The Neighborhood Impact of Industrial Blight: A Path Analysis

Reza Banai (rbanai@memphis.edu)
Department of City and Regional Planning

Ehsan Momeni (hsn.momeni@gmail.com)
Department of Earth Sciences

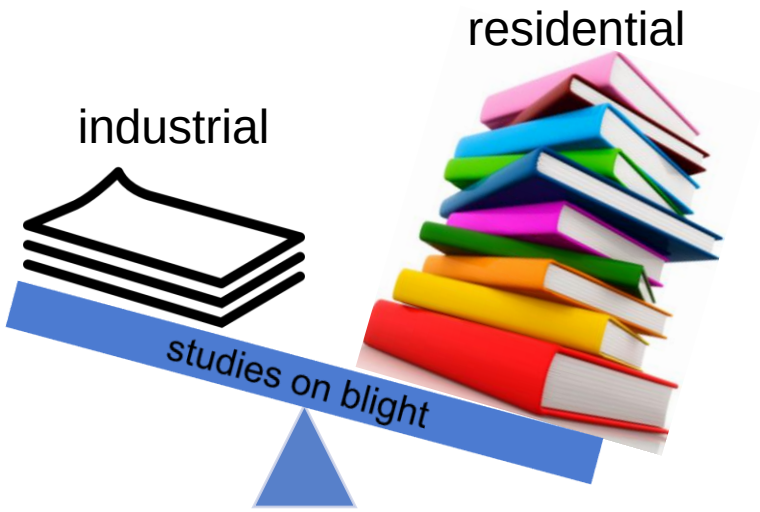
Photo by: Rama Mousavi

50th Annual Conference on Urban Affairs Association
Washington, DC | April 12 – 14, 2022

1. Introduction

- Historically, the American city contained industry, a major source of employment opportunity for residents that selected housing nearby or within a convenient or affordable commuting distance.

- The contemporary American city is characterized by abandoned, blighted industrial properties due to deindustrialization and suburbanization of both jobs and population since the 1940s.



The urban studies literature rarely documents the impact of industrial blight, akin to studies of residential blight on neighborhoods!

An example of industrial area in Memphis, TN

The deindustrialization of the inner city and the suburbanization of population and jobs did not just create blight limited to industrial and manufacturing land use but also contributed to the decline of neighborhoods with increasing vacancy and declining property values of the housing in proximity to the industrial sites that historically provided employment for workers nearby.

- Previous studies shed light on manifestation of the metropolitan region's blight at various spatial scales e.g., neighborhood, downtown, inner city, outer ring;
  - They pose the ambiguity of both the relation and the relative importance of the socio-economic determinants which are site- or context-specific.

- Previous studies do not account how industrial blight, which is a source of "public bad", impacts the neighborhood at various distances from the industrial blight site.

Research Question

- How industrial blight correlates with the socio-economic and physical characteristics of neighborhoods?

Purpose

- To determine the proximity-effect of industrial blight on the neighborhood, thought of as not an isolated, closed system but a connected entity within the city and the region:
  - We fill the void in the literature by a gradation of distance from industrial blight, from ¼ to ½ and ¾ mile. As well, we measure the neighborhood impact of blight for the county as a whole.
  - We determine the direct and indirect impact of the industrial site on the neighborhood with a path analysis by using block-group data

2. Literature Review

We focus our attention on industrial rather than residential or commercial blight, given our purpose to determine the impact of industrial blight on the neighborhood

- Neumann et al. (1973) find shortage of low to moderate income housing in Metropolitan Toronto's blighted areas that include residential, commercial, and industrial use.
  - Suburban growth coupled with deindustrialization did not just result in the inner city's blighted industrial properties. The shrinking inter city is coupled with both residential and non-residential blight.
- Sailer-Fliege (1999) observes the impact of industrial blight on the condition, affordability, and segregation of housing in post-socialist, Central European countries akin to the Neo-Liberal Angelo-American pattern.
  - The remnants of the socialist period are manifest in "the decay of old housing stock, large scale derelict industrial areas and the extent and deficiencies of high-rise housing estates."

2. Literature Review

- Larnell & Downey (2019) study does not mention industrial blight but determine the higher impact of tax increment financing (TIF) in non-white districts of Chicago compared to other districts.

- Ard and Smiley (2021) observe the concentration of poverty and the reduction of the manufacturing employment in proximity to hazardous industrial sites. They also remind the declining population of the White and African-Americans middle-class in industrial areas of the city combined with the declining manufacturing employment intensified the poverty of the minority and proximity to industrial sites.

- Broadway (1995) highlights the socio-economic disparity that exists within and between the Canadian cities as a consequence of post-industrialization,

- Lewis (2020) points out the suburban business and residential development competed with economic and planning policy that targeted (declining) heavy industry and middle-class and upper-class amenities in Chicago's downtown.

- Thomas (2013) observes, despite comprehensive, city wide- and project-planning to stop the physical and economic deterioration in the post-war decades, Detroit epitomizes urban decay. The contributing factors to the physical and economic decline are similar to those of other cities: Industrial activity declining steadily and the white residents decentralizing.

2. Literature Review

- The highway is a major driver of the suburbanization of jobs and the consequent decline of inner city manufacturing . An earlier study observes the relationship of blighted industrial sites and the highway, elevated and depressed on residential development (Thiel 1962).

- The spread of urban blight is linked directly or indirectly to large-scale urban transportation (Schmitt 1977).

- Al-Attar(2011) reminds us that industrial blight is correlated with de-industrializing inner city, and functional and spatial restructuring of industrial activity. Al-Attar (2011) notes blights sited have wide-ranging impacts—physical, socio-economic, and environmental—not just contained within the blighted site but also in surrounding properties.

- Han (2014) finds protracted abandonment not only impacts the value of the “nearby” but also distant property.

2. Literature Review

- Blackmond and Downey (2019) examine the blight-race-property value nexus in Chicago's TIF districts. Interestingly, the observation that tax increment financing districts with majority non-white residents register property value growth rate better that other (non-TIF) districts counters expectations.

- Mui (2017) observes an association between neighborhood crime, foreclosure, and vacancy rates and food swamps. The neighborhood foreclosure and vacancy rates have statistically significant relationship to food swamp scores.

- Solomon et al. (2016) include food deserts ,inferior quality of housing, and park and open space deserts in low income communities near "former industrial sites, major roadways, and agricultural operations."

- Empirical studies observe wide-ranging correlations of industrial blight with housing (property values), racial composition, concentration of poverty, and income (Mui et.al 2017).

3. Methodology

- We have conceptualized industrial blight as a kind of filter in the block group. The viability of the block group as a whole is indicated by income. We use it as a dependent variable in path analysis.

- We use median block income (MBI) analogously to the commonly used median area income (MAI), which is metropolitan region-wide.

1. We apply Pearson correlations that indicate the degrees of relationship among the variables.

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

$\bar{x}$ = mean of the values of the x-variable
y_i = values of the y-variable in a sample
$\bar{y}$ = mean of the values of the y-variable
r = correlation coefficient
x_i = values of the x-variable in a sample

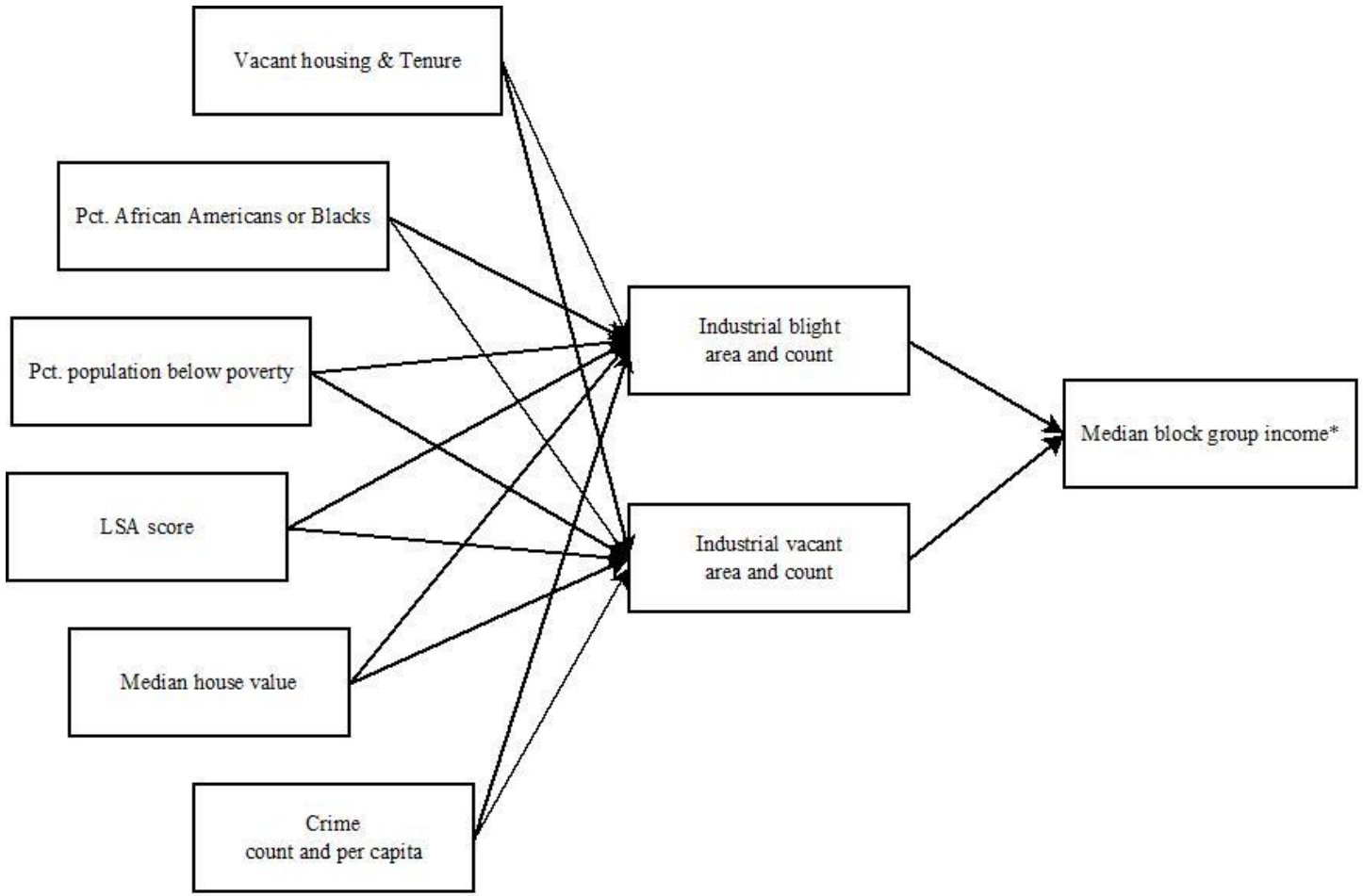
NEXT

2. We apply path analysis to investigate patterns of effect .

Causation is not determined by correlation alone

We use a path analysis to determine the direct and indirect impact of industrial blight in neighborhoods

Diagram of Path analysis

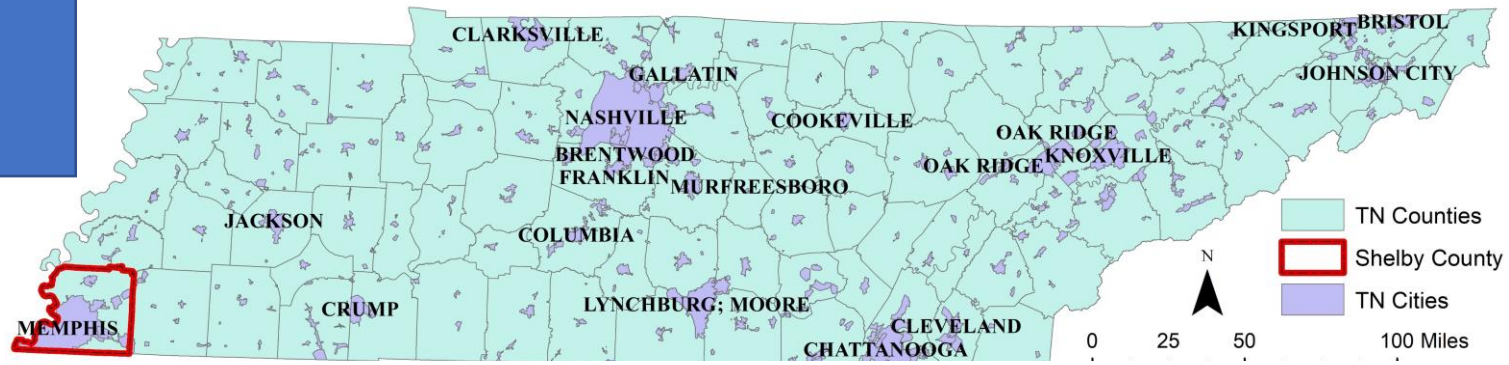


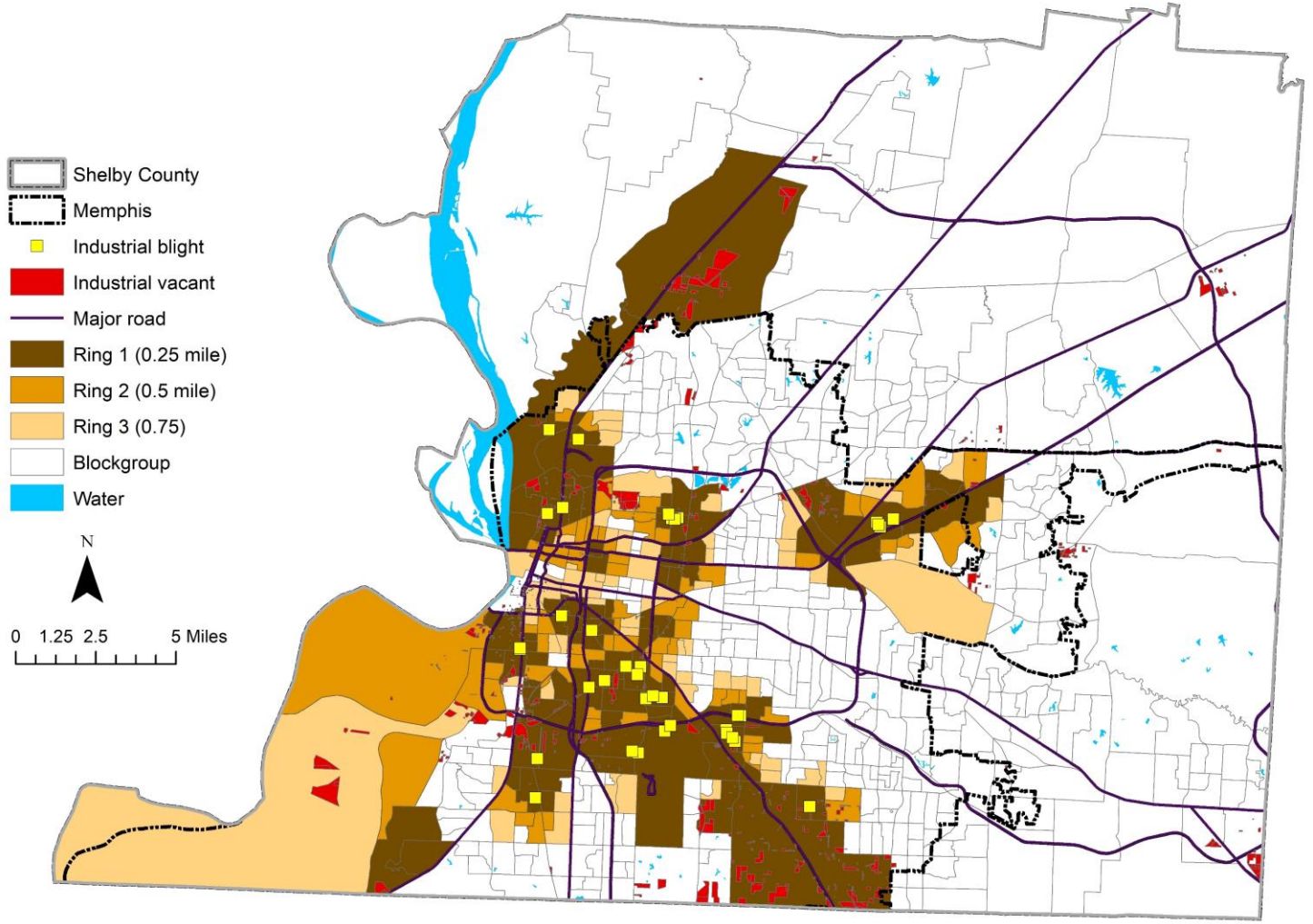
- Housing Tenure measured by % owner occupied.
- Median block income is analogous with commonly used Median Area Income (MAI), which is metropolitan region-wide. We use it as a dependent variable in path analysis.
- Variables have direct and indirect (through industrial blight and industrial vacant) relationship to the median block income.
- For simplicity, direct impacts of explanatory variables on median area income (MAI) are not shown.

4. Data & Study Area

Four main sources of data:

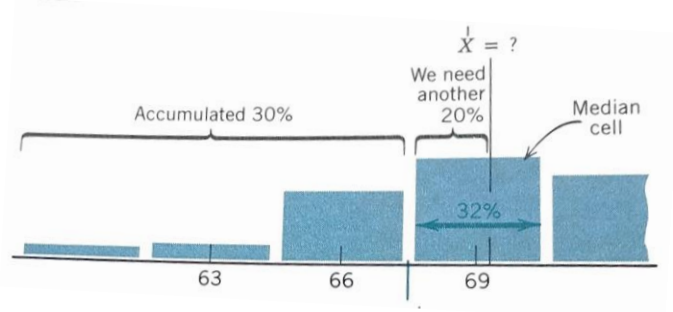
- ❑ Block group boundaries in 2019, household income in the past 12 months in 2018 inflation-adjusted dollars, the poverty rate in 2010, Tenure in 2010, race in 2010 and household values in 2017 were downloaded from the National Historical Geographic Information System (NHGIS), at https://nhgis.org/
- ❑ Limited Supermarket Access (LSA) data in 2016 were downloaded from the PolicyMap, at https://www.policymap.com
- ❑ Vacancy data in 2018 were downloaded from the Shelby County Assessor of Property, at https://www.assessormelvinburgess.com/welcome
- ❑ Crime data in 2018 were downloaded from Memphis Data Hub at https://memphisinternal.data.socrata.com/





4.1. Data preparation

- All data were imported to ArcMap 10.8 and converted to a numeric format, as some data were offered in the text format.
- NHGIS provides data for income, house value, and poverty in detailed intervals. E.g. at each block group, data for income in the past 12 months comes in 16 different intervals such as income less than $10k, $10k to 15k, 15k to20k, etc. House values and poverty also come in 26 and 7 different intervals. In order to calculate the median of those data, a careful approximation of the median was programmed in MatLab R2020b.



A careful approximation of the median
(Wonnacott and Wonnacott, 1990)

	A	B	C	D	E	F	G	H	I	J	K	L
1	GEO_ID	NAME	B19001_001E	B19001_001M	B19001_002E	B19001_002M	B19001_003E	B19001_003M	B19001_004E	B19001_004M	B19001_005E	B19001_005M
2	4.7157E+11	Block Group 1, Census Tract 221.11, Shelby County, Tennessee	866	191	233	109	129	114	41	39	40	51
3	4.7157E+11	Block Group 1, Census Tract 39, Shelby County, Tennessee	1011	58	375	67	123	53	58	36	35	26
4	4.7157E+11	Block Group 1, Census Tract 42, Shelby County, Tennessee	793	139	85	68	38	59	17	18	18	20
5	4.7157E+11	Block Group 1, Census Tract 53, Shelby County, Tennessee	490	108	70	50	120	66	82	60	52	51
6	4.7157E+11	Block Group 1, Census Tract 24, Shelby County, Tennessee	347	63	76	47	47	36	54	41	20	23
7	4.7157E+11	Block Group 3, Census Tract 24, Shelby County, Tennessee	222	81	5	9	42	33	15	23	0	12
8	4.7157E+11	Block Group 2, Census Tract 24, Shelby County, Tennessee	353	66	59	35	20	24	91	53	44	34
9	4.7157E+11	Block Group 1, Census Tract 25, Shelby County, Tennessee	441	118	36	32	98	79	39	54	29	33
10	4.7157E+11	Block Group 2, Census Tract 25, Shelby County, Tennessee	673	121	42	33	55	48	44	42	59	62
11	4.7157E+11	Block Group 2, Census Tract 30, Shelby County, Tennessee	401	88	80	59	46	49	27	24	48	45
12	4.7157E+11	Block Group 1, Census Tract 30, Shelby County, Tennessee	297	79	36	41	36	42	22	25	122	66
13	4.7157E+11	Block Group 3, Census Tract 30, Shelby County, Tennessee	689	103	38	36	71	49	59	64	81	58
14	4.7157E+11	Block Group 2, Census Tract 33, Shelby County, Tennessee	434	81	24	27	23	36	13	15	0	12
15	4.7157E+11	Block Group 1, Census Tract 33, Shelby County, Tennessee	703	95	22	24	0	12	12	18	50	49
16	4.7157E+11	Block Group 1, Census Tract 211.36, Shelby County, Tennessee	827	104	29	27	0	12	12	18	10	15
17	4.7157E+11	Block Group 3, Census Tract 222.10, Shelby County, Tennessee	332	92	48	43	52	51	8	13	52	44
18	4.7157E+11	Block Group 2, Census Tract 222.10, Shelby County, Tennessee	283	79	35	28	29	36	41	46	28	34
19	4.7157E+11	Block Group 1, Census Tract 215.40, Shelby County, Tennessee	1424	130	0	12	19	30	0	12	19	32
20	4.7157E+11	Block Group 1, Census Tract 216.20, Shelby County, Tennessee	313	71	0	12	18	27	0	12	30	28
21	4.7157E+11	Block Group 2, Census Tract 216.20, Shelby County, Tennessee	800	87	39	34	61	51	20	19	82	57
22	4.7157E+11	Block Group 1, Census Tract 217.45, Shelby County, Tennessee	921	172	32	53	10	17	0	12	0	12
23	4.7157E+11	Block Group 2, Census Tract 3, Shelby County, Tennessee	125	50	28	28	10	16	0	12	44	36
24	4.7157E+11	Block Group 2, Census Tract 217.45, Shelby County, Tennessee	1384	169	77	91	7	13	0	12	0	12
25	4.7157E+11	Block Group 1, Census Tract 2, Shelby County, Tennessee	389	54	115	49	96	43	10	10	32	25

Example of raw income data

```
% Careful Approximation of Median

format long
clc

BinLowerLimit = [0,10000,15000,20000,25000,30000,35000,40000,50000,...
                 60000,70000,80000,90000,100000,125000,150000,175000,...
                 200000,250000,300000,400000,500000,750000,1000000,1500000,2000000];

Sum=sum(Data,1);
Percentage=Sum/sum(Sum,2)*100;

TempCumPct = 0;
for i= 1:size(Percentage,2)
    TempCumPct = TempCumPct + Percentage(1,i);
    CumPercentage(1,i) = TempCumPct;
    if TempCumPct < 50
        index = i;
    end

end

Median =((50 - CumPercentage(1,index))/Percentage(1,index+1))* ...
        (BinLowerLimit(index+2)-BinLowerLimit(index+1))+BinLowerLimit(index+1)
```

Careful approximation of the median (Matlab script)

4.1. Data preparation

- In addition, data for vacancies were provided for different land uses. To extract only industrial vacant parcels, an attribute query was made in ArcMap using the *Select by Attributes* tool. Moreover, counts and total areas of industrial vacant parcels within each block group were calculated using the *Spatial Join* tool in ArcMap.

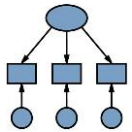
OBJECTID *	PARID *	CLASS	LUC	TAXYR	ALT_ID	ADRNO	ADRADD	ADRDIR	ADRSTR	ADRSUF
1	001080 00007	R	62	2018	D8	703	N	<Null>	FIFTH	ST
2	063071 00037C	C	40	2018	<Null>	5124	<Null>	<Null>	SUMMER	AVE
3	060092 00020C	C	2	2018	<Null>	2271	<Null>	<Null>	AIRWAYS	BLVD
4	050014 00062	R	62	2018	LM-4	2016	<Null>	<Null>	FARRINGTON	ST
5	002086 C00036	R	58	2018	<Null>	717	<Null>	<Null>	RIVERSIDE	DR
6	053074 00019	R	62	2018	<Null>	1628	<Null>	<Null>	WALTER	ST
7	053074 00020	R	62	2018	<Null>	1634	<Null>	<Null>	WALTER	ST
8	050124 00016	R	62	2018	PQ&Q-6	3295	<Null>	<Null>	GILL	RD
9	050124 00017	E	62	2018	PQ&Q-6	3305	<Null>	<Null>	GILL	RD
10	072062 00082	R	62	2018	<Null>	2404	<Null>	<Null>	WHITNEY	AVE
11	072062 00083	R	62	2018	<Null>	2394	<Null>	<Null>	WHITNEY	AVE

- At the next step, the centroid of each block group was estimated, and the distance between the centroid of each block group and industrial blights were calculated using the *Proximity Analysis* in ArcMap, and block groups categorized into three different zones:

- Previous studies shed light on manifestation of the metropolitan region's blight at various spatial scales--e.g., neighborhood, downtown, inner city, outer ring. This study defined three different zones (rings)

Z_1: block groups within 0.25 miles of an industrial blight;
Z_2: block groups within 0.50 miles of an industrial blight excluding Z_1;
Z_3: block groups within 0.70 miles of an industrial blight excluding Z_1 and Z_2;

IBM SPSS SPSS v26 and SPSS Amos were used for statistical analysis of pre-processed data



5. Results

Socio-Economic (Pearson) Correlations of Industrial Blight (Count and Area)

Variable	Distance	Industrial Blight – Count – Correlation	Count – p-value	Percent – Correlation	Percent – p-value	Industrial Blight – Area – Correlation	Area – p-value	Percent – Correlation	Percent – p-value
Residential Vacant Count	*Ring 1*	-0.001	0.989	-0.146	0.169	-0.113	0.288	-0.11	0.301
	Ring 2	-0.005	0.953	-0.103	0.194	-0.081	0.311	-0.078	0.326
	Ring 3	0.039	0.559	-0.061	0.363	-0.044	0.511	-0.032	0.632
	SC	0.075	0.06	-0.006	0.877	0.002	0.966	0.021	0.607
Pct. Residential Vacant Count	*Ring 1*	-0.05	0.638	-0.152	0.15	-0.138	0.192	-0.09	0.396
	Ring 2	-0.044	0.585	-0.112	0.16	-0.102	0.201	-0.07	0.379
	Ring 3	-0.002	0.971	-0.071	0.288	-0.066	0.33	-0.03	0.659
	SC	0.074	0.062	0.007	0.862	0.005	0.901	0.047	0.24
Residential Vacant Area	*Ring 1*	-0.04	0.707	-0.055	0.608	0.012	0.912	-0.051	0.632
	Ring 2	-0.019	0.808	-0.03	0.708	0.01	0.899	-0.027	0.738
	Ring 3	-0.018	0.79	-0.018	0.793	-0.006	0.933	-0.019	0.783
	SC	-0.027	0.494	-0.024	0.554	-0.014	0.721	-0.026	0.512
Pct. Residential Vacant Area	*Ring 1*	-0.13	0.218	-0.144	0.174	-0.086	0.418	-0.047	0.656
	Ring 2	-0.119	0.134	-0.121	0.128	-0.08	0.314	-0.062	0.439
	Ring 3	-0.077	0.25	-0.085	0.205	-0.053	0.433	-0.032	0.636
	SC	-0.033	0.414	-0.038	0.342	-0.023	0.572	-0.011	0.779
LSA Score	*Ring 1*	0.013	0.899	-0.01	0.926	-0.078	0.463	0.009	0.931
	Ring 2	-0.01	0.904	-0.022	0.784	-0.071	0.372	-0.01	0.896
	Ring 3	-0.015	0.821	-0.024	0.725	-0.064	0.34	-0.015	0.823
	SC	0.035	0.384	0.018	0.66	-0.015	0.701	0.03	0.454
Med. Income	*Ring 1*	-0.182	0.084	-0.132	0.214	-0.047	0.661	-0.153	0.147
	Ring 2	-0.133	0.095	-0.098	0.218	-0.041	0.604	-0.114	0.153
	Ring 3	-0.122	0.068	-0.091	0.175	-0.043	0.521	-0.106	0.116
	SC	-0.131***	0.001	-0.099*	0.013	-0.07	0.081	-0.116**	0.004
Med. House Value	*Ring 1*	-0.171	0.105	-0.204	0.052	-0.13	0.221	-0.15	0.156
	Ring 2	-0.127	0.111	-0.133	0.095	-0.093	0.241	-0.112	0.158
	Ring 3	-0.118	0.079	-0.122	0.07	-0.087	0.196	-0.105	0.118
	SC	-0.119**	0.003	-0.109**	0.006	-0.085*	0.033	-0.106**	0.008
Pct. Blacks or AA	*Ring 1*	0.108	0.306	0.027	0.797	0.023	0.827	0.165	0.119
	Ring 2	0.068	0.398	0.013	0.875	0.01	0.896	0.11	0.168
	Ring 3	0.077	0.251	0.028	0.682	0.024	0.721	0.109	0.105
	SC	0.107**	0.008	0.066	0.099	0.059	0.142	0.115**	0.004
Pct. Pop. Below Poverty	*Ring 1*	0.13	0.221	0.178	0.091	0.059	0.576	0.175	0.096
	Ring 2	0.108	0.175	0.141	0.077	0.054	0.499	0.14	0.079
	Ring 3	0.112	0.094	0.134*	0.046	0.061	0.366	0.136*	0.043
	SC	0.129***	0.001	0.125**	0.002	0.079*	0.047	0.135***	0.001
Pct. Home Owner	*Ring 1*	-0.127	0.23	-0.25*	0.017	-0.023	0.829	-0.053	0.615
	Ring 2	-0.132	0.097	-0.215**	0.006	-0.044	0.586	-0.074	0.352
	Ring 3	-0.098	0.143	-0.17*	0.011	-0.03	0.66	-0.053	0.435
	SC	-0.12**	0.003	-0.139***	0	-0.063	0.115	-0.089*	0.025
Total Crime	*Ring 1*	.233*	0.026	0.155	0.143	.314**	0.002	0.059	0.58
	Ring 2	.254**	0.001	.176*	0.027	.312**	0	0.099	0.216
	Ring 3	.251**	0	.176**	0.008	.301**	0	0.107	0.112
	SC	.213**	0	.154**	0	.231**	0	.116**	0.004
Per Capita Crime	*Ring 1*	.365**	0	.304**	0.003	0.149	0.158	0.005	0.963
	Ring 2	0.041	0.608	0.037	0.646	0.012	0.877	-0.016	0.838
	Ring 3	0.049	0.47	0.043	0.526	0.018	0.79	-0.009	0.898
	SC	0.068	0.087	0.058	0.148	0.032	0.424	0.01	0.794

Significance level (2-tailed): * at 0.05; ** at 0.01; *** at 0.001.
Distance in miles from blight: Ring 1 ≤ 0.25; Ring 2 ≤ 0.5; Ring 3 ≤ 0.75.

Socio-Economic (Pearson) Correlations of Industrial Vacancy (Count and Area)

Variable	Distance	Industrial Vacant – Count – Correlation	Count – p-value	Percent – Correlation	Percent – p-value	Industrial Vacant – Area – Correlation	Area – p-value	Percent – Correlation	Percent – p-value
Residential Vacant Count	*Ring 1*	0.629***	0	0.073	0.491	-0.058	0.585	0.033	0.759
	Ring 2	0.654***	0	0.021	0.794	-0.078	0.331	0.042	0.598
	Ring 3	0.677***	0	0.086	0.201	-0.055	0.414	0.131	0.051
	SC	0.626***	0	0.138***	0.001	0.08*	0.046	0.174***	0
Pct. Residential Vacant Count	*Ring 1*	0.501***	0	-0.058	0.587	-0.032	0.761	-0.04	0.707
	Ring 2	0.529***	0	-0.078	0.327	-0.072	0.366	0	0.997
	Ring 3	0.564***	0	0.019	0.776	-0.033	0.626	0.068	0.312
	SC	0.502***	0	0.122**	0.002	-0.005	0.909	0.162***	0
Residential Vacant Area	*Ring 1*	0.065	0.538	0.088	0.408	0.04	0.704	0.059	0.58
	Ring 2	0.134	0.092	0.036	0.654	0.028	0.731	0.026	0.749
	Ring 3	0.048	0.476	0.36***	0	0.943***	0	0.017	0.805
	SC	0.192***	0	0.223***	0	0.682***	0	0.011	0.786
Pct. Residential Vacant Area	*Ring 1*	0.189	0.074	-0.257*	0.014	-0.095	0.372	-0.153	0.149
	Ring 2	0.189*	0.017	-0.235**	0.003	-0.099	0.214	-0.153	0.054
	Ring 3	0.196**	0.003	-0.121	0.07	0.079	0.238	-0.109	0.106
	SC	0.176***	0	-0.043	0.277	0.053	0.185	-0.005	0.906
LSA Score	*Ring 1*	0.442***	0	-0.091	0.389	-0.12	0.256	0.047	0.659
	Ring 2	0.369***	0	-0.103	0.197	-0.128	0.107	-0.005	0.95
	Ring 3	0.362***	0	-0.062	0.358	-0.077	0.249	0	0.994
	SC	0.362***	0	0.029	0.473	-0.001	0.972	0.049	0.216
Med. Income	*Ring 1*	-0.237*	0.024	0.012	0.912	-0.049	0.646	-0.042	0.695
	Ring 2	-0.285***	0	-0.059	0.46	-0.09	0.259	-0.062	0.436
	Ring 3	-0.29***	0	-0.114	0.09	-0.108	0.108	-0.083	0.217
	SC	-0.18***	0	-0.145***	0	0.041	0.306	-0.124**	0.002
Med. House Value	*Ring 1*	-0.19	0.072	-0.129	0.222	-0.122	0.248	-0.128	0.227
	Ring 2	-0.208**	0.009	-0.139	0.08	-0.111	0.162	-0.124	0.121
	Ring 3	-0.199**	0.003	-0.158*	0.018	-0.084	0.212	-0.126	0.059
	SC	-0.102*	0.011	-0.158***	0	0.057	0.152	-0.144***	0
Pct. Blacks or AA	*Ring 1*	0.231*	0.028	0.007	0.945	-0.136	0.198	0.072	0.5
	Ring 2	0.286***	0	0.03	0.708	-0.024	0.766	0.057	0.478
	Ring 3	0.302***	0	0.004	0.955	-0.16*	0.017	0.08	0.232
	SC	0.217***	0	0.093*	0.02	-0.14***	0	0.143***	0
Pct. Pop. Below Poverty	*Ring 1*	0.143	0.178	-0.045	0.67	0.352***	0.001	0.054	0.613
	Ring 2	0.186*	0.019	-0.092	0.249	0.138	0.082	0.022	0.779
	Ring 3	0.214***	0.001	-0.056	0.408	-0.093	0.165	0.036	0.588
	SC	0.241***	0	0.064	0.107	-0.113**	0.005	0.138***	0.001
Pct. Home Owner	*Ring 1*	-0.091	0.391	-0.253*	0.015	-0.095	0.371	-0.17	0.107
	Ring 2	-0.143	0.072	-0.27***	0.001	-0.207**	0.009	-0.107	0.18
	Ring 3	-0.112	0.097	-0.269***	0	-0.159*	0.017	-0.069	0.303
	SC	-0.093*	0.02	-0.236***	0	-0.01	0.804	-0.095*	0.017
Total Crime	*Ring 1*	-0.116	0.275	.597**	0	-0.012	0.908	.222*	0.034
	Ring 2	0.004	0.963	.511**	0	-0.021	0.788	.214**	0.007
	Ring 3	0.025	0.713	.410**	0	-0.072	0.285	.202**	0.002
	SC	0.042	0.299	.329**	0	-.107**	0.007	.157**	0
Per Capita Crime	*Ring 1*	-0.015	0.886	.269*	0.01	.538**	0	0.029	0.786
	Ring 2	-0.027	0.733	.442**	0	.672**	0	-0.012	0.883
	Ring 3	-0.009	0.896	.381**	0	0.109	0.103	-0.004	0.95
	SC	0.016	0.689	.381**	0	.079*	0.048	0.014	0.731

Significance level (2-tailed): * at 0.05; ** at 0.01; *** at 0.001.
Distance in miles from blight: Ring 1 ≤ 0.25; Ring 2 ≤ 0.5; Ring 3 ≤ 0.75.

5. Results

Direct, indirect, and total effects of variables on median income of blockgroups in Ring1

Variable	Direct effect	Indirect effect	Total effect
Per capita crime rate	-4930.649	2122.413	-2808.236
Count of crimes	6.411	2.374	8.785
Pct. people below poverty level	-305.711	58.472	-247.24
Pct. Blacks or African-Americans	-276.846	-26.867	-303.713
Median house value	0.169	-0.005	0.164
Score of limited supermarket access	-19.592	-22.247	-41.839
Pct. owner occupied houses	149.302	-17.402	131.9
Area of residential vacant	-55.482	-141.951	-197.433
Pct. area of residential vacant	0	0	0
Count of residential vacant	337.254	78.625	415.879
Pct. count of residential vacant	-24.875	-4.931	-29.806
Area of industrial vacant	-19.153	0	-19.153
Pct. area of industrial vacant	0	0	0
Count of industrial vacant	821.173	0	821.173
Pct. count of industrial vacant	1.748	0	1.748
Area of industrial blight	21.131	0	21.131
Pct. area of industrial blight	0.003	0	0.003
Count of industrial blight	5223.231	0	5223.231
Pct. count of industrial blight	-3046.774	0	-3046.774

Direct, indirect, and total effects of variables on median income of blockgroups in Shelby County

Variable	Direct effect	Indirect effect	Total effect
Per capita crime rate	-1115.058	123.759	-991.299
Count of crimes	-6.231	3.002	-3.229
Pct. people below poverty level	-412.804	4.291	-408.514
Pct. Blacks or African-Americans	-113.797	-2.717	-116.513
Median house value	0.174	-0.001	0.173
Score of limited supermarket access	-73.908	1.646	-72.263
Pct. owner occupied houses	78.572	0.844	79.416
Area of residential vacant	-2.738	-1.08	-3.817
Pct. area of residential vacant	0	0	0
Count of residential vacant	-76.925	-8.002	-84.927
Pct. count of residential vacant	13.355	12.639	25.994
Area of industrial vacant	70.887	0	70.887
Pct. area of industrial vacant	0	0	0
Count of industrial vacant	537.97	0	537.97
Pct. count of industrial vacant	8.836	0	8.836
Area of industrial blight	-118.3	0	-118.3
Pct. area of industrial blight	0.008	0	0.008
Count of industrial blight	7108.752	0	7108.752
Pct. count of industrial blight	-3285.342	0	-3285.342

6. Discussion

We explored the association between the socio-economic variables with various distance to industrial blight and vacant sites, from the immediate ¼ mile to distances beyond up to ¾ miles and for Shelby County:

- Industrial vacant is directly related to the number of residential vacancies at various distance from the vacant site.

In agreement with findings of Marlow et al. (2020) in Rhode Island

- The correlations of the limited supermarket area (LSA) with the number of industrial vacant site are statistically discernible (*p-value* = 0) at all three rings, from ¼ to ¾ mile distance and for Shelby County.
  - The highest correlation is in Ring 1, the quarter-mile distance of blight (0.442).

In agreement with findings of Nassauer (2014) in Maryland

- Median income's correlations are also statistically discernible with expected sign for various rings and for Shelby County:
  - Median income declines with the number of industrial vacancies, and similarly with the number of industrial blight;
  - For Shelby County the correlations are statistically discernible whether the number, or percent, or percent of area is measured.

In agreement with findings of Lavoice (2019) across 28 U.S. cities

7. Conclusion

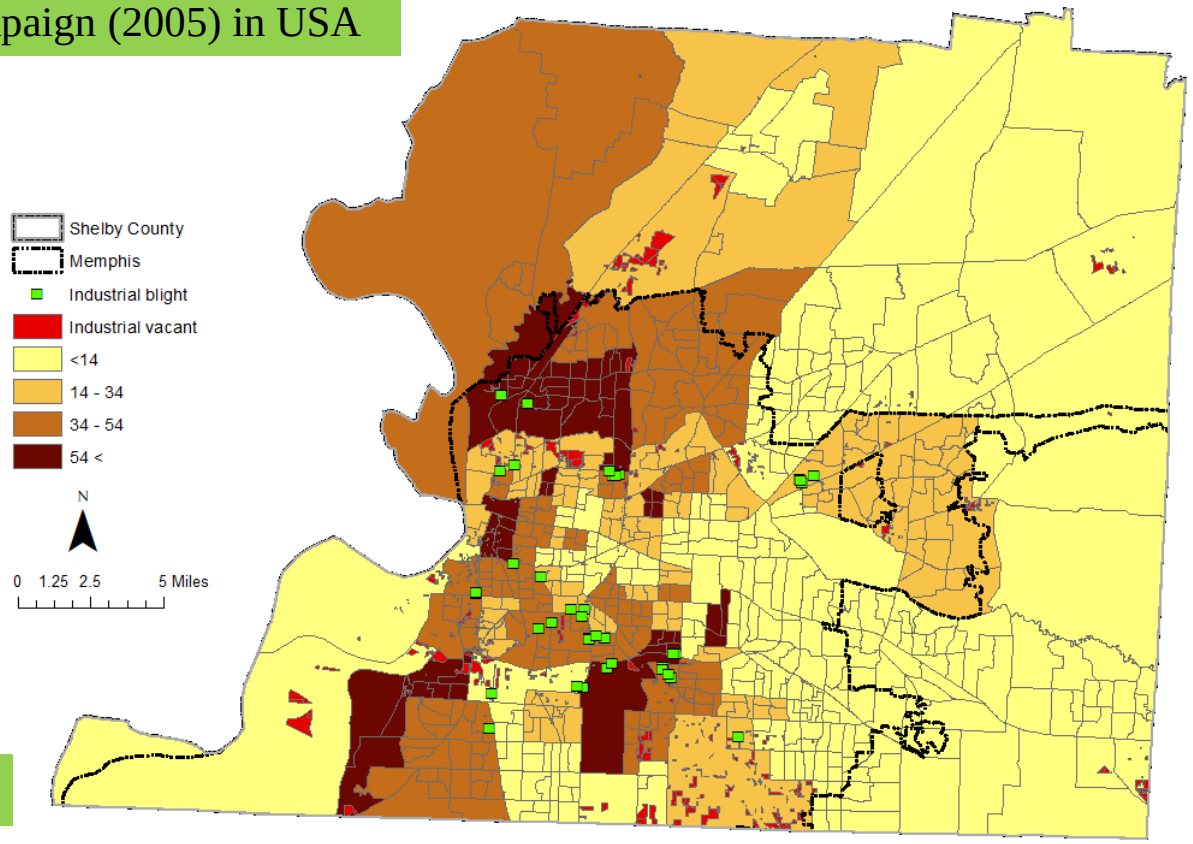
- The median house value correlates indirectly with the number of industrial vacancies, statistically discernible at various rings and Shelby County, with *p-value* of 0.07 and better.

- Home ownership declines with vacancies. Statistically discernible correlations are found for Shelby County's industrial vacant whether measured by the number, the area or percent of the block group vacant area.

In agreement with findings of the National Vacant Properties Campaign (2005) in USA

- Population below poverty (percent) increases with industrial vacancies (Highest correlation is for Shelby County):
  - Statistically discernible correlations are at ½ mile and ¾ mile and Shelby County, rather than ¼ mile distance;
  - Population in poverty also increase with industrial blight with statistically significant correlations for Ring 3, ¾ distance, and Shelby County.

In agreement with findings of Silverman et al. (2013) in Buffalo, NY

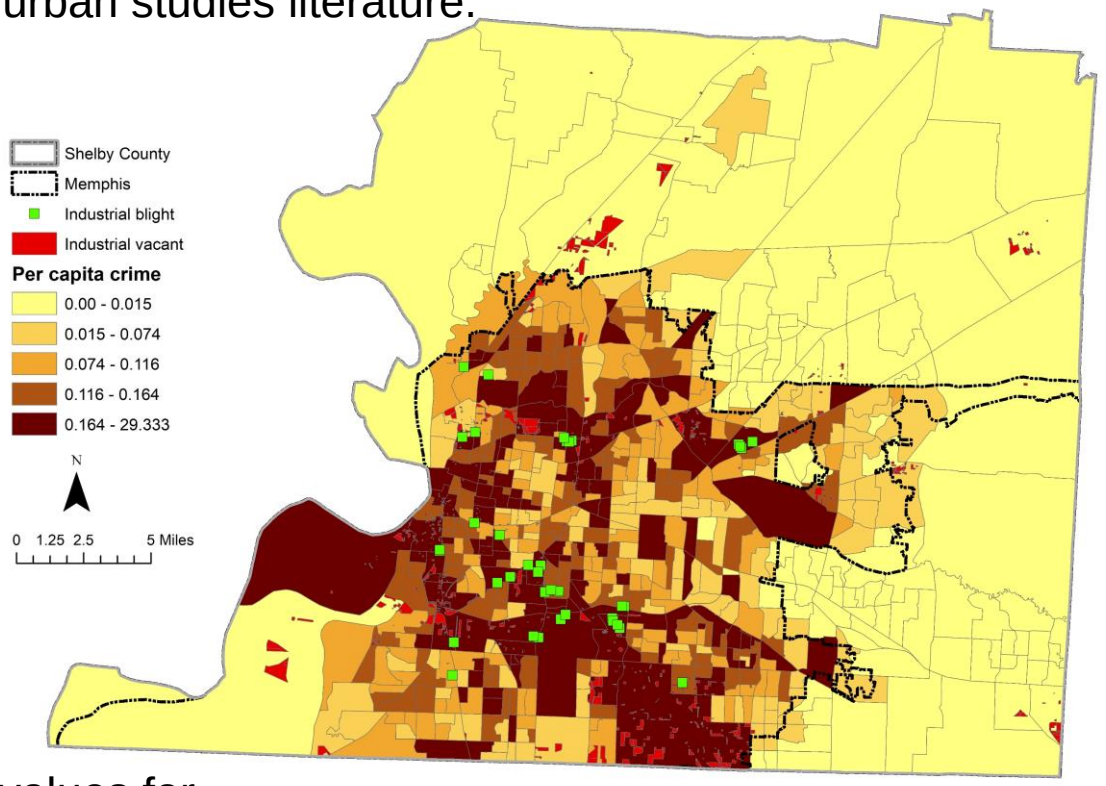


Percent of population below poverty level

7. Conclusion

The association of the inner city and crime is commonly noted in urban studies literature.

Our focus is with the nexus of crime and industrial blight using two indicators: total crime, per capita crime



- ❑ Total crime has a positive correlation with the percent area of industrial vacancies (highest correlation at ¼ mile distance of the vacant industrial area, decreasing in value with increasing distance in Ring 2, Ring 3, and Shelby County)
- ❑ Even higher correlation values is reached when per capita crime is used. The correlation of per capita crime and the area of industrial vacancies have highest positive or direct correlation at ½ mile distance (0.672; *p-value* = 0).
- ❑ Similar results was achieved for industrial blight, with positive values for total crime from ¼ mile to ¾ mile distance and in Shelby County.
  - Statistically significant results achieved when the count and area of industrial blight is measured;
  - Per capita crime has highest correlation at ¼ mile distance whether blight is measure in number or percent of the property blight.

All these findings are in agreement with findings of Branas et al. (2012) in Philadelphia, PA and results of a research by Center on Urban Poverty and Community Development (2017) in Cleveland, OH

7. Conclusion and Further Works

- Methodologically by measuring industrial vacancies by *both* the number *and* the area allowed us to sift through statistically discernible associations which would likely be missed if measured as either/or.
- Furthermore, data on the number and the area of industrial vacancies facilitated by a GIS enabled spatial analysis of the correlations of the socio-economic variables at various distances from the blight source.
- This finer-grain investigation of the impact of industrial blight complements studies commonly done at a coarse grain of the inner city of the metropolitan region.
- The distinction made between blight and vacant industrial properties provides further implications for public policy that aims at blight remediation vs. reduction of vacancies. The socio-economic variables measured directly and indirectly for block group-impact in path analysis provides further clues for targeted policy intervention.
- We have presented results of blight and vacant properties parsimoniously for the ¼ mile distance and for Shelby County. Comparisons of the impact of blight and vacant properties at various distances noted above await further observation.
- To determine the impact of industrial blight and vacancy on the block group, we used readily available block group median income (BMI) analogously to commonly used metropolitan area median income (AMI) as a dependent variable in the path analysis. Alternative indicator of block group vitality is plausibly explored in further research.

References

Al-Attar, A. (2011). Planning for Reuse and Redevelopment of Inner City Blighted Contaminated Industrial Sites. *UWSpace*. http://hdl.handle.net/10012/6330

Antipova, A., Momeni, E., & Banai, R. (April 2022a). Analysis of Urban Sprawl and Blight Using Shannon Entropy Index: A Case Study of Memphis, Tennessee. In U. Chatterjee, A. Biswas, J. Mukherjee & S. Majumdar (Eds.). *Advances in Urbanism, Smart Cities, and Sustainability* (Chapter 17, pp. 299-322). Boca Raton, FL: Taylor & Francis Group CRC Press. DOI: 10.1201/9781003126195-21

Antipova, A., Momeni, E., & Banai, R. (April 2022b). Urban Sprawl, Blight, and the COVID-19 Pandemic. In U. Chatterjee, A. Biswas, J. Mukherjee & S. Majumdar (Eds.). *Advances in Urbanism, Smart Cities, and Sustainability* (Chapter 15, pp. 263-281). Boca Raton, FL: Taylor & Francis Group CRC Press. DOI: 10.1201/9781003126195-19

Ard, K., & Smiley, K. (2021). Examining the Relationship Between Racialized Poverty Segregation and Hazardous Industrial Facilities in the US Over Time. *American Behavioral Scientist*, https://doi.org/10.1177/00027642211013417

Area Median Income (AMI). *DU.S. Department of Housing and Urban Development*, https://www.huduser.gov

Banai, R., & Antipova. A. (2016). Retail-center viability and urban form: a micro analysis. *The International Review of Retail, Distribution and Consumer Research*, 26:5, 521-540

Banai, R., Antipova, A., & Momeni, E. (June 2021). Mapping the morphology of sprawl and blight: A note on entropy. *GeoScape*, 15(1), 1-18. DOI: 10.2478/geosc-2021-0001

Blackmond, L. T., & Downey, D. C. (2019). Tax Increment Financing in Chicago: The Perplexing Relationship Between Blight, Race, and Property Values. *Economic Development Quarterly*, 33(4), 316–330. https://doi-org.ezproxy.memphis.edu/10.1177/0891242419877944

Branas, C. C., Kondo, M. C., Murphy, S. M., South, E. C., Polsky, D., & MacDonald, J. M. (2016). Urban blight remediation as a cost-beneficial solution to firearm violence. American journal of public health, 106(12), 2158-2164. https://doi.org/10.2105/AJPH.2016.303434

Broadway, M. (1995). The Canadian inner city (1971-1991): Regeneration and Decline. *Canadian Journal of Urban Research*, 4:1-20. https://www-jstor-org.ezproxy.memphis.edu/stable/44320903

Center on Urban Poverty and Community Development. (2017). Exploring the Relationship Between Vacant and Distressed Properties and Community Health and Safety. Retrieved from https://case.edu/socialwork/sites/case.edu.socialwork/files/2018-10/vacant_distressed_props_comm_health_safety.pdf

Han, H. S. (2014). The impact of abandoned properties on nearby property values. *Housing Policy Debate*, 24(2), 311-334. https://doi.org/10.1080/10511482.2013.832350

Lavoice, J. (2019). The long-run implications of slum clearance: A neighborhood analysis. Department of Economics, Bowdoin College. https://drive.google.com/file/d/1pX7MLBb8I0bJOgfF11W_NTkH8Tnk4des/view

Lewis, R. (2020). Chicago's Industrial Decline : The Failure of Redevelopment, 1920–1975. Chapter 3. Cornell University Press. http://ezproxy.memphis.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2439247&site=eds-live&scope=site&ebv=EK&ppid=Page-__-57

Marlow, T., Frickel, S., & Elliott, J. R. (2020, December). Do Legacy Industrial Sites Produce Legacy Effects in Ethnic and Racial Residential Settlement? Environmental Inequality Formation in Rhode Island's Industrial Core 1. *In Sociological Forum*, 35(4), pp. 1093-1113. https://doi.org/10.1111/socf.12639

Momeni E., Antipova, A. (2022a). A micro-level analysis of commuting and urban land using the Simpson's Index and Socio-Demographic Factors. Applied Geography

Momeni E., Antipova, A. (2022b). The Kappa coefficient is still alive. Transactions in GIS

Mui, Y., Jones-Smith, J. C., Thornton, R. L., Pollack P. K., & Gittelsohn, J. (2017). Relationships between vacant homes and food swamps: a longitudinal study of an urban food environment. *International journal of environmental research and public health*, 14(11), 1426. https://doi.org/10.3390/ijerph14111426

Nassauer, J.I., Raskin, J., *Urban vacancy and land use legacies: A frontier for urban ecological research, design, and planning*, Landscape and Urban Planning, Volume 125, 2014, Pages 245-253, https://doi.org/10.1016/j.landurbplan.2013.10.008.

National Vacant Properties Campaign (2005). The True Costs to Communities. Retrieved from https://files.hudexchange.info/resources/documents/VacantPropertiesTrueCosttoCommunities.pdf

Neumann, B., Mezoff, R., & Richmond, A. H. (1973). Long-Term Plans for Urban Improvement in Toronto. *In Immigrant Integration and Urban Renewal in Toronto* (pp. 1 8). Springer, Dordrecht. https://doi.org/10.1007/978-94-011-6794-9_1

Parent, O., & vom Hofe, R. (2013). Understanding the impact of trails on residential property values in the presence.

Ross, C. L., & Leigh, N. G. (2000). Planning Urban Revitalization and Inner City: An Exploration of Structural Racism, *Journal of Planning Literature*,14, 3: 367-380

Sailer-Fliege, U. (1999). Characteristics of post-socialist urban transformation in East Central Europe. *GeoJournal*, 49(1), 7-16. https://doi.org/10.1023/A:1006905405818

Schmitt, R. R. (1977). Predicting the impacts of transportation on the spread of urban blight. *Transportation research record*, 634, 27-32. https://trid.trb.org/view/72438

Silverman, R. M., Yin, L., & Patterson, K. L. (2013). Dawn of the dead city: An exploratory analysis of vacant addresses in Buffalo, NY 2008–2010. Journal of Urban Affairs, 35(2), 131-152. https://doi.org/10.1111/j.1467-9906.2012.00627.x

Solomon, G. M., Morello-Frosch, R., Zeise, L., & Faust, J. B. (2016). Cumulative environmental impacts: science and policy to protect communities. *Annual review of public health*, 37, 83-96. https://doi.org/10.1146/annurev-publhealth-032315-021807

Thiel, F. I. (1962). Social effects of modern highway transportation. *Highway Research Board Bulletin*, 327, 1-20. http://onlinepubs.trb.org/Onlinepubs/hrbbulletin/327/327-001.pdf

Thomas, J. M. (2013). *Redevelopment and Race : Planning a Finer City in Postwar Detroit*. Paperback ed. Wayne State University Press. http://ezproxy.memphis.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=698561&site=eds-live&scope=site

vom Hofe, R., Parent, O., & Grabill M. (2019). What to do with vacant and abandoned residential structures? The effects of teardowns and rehabilitations on nearby properties, *Journal of Regional Science,* 59:228–249.

Wainright, O. (2020). The countryside is where the radical changes are: Rem Koolhaas goes rural. *The Guardian,* https://www.theguardian.com/artanddesign/2020/feb/11/rem-koolhaas-rural-countryside-the-future-guggenheim

Wonnacott, H. W. , & Wonnacott R. J. (1990). *Introductory Statistics,* Fifth ed, John Wiley & Sons, NY.