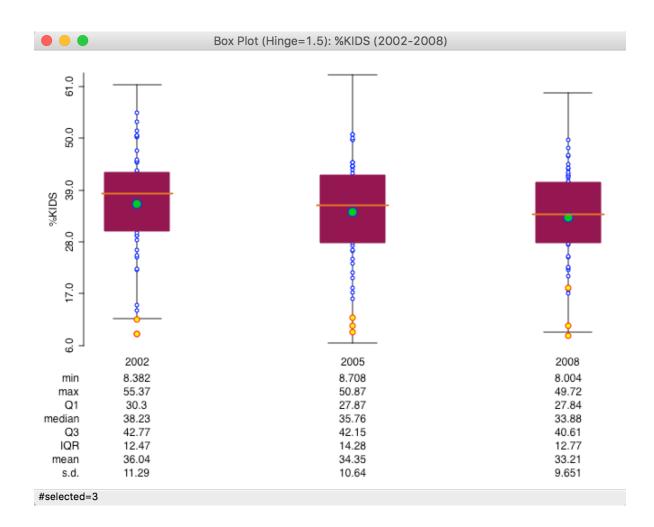
Time Player					
Current time: 2008					
✓ Loop					



## box map 2008





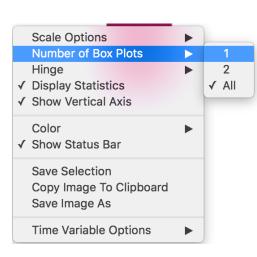


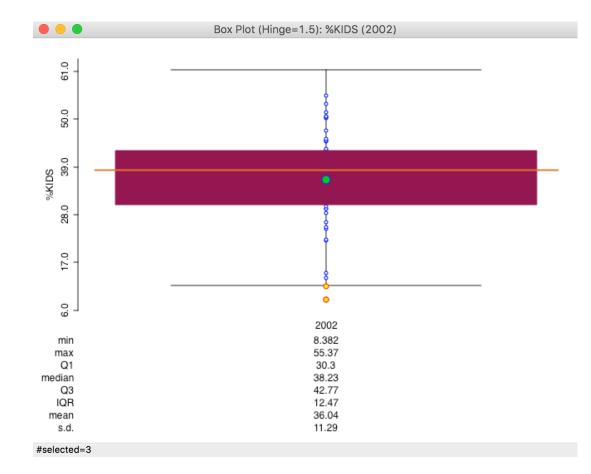
## three period box plot





Copyright © 2016 by Luc Anselin, All Rights Reserved





#### number of box plots option





Copyright © 2016 by Luc Anselin, All Rights Reserved

## **Differential Spatial Autocorrelation**







spatial autocorrelation on change over time, i.e., on  $y_t - y_{t-1}$ 

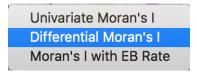
Moran scatterplot for  $y_t - y_{t-1}$ 

Local Moran maps for  $y_t - y_{t-1}$ 

replacement of bivariate Moran





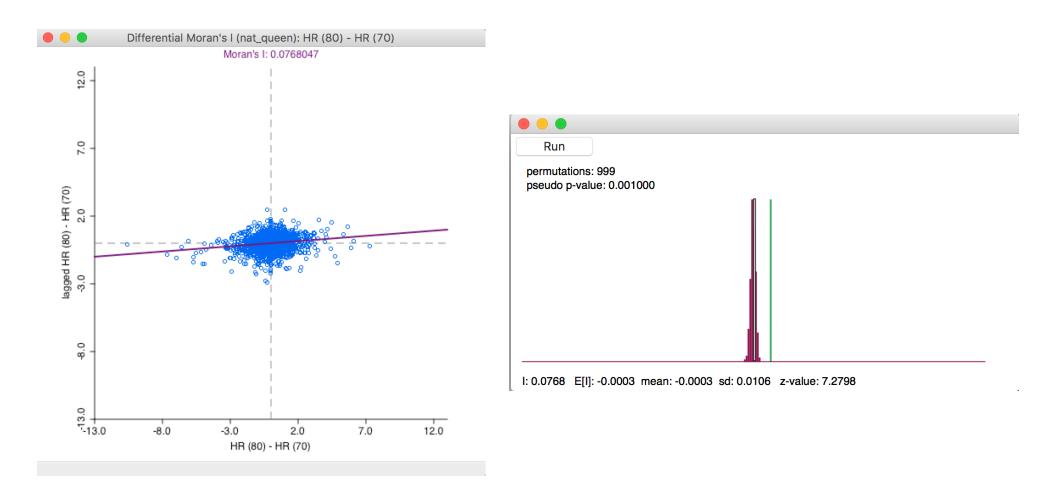


	Differential Moran Variable	Settings	
Select variable HR	and two time periods:		and 60 💙
		60 70 80	
Weights nat_queen		90	
	Ok Close	e	

## differential Moran's I (scatter plot) variable selection using two time periods



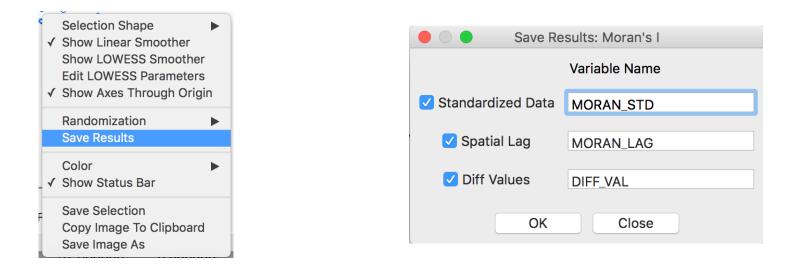




## differential Moran scatter plot







Т	able - natregime	es			
	FH (60)	West	MORAN_STD	MORAN_LAG	DIFF_VAL
35	11.279621	0	1.2198860	0.0255470	8.8558270
58	10.053476	1	2.4456820	0.0914580	17.2087420
99	9.258437	1	0.1456410	0.8732250	1.5356160
40	9.039900	1	0.2101460	0.4930810	1.9751710
63	8.243930	1	1.0605420	0.3052060	7.7700080

save lag and standardized and unstandardized first difference





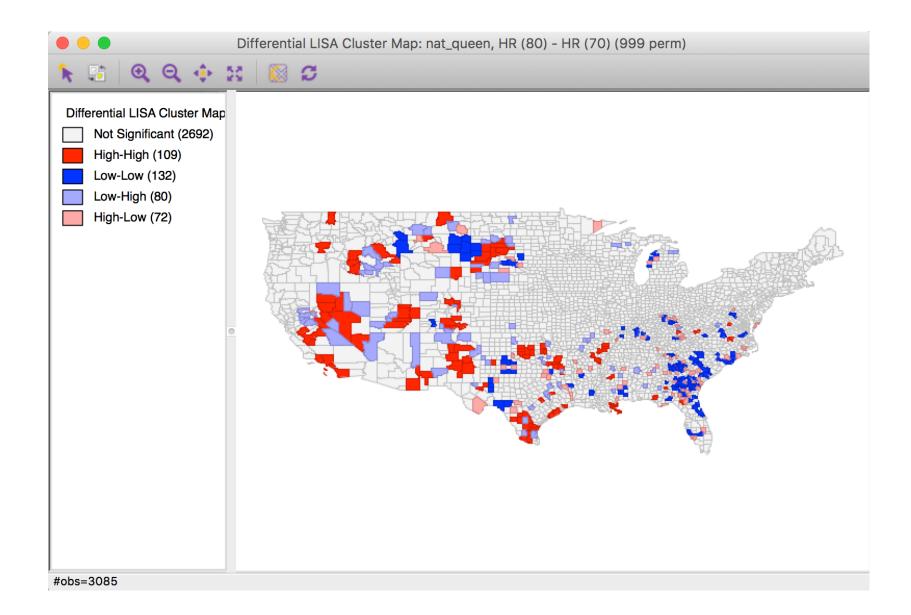
Univariate Local Moran's I
Differential Local Moran's I
Local Moran's I with EB Rate
Local G Cluster Map Local G* Cluster Map

	Differential Moran Variable	Settings	
Select variable HR	and two time periods:	70 <b>×</b>	and 60 🔽
		70 80	
Weights nat_queen	~	90	
	Ok Close	9	

## differential local Moran







## differential local Moran cluster map local clustering of the change





# Averages Tool





## • Principle

simple treatment effects analysis

compare mean of a variable in selected vs unselected set of observations

cross-section: selected vs unselected

all observations: one time period vs another time period

selected: one time period vs another time period

simple F test on difference in means





## • Difference-in-Differences Test

dummy variable regression

cross-sectional case: selected observations = I

all observations: second time period = I

selected at different points in time

selected = I, second time = I, interaction = I







creates new data set with dummy variables

in space-time case a space-time data set is created with a matching space-time spatial weights file (if a weights file is specified)

this allows for space-time regression in the regression modules using the new data file and matching spatial weights file

weights file is block-diagonal between time periods

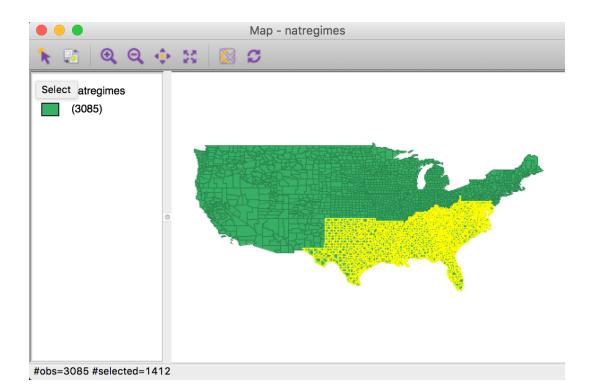






### averages chart icon and menu selection

ExploreSpaceTimeRHistogramBox PlotIIBox PlotIIIScatter PlotIIIScatter Plot MatrixIIBubble ChartII3D Scatter PlotIIParallel Coordinate PlotIAverages ChartIConditional PlotI





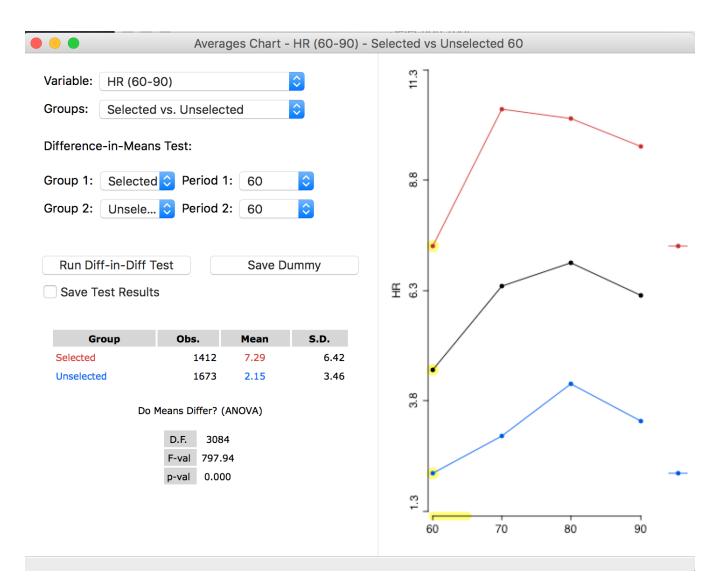


selection: south = I

## **Cross-Section**



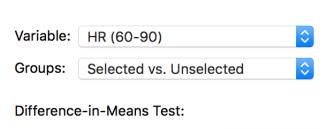


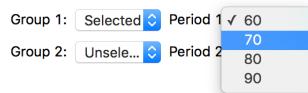


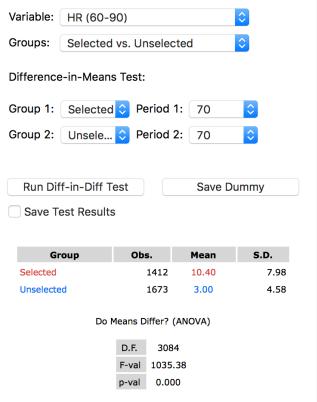
## selected vs unselected for HR in 60











## Averages Chart - HR (60-90) - Selected vs Unselected 70 11.3 8.8 НВ 6.3 3.8 1.3 60 70 80 90







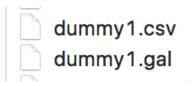
**Diff-in-Diff Regression Report** 

>>05/05/2016 03:45: REGRESSION (DIFF-IN		REGIMES)		
SUMMARY OF OUTPUT:	ORDINARY LEAST	SOUARES ESTIMATI	ON	
Data Set				
Dependent Variable			vations: 308	35
Mean dependent var				
S.D. dependent var	: 5.64881	Degrees of Free	dom : 308	33
R-squared	: 0.205604	F-statistic	:	797.938
Adjusted R-squared Sum squared residua	: 0.205347	Prob(F-statisti	c) :	0
Sum squared residua	1: 78199.7	Log likelihood	:	-9363.89
Sigma-square	: 25.3648	Akaike info cri	terion :	18731.8
S.E. of regression	: 5.03635	Schwarz criteri	on :	18743.8
Sigma-square ML				
S.E of regression M	L: 5.03472			
Variable	Coefficient	Std.Error	t-Statistic	c Probability
CONSTANT	2.15096	0.123131	17.4689	0.00000
SPACE	5.14118	0.182003	28.2478	3 0.00000

## run diff-in-diff test = dummy variable regression







STID, FIPSNO, PER	RIOD, HR, SPACE
1,27077,60,	0.00000000,0
2,53019,60,	0.00000000,0
3,53065,60,	1.863863416,0
4,53047,60,	2.612330199,0
5,53051,60,	0.00000000,0
6,16021,60,	0.00000000,0
7,30053,60,	7.976389886,0
8,30029,60,	1.011173467,0
9,30035,60,	11.529038766,0
10,30101,60,	0.000000000,0

0 3085 dummy1 STID
1 3
30 22 40
2 3
69 2 3
3 4
1 62 4 69
4 7
69 1 27 31 42 55 68
54
2 5 28 62

## files created by save dummy

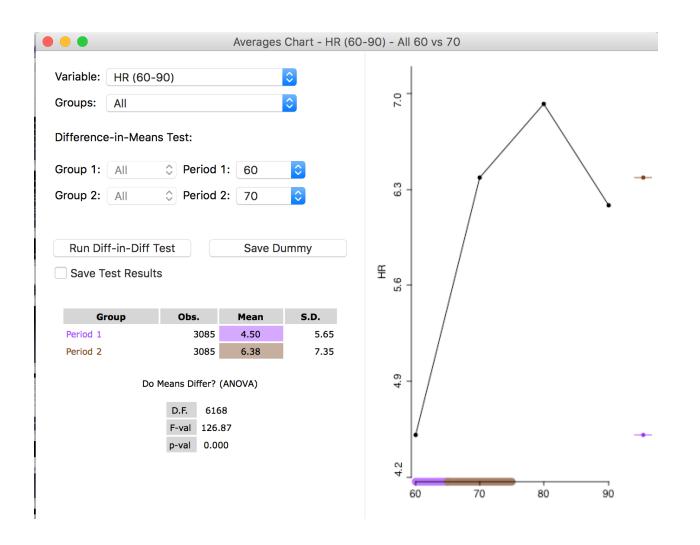




## All Observations - Two Periods







#### comparison of all observations in two time periods





		Diff-in-Diff Regres		
<b>*</b>				
>>05/05/2016 04:48: REGRESSION (DIFF-IN-		TIME PERIOD)		
SUMMARY OF OUTPUT: ( Data Set			ON	
Dependent Variable	: HR (60,70)	Number of Obser	vations: 6170	
lean dependent var	: 5.44426	Number of Varia	bles : 2	
S.D. dependent var				
R-squared	: 0.020154	F-statistic	:	126.868
Adjusted R-squared	: 0.019995	Prob(F-statisti	c) : 3.81	769e-29
Sum squared residua	L: 265156	Log likelihood	: -	20356.4
Sigma-square	: 42.989	Akaike info cri	terion :	40716.7
S.E. of regression	: 6.5566	Schwarz criteri	on :	40730.2
Sigma-square ML	: 42.9751			
S.E of regression M	L: 6.55554			
		Std.Error		-
		0.118046		
ПТМЕ	1.88037	0.166942	11.2636	0.00000

run diff-in-diff test = dummy variable regression





STID, FIPSNO, PER	IOD,HR,TIME
1,27077,60,	0.00000000,0
2,53019,60,	0.00000000,0
3,53065,60,	1.863863416,0
4,53047,60,	2.612330199,0
5,53051,60,	0.00000000,0
6,16021,60,	0.00000000,0
7,30053,60,	7.976389886,0
8,30029,60,	1.011173467,0
9,30035,60,	11.529038766,0

#### save dummy

space-time data set and gal weights file

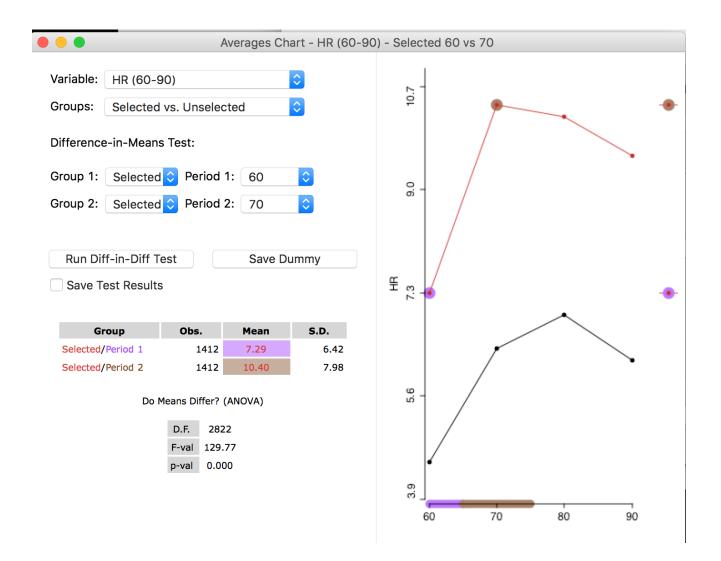




## Selected - Two Periods







comparison of selected observations in two time periods





Diff-in-Diff Regression Report



>>05/05/2016 04:55:				
REGRESSION (DIFF-IN-	-DIFF, COMPARE	REGIMES AND TIM	ME PERIOD)	
SUMMARY OF OUTPUT: (	ORDINARY LEAST	SOLIARES ESTIMAT	NON	
Data Set				
Dependent Variable		Number of Obse	ervations: 6170	
Mean dependent var	•			
S.D. dependent var	: 6.62262	Degrees of Fre	edom : 6166	
R-squared	: 0.249831	F-statistic	: 6	584.495
Adjusted R-squared				
Sum squared residual	L: 203003	Log likelihood	cic) : 1 : -1	19532.4
Sigma-square	: 32.923	Akaike info cr	iterion : 3	39072.7
S.E. of regression	: 5.73786	Schwarz criter	rion : 3	39099.7
Sigma-square ML				
S.E of regression MI	5.736			
Variable	Coefficient	Std.Error	t-Statistic	Probability
CONSTANT	2.15096	0.140282	15.3332	0.00000
SPACE	5.14118	0.207354	24.7942	0.00000
TIME	0.847231	0.198389	4.27056	0.00002
INTERACT	2.25724	0.293243	7.69751	0.00000
	ENI	O OF REPORT ====		

run diff-in-diff test = space and time dummies and interaction





# Spatial Regression





## • Functionality

OLS regression with diagnostics for spatial effects

ML regression of spatial lag and spatial error models

save residuals and predicted values

limitation: only for intrinsically symmetric weights





	Regression			
Variables		De	pendent Variable	
DV (70)	>	HR (60)		
DV (80)			Covariates	
DV (90)		RD (60)		
MA (60)		UE (60)		
MA (70)	>	PS (60)		
MA (80)	<	DV (60)		
MA (90)	>>			
POL (60)	<<			
POL (70) POL (80)				
POL (90)				
DNL (60)				
DNL (70)				
Veights File nat_queen			•	W
Models				
• Classic	Spatial La	g	O Spatial Error	
Pred. Val. and Res.	Coeff.	Var. Mat.	White Test	
Run Save to Tab	le Sav	e to File	Reset	



## regression toolbar icon and interface





**Regression Report** 

>>05/05/2016 05:57:4 REGRESSION	2 PM				
SUMMARY OF OUTPUT: O			UARES ESTIMAT	ION	
Data set	: natree	gimes			
Dependent Variable Mean dependent var S.D. dependent var	: HR	(60) N	umber of Obse	rvations: 308	5
Mean dependent var	: 4.5	50408 N	umber of Varia	ables : !	5
S.D. dependent var	: 5.6	54881 D	egrees of Fre	edom : 3080	0
R-squared Adjusted R-squared Sum squared residual Sigma-square S.E. of regression Sigma-square ML S.E of regression ML	: 0.22	20243 F	-statistic	:	217.488
Adjusted R-squared	: 0.21	19231 P	rob(F-statist	ic) :	0
Sum squared residual	: 767	758.7 L	og likelihood	:	-9335.2
Sigma-square	: 24.	.9217 A	kaike info cr	iterion :	18680.4
S.E. of regression	: 4.9	99216 S	chwarz criter	ion :	18710.6
Sigma-square ML	: 24.	.8813			
S.E of regression ML	. 4.9	98811			
Variable					
CONSTANT	2.65		0.252745	10.4882	0.0000
PD (60)	2.05	7011	0.0987288	29 0706	0.00000
KD (00)	-0 0367	7470	0.0364174	_1 00908	0.31300
UE (60)	-0.0307	7473	0.0304174	-1.00908	0.31300
PS (00)	0.702	2009			
DV (60)	1.07	7469	0.0976658	10.4882 29.0706 -1.00908 7.47318 11.0037	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO	CS	NUMBER		11.0037	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF	CS NDITION N 'ERRORS	NUMBER	5.711199		0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF	CS NDITION N 'ERRORS	NUMBER	5.711199		0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF	CS NDITION N 'ERRORS	NUMBER	5.711199	PROB 0.00000	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF	CS NDITION N CERRORS DF 2 ROSKEDAST	NUMBER V 2961	5.711199		0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST	CS NDITION M ' ERRORS DF 2 ROSKEDAST DF	NUMBER V. 2961 FICITY V	5.711199 ALUE 91.3107	PROB 0.00000	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST	CS NDITION M ' ERRORS DF 2 ROSKEDAST DF	NUMBER V. 2961 FICITY V	5.711199 ALUE 91.3107 ALUE	PROB 0.00000 PROB	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS	CS NDITION M ' ERRORS DF 2 ROSKEDAST DF	NUMBER V. 2961 FICITY V	5.711199 ALUE 91.3107	PROB 0.00000 PROB 0.00000	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4	NUMBER V. 2961 FICITY V. 4	5.711199 ALUE 91.3107 ALUE 60.2628	PROB 0.00000 PROB	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX :	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 4 2 1AL DEPEN nat_queer	NUMBER V 2961 FICITY V 4 NDENCE	5.711199 ALUE 91.3107 ALUE 60.2628	PROB 0.00000 PROB	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized	CS NDDITION M PERRORS DF 2 ROSKEDAST DF 4 4 4 A TIAL DEPEN nat_queen U weights)	NUMBER V 2961 FICITY V 4 NDENCE	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704	PROB 0.00000 PROB 0.00000 0.00091	0.00000
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized TEST Moran's I (error)	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized TEST Moran's I (error)	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized TEST Moran's I (error)	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized TEST Moran's I (error)	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized TEST Moran's I (error)	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200
REGRESSION DIAGNOSTI MULTICOLLINEARITY CO TEST ON NORMALITY OF TEST Jarque-Bera DIAGNOSTICS FOR HETE RANDOM COEFFICIENTS TEST Breusch-Pagan test Koenker-Bassett test DIAGNOSTICS FOR SPAT FOR WEIGHT MATRIX : (row-standardized	CS NDITION N PERRORS DF 2 ROSKEDAST DF 4 4 CIAL DEPEN nat_queer weights)	NUMBER V 2961 FICITY V 4 NDENCE h ) MI/DF 0.1906	5.711199 ALUE 91.3107 ALUE 60.2628 18.6704 VALUE 17.853	PROB 0.00000 PROB 0.00000 0.00091 PROB 5 0.000	200

GeoDa



Copyright © 2016 by Luc Anselin, All Rights Reserved

ols regression results with diagnostics

#### >>05/05/2016 05:58:11 PM REGRESSION

REGRESSION				
SUMMARY OF OUTPUT: SPAT		EL - MAXIMUM L	IKELIHOOD EST:	IMATION
Data set : na	atregimes			
Spatial Weight : na	at_queen			-
Dependent Variable :	HR (60)	Number of Obse	ervations: 30	85
Mean dependent var :	4.50408	Number of Var	iables :	6
Mean dependent var : S.D. dependent var : Lag coeff. (Rho) :	5.64881	Degrees of Fre	eedom : 30	79
Lag coeff. (Rho) :	0.387045			
R-squared :	0.309955	Log likelihood	d :	-9191.23
Sq. Correlation : - Sigma-square :		Akaike info c	riterion :	18394.5
Sigma-square :	22.0186	Schwarz crite	rion :	18430.7
S.E of regression :	4.6924			
Variable Co	oefficient	Std.Error	z-value	Probability
W_HR (60)	0.387045	0.0231936	16.687	 6 0.00000
		0.251275		
		0.106873		
UE (60) 0	.00261764	0.0342308	0.076470	3 0.93904
		0.0893103		
		0.0924862		
REGRESSION DIAGNOSTICS				
DIAGNOSTICS FOR HETEROS	KEDASTICITY			
RANDOM COEFFICIENTS				
TEST		DF	VALUE	PROB
Breusch-Pagan test			649.4843	
Dicabon ragan cobe		•	0101010	
DIAGNOSTICS FOR SPATIAL	DEPENDENCE			
SPATIAL LAG DEPENDENCE	FOR WEIGHT 1	MATRIX : nat_qu	ueen	
TEST		DF	VALUE	PROB
Likelihood Ratio Test		1	287.9311	0.00000
	===== END	OF REPORT ====		

ML estimation spatial lag





#### >>05/05/2016 05:58:30 PM REGRESSION

LAMBDA

\_\_\_\_\_

\_\_\_\_\_

SUMMARY OF OUTPUT:		ODEL - MAXIMUM LI	KELIHOOD ESTI	IMATION
Data set	-			
Spatial Weight	: nat_queen			
Dependent Variable	: HR (60)	Number of Observ	ations: 3085	
Mean dependent var	: 4.504075	Number of Variab	oles : 5	
S.D. dependent var	: 5.648806	Degrees of Freed	lom : 3080	
Lag coeff. (Lambda)	: 0.391016			
R-squared	: 0.300728	R-squared (BUSE)	: -	
Sq. Correlation	: -	Log likelihood	:-9212.	716168
Sigma-square	: 22.3131	Akaike info crit	erion: 1	18435.4
S.E of regression	: 4.72367	Schwarz criteric	on : 1	18465.6
		Std.Error		
CONSTANT	2.96545	0.309134	9.59279	0.00000
		0.129618		
UE (60)	0.0359107	0.0413815	0.867796	0.38551
		0.111279		
DV (60)	0.693085	0.109803	6.31207	0.00000
• • •		0 0243657		

REGRESSION DIAGNOSTICS DIAGNOSTICS FOR HETEROSKEDASTICITY RANDOM COEFFICIENTS				
TEST	DF	VALUE	PROB	
Breusch-Pagan test	4	613.6859	0.00000	
DIAGNOSTICS FOR SPATIAL DEPENDENCE				
SPATIAL ERROR DEPENDENCE FOR WEIGHT M	MATRIX : na	at_queen		
TEST	DF	VALUE	PROB	
Likelihood Ratio Test	1	244.9628	0.00000	
====== END OF	REPORT ==			===:

0.0243657

------

0.00000

\_\_\_\_\_

16.0478

DV (60)0.6930850.109803LAMBDA0.3910160.0243657

0.391016

## ML spatial error model





Save Regression Results		
	Variable Name	
Predicted Value	LAG_PREDIC	
🗸 Residual	LAG_RESIDU	
Prediction Error	LAG_PRDERR	
ОК	Close	

## save to table for spatial lag model



