Crime and Neighborhood Disorder

A Dynamic Spatial Panel Analysis in Two Cities

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Research Question:

George Kelling and James Wilson's 1982 "Broken Windows" theory of crime proposes a connection between neighborhood disorder and criminal activity. They argue that an abundance of disorder and vandalism create a signalling effect to would-be criminals that the neighborhood is less likely to care about additional crimes, reducing the "costs" or risks associated with committing a crime. The goal of this research is to use an existing economic framework – deterrence theory – to test the claims of Kelling and Wilson using data from a number of cities across the U.S. This research will make use of econometric models and techniques that have not yet been used in the literature.

Literature:

- Much of the "Broken Windows" research has been conducted in fields other than economics.
- Donahue and Levitt attribute decrease in crime to change in abortion laws, dismissing the effectiveness of "Broken Windows" style policing (2001).
- Harcourt argues that evidence in favor of the theory fails to account for other factors that simultaneously affect neighborhood deterioration (1998) and finds crime and disorder are not related when demographics and socioeconomic factors are accounted for (2001).
- Kelling and Sousa find that an increase in misdemeanor arrests (for crimes such as vandalism) led to a significant decrease in crime in New York City (2001).
- Currently, there is no consensus regarding the validity of the theory or the effectiveness of policing strategies based on the theory.

Data:

- Open City data from Chicago (2011-2012) and Boston (7/2011-2012).
- Provides geolocated crime reports and requests for service to 311, including reports of abandoned buildings, abandoned vehicles, sanitation issues, and graffiti.
- Crimes and calls were matched to census tracts and broken down by month.
- Each tract was paired with annual demographic and socioeconomic data from the American Community Survey (ACS).

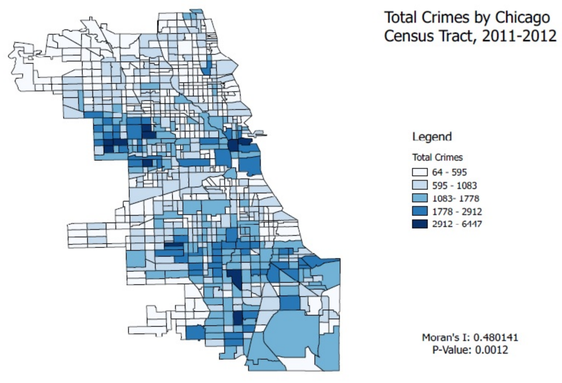
- Notes:
  - Some tracts were removed for having little to no population (airports, parks, etc.)
  - Duplicate 311 requests (same address and day) were removed.

Summary Statistics:

	Chicago		Boston	
Variable	Mean	S.D.	Mean	S.D.
Crimes	22.8	19.94	19.72	19.24
Index Crimes	13.03	11.43	11.97	12.41
Total Crimes	35.83	28.48	31.69	29.29
Abandoned Building Calls	1.45	2.7	0.98	1.74
Sanitation Calls	1.95	2.57	4.65	5.63
Abandoned Vehicle Calls	2.15	2.57	0.84	1.32
Graffiti Calls	12.24	22.24	1.86	3.37
Household Income	73818.35	48904.14	76677.92	38738.7
Pct. Black	38.19	41.15	27.13	27.08
Pct. Hispanic	25.31	29.36	17.29	15.01
Unemployment Rate	14.58	9.31	10.68	6.79
Poverty Rate	19.36	14.5	22.03	12.83
Pct. With H.S. Diploma	79.51	14.25	84.33	11.95
Total Observations	18912		3006	

Spatial Autocorrelation:

- There is a high degree of spatial autocorrelation across census tracts for both total crimes and index crimes. (Example map below)
- In addition, some degree of spatial autocorrelation of 311 service requests across tracts.
- Does the level of crime in one census tract have a significant impact on the level of crime in another tract, all other things considered?
- Additionally, can disorder in neighborhood A increase crime in a different neighborhood B both indirectly (through the level of crime in A) and directly (via a spillover effect to B)?



Simplified Model:

- Each individual knows the potential benefits (B_{it}) and potential punishment of committing a crime ($J_{it}>0$)

- They also form an expected probability of arrest $E(\pi|H_{it},D_{it})$, based on previous experience, socioeconomic background, etc (H_{it}) as well as the disorder in their surroundings (D_{it}).

- Thus, an individual only commits a crime if the benefit outweighs the expected risks:
  - $B_{it} > E(\pi|H_{it},D_{it}) * J_{it}$

- According to "Broken Windows" theory, an increase in D_{it} should increase the likelihood that any particular individual commits a crime.

- This model is generalized to the neighborhood level.

Econometric Techniques:

- The analysis begins with a series of three simple pooled OLS and FE models (no controls, ACS controls, ACS controls and time fixed effects).
- Spatial analysis is conducted using the Spatial Durbin Model (SDM), allowing for spatially lagged measures of both the dependent and independent variables to account for spillovers.
  - SDM produces unbiased results, even if the true data generating process differs. Allows for the calculation of direct and indirect effects. Dynamic SDM allows for the estimation of both short and long term effects (Elhorst 2010).
- Analysis was conducted using both total crimes and index crimes as the independent variable for both cities.
- **Note:** Only the results of the Chicago analysis will be displayed here, though the Boston results follow a strikingly similar pattern. All estimates use heteroskedasticity robust standard errors.

Chicago OLS/Fixed Effects Results, Log(Total Crimes)

	OLS			Fixed Effects		
Log(Buildings)	0.454***	0.184***	0.180***	0.0394***	0.0380***	0.00165
	(74.46)	(29.33)	(28.46)	(10.03)	(9.65)	(0.43)
Log(Sanitation)	0.212***	0.169***	0.161***	0.0401***	0.0404***	0.00397
	(32.23)	(29.66)	(27.17)	(12.03)	(12.12)	(1.21)
Log(Vehicles)	0.0409***	0.0800***	0.0906***	0.00318	0.00218	0.00667*
	(6.37)	(14.46)	(16.18)	(0.94)	(0.64)	(2.09)
Log(Graf)	0.0305***	0.206***	0.206***	0.0300***	0.0283***	0.0142***
	(8.99)	(46.16)	(46.09)	(8.76)	(8.20)	(4.39)
ACS Controls		X	X		X	X
Time Fixed Effects			X			X
N	18912	18912	18912	18912	18912	18912
adj. R-sq	0.312	0.483	0.490	0.019	0.021	0.147

t statistics in parentheses
* p<0.05 ** p<0.01 *** p<0.001

Results:

- The introduction of individual and time fixed effects greatly reduce the magnitude of the disorder variable effects.
  - The large decline in the size of the effects following the introduction of time fixed effects suggests similar seasonality in both crime and neighborhood disorder.
- These effects shrink further under the dynamic SDM model.
- The SDM model is estimated using both monthly mean temperature and time fixed effects, and the results remain largely unchanged between the two.
- Once spatial autocorrelation, as well as time and individual fixed effects are accounted for, little effect on crime from neighborhood disorder remains, with the exception of a very small direct effect associated with graffiti calls, and, in the mean temperature estimation, very small indirect and direct effects associated with calls regarding abandoned vehicles.

Chicago SDM Fixed Effects Results, Log(Total Crimes)

Spatial Lag				
Log (Total Crimes)	0.306***	0.304***	0.141***	0.208***
	(29.28)	(28.89)	(12.68)	(18.70)
Direct				
Log (Total Crimes) (t-1)	0.0886***	0.0864***	0.0739***	0.0610***
	(9.41)	(9.17)	(7.75)	(6.43)
Log (Buildings)	0.0142***	0.0131**	0.000521	0.00494
	(3.35)	(3.04)	(0.12)	(1.16)
Log(Vehicles)	0.00507	0.00422	0.00526	0.00871*
	(1.44)	(1.22)	(1.55)	(2.55)
Log(Sanitation)	0.0161***	0.0168***	0.00449	0.00285
	(5.29)	(5.49)	(1.44)	(0.92)
Log(Graffiti)	0.0202***	0.0197***	0.0155***	0.0169***
	(6.43)	(6.14)	(4.89)	(5.34)
Indirect				
Log(Total Crimes) (t-1)	0.273***	0.258***	0.160***	0.0736**
	(12.11)	(12.03)	(6.81)	(3.11)
Log(Buildings)	0.0797***	0.0720***	-0.0125	0.0122
	(6.89)	(6.01)	(-1.15)	(1.26)
Log(Vehicles)	0.00463	-0.00296	0.00241	0.0282***
	(0.43)	(-0.28)	(0.27)	(3.30)
Log(Sanitation)	0.0750***	0.0806***	-0.00337	-0.0151
	(9.58)	(9.91)	(-0.43)	(-1.66)
Log(Graffiti)	0.0293***	0.0248**	-0.0117	0.00256
	(3.34)	(2.87)	(-1.56)	(0.33)
ACS Controls		X	X	X
Time Fixed Effects			X	
Mean Temperature				X
N	18124	18124	18124	18124
R-sq	0.580	0.445	0.419	0.271

t statistics in parentheses
*p<0.05 ** p<0.01 *** p<0.001