Redlining and residential property values in the City of Philadelphia

November 10, 2018

Current neighborhood conditions—for example, crime and violence, school quality, access to jobs and amenities—affect the desirability and property values of homes. When we control for these factors, do historically discriminatory practices such as redlining affect present-day property values? The results here indicate that *neighborhoods once rated "A" or "B" by the Home Owners' Loan Corporation (HOLC) have significantly higher assessed values per square foot than their downgraded counterparts.*

Appraised home values, as measured in cost per square foot, are highly neighborhood-dependent (Figure 1). An analysis of the regression residuals shows that the existing model does not account well for these differences (Figure 2). Going forward, a spatial autoregressive model will better handle spatial correlation in the regression residuals.

Input data and methods

- **Appraised home values.** A random 25% sample (n=145,179) of Philadelphia's appraisal data is subset for processing speed. Single-family residential properties are extracted using fields `Category Code`, `Parcel Number`, and `Unfinished` (resultant n=105,792). The appraised property value is divided by the living area to obtain a cost in square feet. Source: Philadelphia Office of Property Assessment.

- **Neighborhood violence.** Point-level shootings data is used as a measure of neighborhood violence. The data is smoothed through a kernel density estimation and then standardized using the cumulative normal distribution function. Each appraisal data point is assigned a score of its violence relative to the rest of the City, with possible values ranging from 0 to 100. Source: Philadelphia Police Department.

- **School quality.** The School District of Philadelphia issues annual reports of high schools, including overall performance scores ranging from 0 to 100. For an example, see this report. Each appraisal data point is assigned to its nearest school's performance score using Voronoi polygons. Source: School District of Philadelphia.

- **Job accessibility.** The University of Minnesota's Access Across America Project computes the number of jobs available within a 30-minute commute via transit at the

census block level. Each appraisal data point is assigned the number of accessible jobs, in thousands, using a point-in-polygon operation. Source: Access Across America.

- **HOLC ratings.** The University of Richmond's Digital Scholarship Lab provides digitized HOLC redlining maps for dozens of U.S. cities. HOLC grades range from "A" (Best) to "D" (Hazardous). The HOLC ratings are reclassified into four Boolean variables. Each appraisal data point is linked to the four Boolean variables. Source: Digital Scholarship Lab.

Results

Table 1: Single-Family Housing Values

	Cost Per Sq. Ft.
Overall Performance Score of Nearest HS	0.115***
	(0.007)
Relative Density of Shootings	−1.200***
	(0.005)
Number of Jobs Within 30 Mins.	0.129***
	(0.001)
HOLC Grade A	13.950***
	(0.846)
HOLC Grade B	3.545***
	(0.412)
HOLC Grade C	−0.124
	(0.386)
Constant	98.530***
	(0.472)
N	94,752
R^2	0.388
Adjusted R^2	0.388
Residual Std. Error	40.567 (df = 94745)
F Statistic	10,017.010*** (df = 6; 94745)
Notes:	***Significant at the 1 percent level.
	**Significant at the 5 percent level.
	*Significant at the 10 percent level.

Figure 1: Appraised home value per square foot depends heavily on neighborhood.

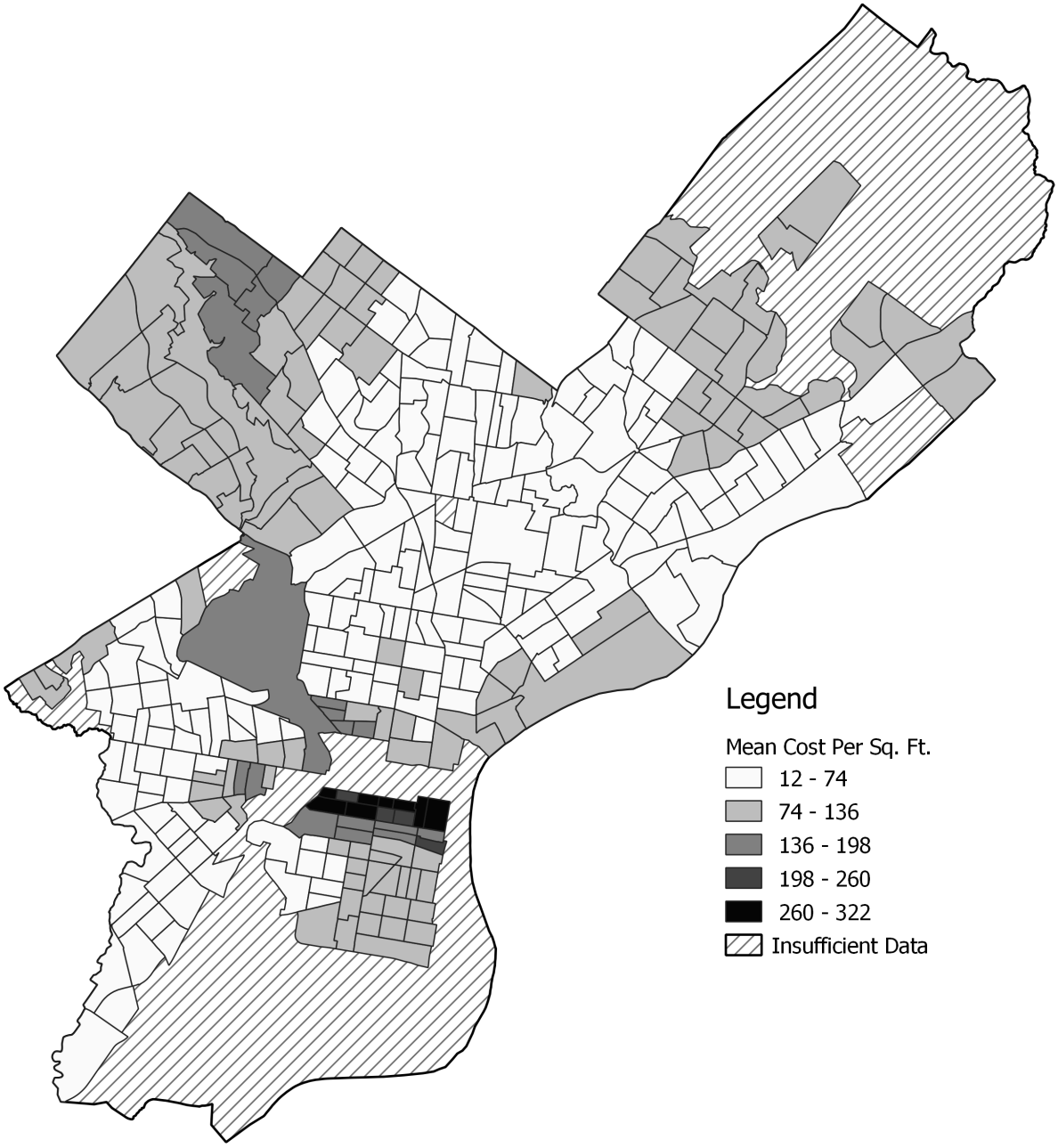

Figure 2: The spatial distribution of the regression residuals indicate additional "neighborhood effects" not accounted for in the model. Positive residual values indicate that the model underestimates actual appraised cost per square foot, and vice versa.