The Professional Geographer

ISSN: 0033-0124 (Print) 1467-9272 (Online) Journal homepage: www.tandfonline.com/journals/rtpg20

The Lingering Effects of Neighborhood Appraisal: Evaluating Redlining's Legacy in Pittsburgh

Devin Q. Rutan & Michael R. Glass

To cite this article: Devin Q. Rutan & Michael R. Glass (2018) The Lingering Effects of Neighborhood Appraisal: Evaluating Redlining's Legacy in Pittsburgh, The Professional Geographer, 70:3, 339-349, DOI: 10.1080/00330124.2017.1371610

To link to this article: https://doi.org/10.1080/00330124.2017.1371610

Published online: 09 Oct 2017.

Submit your article to this journal

Article views: 2096

View related articles

View Crossmark data

Citing articles: 32 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=rtpg20

Check for updates

The Lingering Effects of Neighborhood Appraisal: Evaluating Redlining's Legacy in Pittsburgh

Devin Q. Rutan and Michael R. Glass
University of Pittsburgh

Place-based classifications can create long-standing influences on neighborhood fortunes. Redlining is a classic example of these unintended effects. The Federal Home Loan Bank Board developed housing appraisal standards subsequently codified in Residential Security Maps. By georeferencing the 1937 map of Pittsburgh, we evaluated the spatial legacies of neighborhood appraisals. We identify persistent neighborhood conditions by comparing neighborhood evaluations with normalized census data from 1970 to 2000. Contemporary conditions correspond with security grades from the 1937 map. Concentrations of poverty, people of color, and vacancy persist in historically redlined areas. Concentrations of high incomes, home values, and homeownership persist elsewhere. **Key Words: applied GIS, appraisals, housing, redlining, spatial analysis.**

根据地方的分类，会对邻里的命运产生长期的影响。拒绝贷款地区便是这些不在计画内的效应之经典案例。联邦住宅贷款银行委员会建立的住房估价标准，随后编入了居住安全地图。我们透过在空间上参照匹兹堡 1937 年的地图，评估邻里估价的空间遗产。我们透过比较 1970 年至 2000 年的邻里评估与标准化的人口调查数据，指认续存的邻里状况。当前的状况与 1937 年地图的安全评分相符合。历史上拒绝贷款的地区仍然存在着贫穷、少数族裔与空屋率的集中。高所得、房价、以及房屋所有权则持续集中于他处。**关键词: 应用地理信息系统，估价，住宅，拒绝贷款地区，空间分析。**

Las clasificaciones basadas en lugar pueden crear influencias duraderas sobre los destinos de los vecindarios. Las prácticas discriminatorias son un ejemplo clásico de estos efectos involuntarios. La Junta Directiva del Banco Federal de Crédito para Vivienda desarrolló los estándares para el avalúo de viviendas que posteriormente serían codificadas en los Mapas de Seguridad Residencial. Georreferenciando el mapa de Pittsburgh de 1937, evaluamos las herencias espaciales en los avalúos de barrio. Identificamos las condiciones vecinales persistentes comparando las evaluaciones de los barrios con los datos censales normalizados de 1970 a 2000. Las condiciones contemporáneas concuerdan con los grados de seguridad del mapa de 1937. Las concentraciones de pobreza, gente de color y desempleo persisten en áreas históricamente discriminadas. Igualmente, las concentraciones de ingresos altos, valor de la casa y vivienda propia persisten en otras áreas. **Palabras clave: SIG aplicado, avalúos, vivienda, discriminación espacial, análisis espacial.**

Perceptions of inner cities in the United States are invariably shaped by the relative position of the observer. Investors, politicians, residents, and tourists all construct a shorthand for distinguishing between areas of the built environment, whether it is through terms like *authenticity*, *potential*, and *charm* or more inflammatory rhetoric like *danger*, *disaster*, or *carnage*. Such perceptions can become entrenched over time, creating trajectories of intraurban inequality (Molotch 1976). Labels therefore have effects, as neighborhoods tagged as successful might attract more social or economic investment and pejoratively framed spaces are ignored, isolated, and targeted by predatory services (Graves 2003; Crossney 2017).

We argue in this article that post-Depression neighborhood appraisal by the Home Owners Loan Corporation (HOLC) contributed to local socioeconomic patterns that persist in Pittsburgh, Pennsylvania. Pittsburgh exemplifies the North American transition of legacy industrial cities from deindustrialization toward postindustrial renewal. Neumann (2016) used Pittsburgh to argue that the rhetoric of postindustrial transformation alleges regionwide benefits yet actually benefits a smaller set of younger, educated professionals. We concur that the rhetoric of renewal masks significant urban inequality and use spatial analysis to show how long-standing structural disparities have withstood the broader changes that Pittsburgh experienced after 1970.

The regime of neighborhood evaluation now known as *redlining* had clear, perceptible geographic effects. HOLC developed neighborhood appraisal strategies in the 1930s to assist modernization of mortgage markets. These methods defined the value of neighborhoods according to criteria biased against older neighborhoods marked by racial, ethnic, religious, and economic integration. Appraisals discouraged economic investment in areas considered unsuitable and unworthy; therefore, appraisers simultaneously undermined the stability of older, integrated communities and privileged newer, racially segregated communities (Greer 2013).

Although neighborhood appraisals occurred more than seventy years ago, their impact is still regarded as influential in popular and academic discourse (i.e., Fullilove 2004; Sharkey 2013). Historic redlining is cited as undermining contemporary communities of color (Jackson 1985; Massey and Denton 1998).

The Professional Geographer, 70(3) 2018, pages 339–349 © 2018 by American Association of Geographers.
Initial submission, April 2017; revised submission, July 2017; final acceptance, July 2017.
Published by Taylor & Francis Group, LLC.

Studies argue that redlining, mortgage discrimination, and other federal policies reinforced racialized housing markets. This undercut intergenerational wealth accumulation and community stability (Hirsch 1998; Satter 2009). Measuring the lingering effects of redlining has received less attention, as they are more difficult to trace. Spatial analysis, however, can answer whether HOLC's original neighborhood assessments eventually transformed those perceptions into reality.

We measure the legacies of neighborhood appraisal and uneven urban investment in Pittsburgh using the 1937 Residential Security Map (RSM). We compared the map to 1940 Census conditions in Pittsburgh's city neighborhoods and used standardized census data from 1970 to 2000 to assess persistent neighborhood stratification and division. Our results prove that historically redlined spaces correspond with areas subsequently characterized by indicators of neighborhood instability during the 1970 to 2000 period (persistent poverty, population loss, and the inability to generate wealth). Neighborhoods receiving positive HOLC grades maintained historic advantages in characteristics associated with neighborhood stability (high home ownership rates, above-average incomes, and high home values). By 2000, Pittsburgh remained organized around a similar social geography to that described in the 1937 map. This occurred because neighborhood appraisal supported preconceptions of place, guiding investment away from some communities and toward others. This analysis therefore points to the long-term influence of policy decisions and provides a methodology for evaluating place-based effects.

The Home Owners Loan Corporation

HOLC was established by Congress in June 1933, under the Federal Home Loan Bank Board (FHLBB). Their mission was to stabilize the U.S. housing market, providing capital to mortgage lenders and providing a path to homeownership (Jackson 1985). By 1935, HOLC was administering a mortgage portfolio of approximately 20 percent of nonfarmer houses in the United States (Harriss 1951). Whereas HOLC had no mandate for stabilizing the physical quality of homes and neighborhoods, it gradually turned to place-based assessments to protect its financial position (Greer 2013).

The FHLBB moved to assert both regulatory and intellectual influence on the faltering housing market (FHLBB 1935a; Twohy 1939). The FHLBB considered real estate appraisal standards as woefully inadequate and directed HOLC's Mortgagee Rehabilitation Unit to survey real estate conditions of more than 200 urban markets (Fahey 1934). The resulting public summary file and a more detailed confidential survey file informed policy and procedures of agencies under the FHLBB umbrella (FHLBB 1935a; Woods 2012). The FHLBB published the methodology of the program in its journal the *Federal Home Loan Bank*

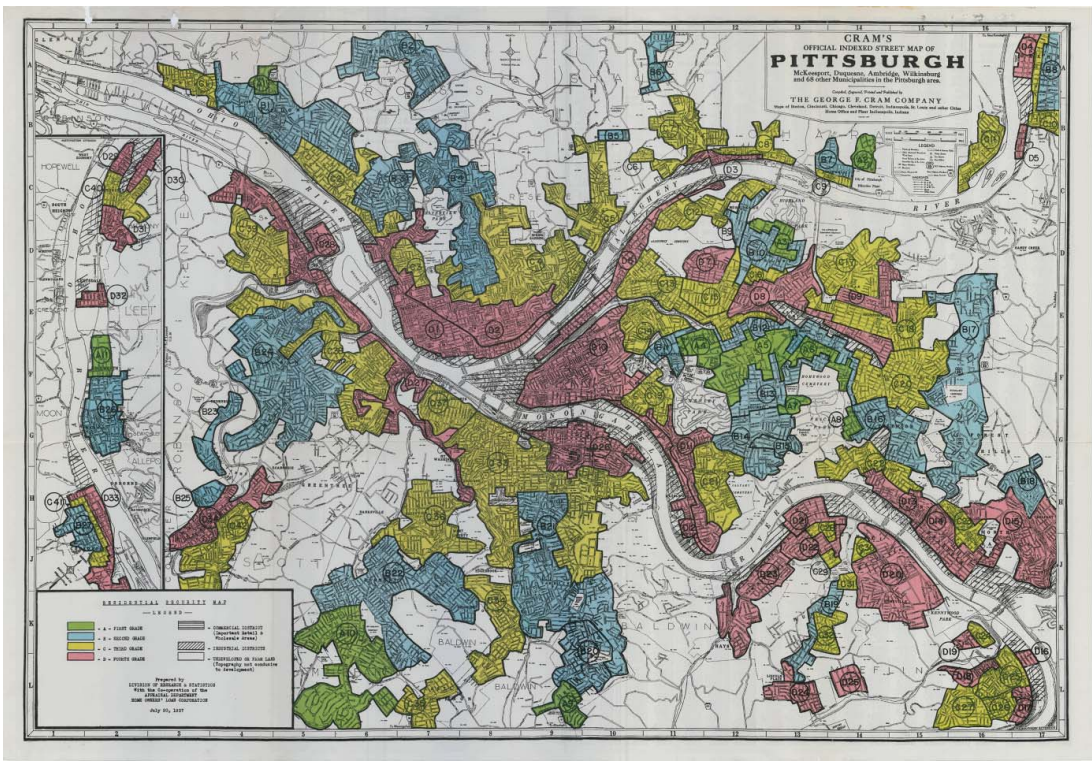

Figure 1 *The residential security map of Pittsburgh, Pennsylvania. Source: Nelson et al. (2017). (Color figure available online.)*

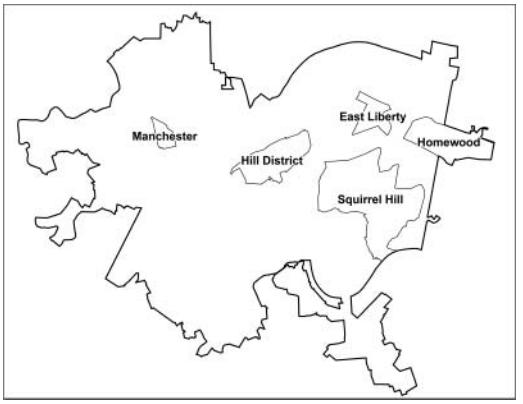

Figure 2 *Selected Pittsburgh neighborhoods referenced in the text.*

Review (FHLBB 1935b, 1935c, 1936). The Board's advocacy for more scientific appraisal standards—presumed to create better management of capital investments—paralleled efforts by policymakers nationwide to ensure the future value of property through regulation, particularly through zoning (Hirt 2014).

Jackson argued that the RSMs guided private lending decisions and instituted redlining nationwide, a perspective echoed by several authors (Jackson 1985; Massey and Denton 1998; Gotham 2000). Recent research, however, argues that the maps were only included in the confidential file; therefore, they were available to a limited government audience and were not available to guide specific lending decisions in the broader industry or to guide consumer housing behavior (Hillier 2003). This means that the maps did not redline neighborhoods and social groups; rather, they graded neighborhoods according to period attitudes about risk and worth (Stuart 2003; Hillier 2005; Greer 2013). The 1937 Map of Pittsburgh is representative (see Figure 1). The highest grade, green, was reserved for neighborhoods under construction. These areas captured homes with modern amenities and legal protections provided by zoning and restrictive racial covenants and catered to a professional, white constituency. Blue areas were already fully built but otherwise had features similar to those of the green areas. The third tier, yellow areas, described neighborhoods in "transition": Formerly valuable, these communities were characterized by age or functional obsolescence, poor maintenance, or the "infiltration of a lower grade population." The lowest grade (red) depicted communities "characterized by detrimental influences in a pronounced degree" particularly an "undesirable population" (Division of Research and Statistics 1937).

It is accepted that the maps did not directly cause urban disinvestment (Hillier 2003), but the maps do provide a localized representation of specific lending conditions in each city where they were drafted (Crossney and Bartelt 2005b). This is because HOLC relied on guidance from local field offices and interviews with housing industry representatives, rather than based on a generic, centrally derived rubric. The RSMs thus embody a locally and historically contingent real estate appraisal ideology that reveals how local stakeholders perceived comparative neighborhood risk and value (Rutan 2016).

Pittsburgh during the HOLC Period

HOLC appraisers surveying Pittsburgh in 1937 saw a deeply divided city. A racially segregated housing market restricted communities of color—buttressed by zoning laws—to some of the densest parts of the city (Trotter and Day 2010). In the mid-1930s, 70 percent of the black population lived in one of three neighborhoods: the Hill District, East Liberty, or Homewood (highlighted in Figure 2; Klein 1938). Some industries, particularly high-paying ones, were nearly exclusively available to native-born white Pittsburghers; lower paying and lower status industries such as domestic service disproportionately employed African Americans (Trotter and Day 2010). Uneven economic power was dictated partially by race and ethnicity and shaped neighborhood stability, social standing, and the ability of property owners to maintain their properties.

Period research notes the sociospatial divisions of Pittsburgh were based on wealth, ethnicity, and race (Klein 1938). Neighborhood characteristics varied considerably across Pittsburgh with pockets of luxury and new development located adjacent to pockets of profound blight and disrepair. Housing in Pittsburgh's affluent communities was often equipped with modern technologies such as indoor plumbing, electric lighting, and furnace-type heating (Klein 1938). Housing for African Americans was "more concentrated at the lowest standards recorded" (Klein 1938, 273). These observations suggest that real estate appraisers also held opinions about neighborhood structure. Neighborhood assessments included biases against minority groups and reflected divisions in housing quality and neighborhood fortunes (Gotham 2000; Crossney and Bartelt 2005a, 2005b). What remains unclear is whether HOLC observations and classifications are correlated with neighborhood conditions in later decades.

Assessing the Geographic Legacy of Redlining

Assessing the geographic legacy of redlining involves associating areas coded by the HOLC with modern census geographies and assessing changes found within them. This requires several methodological assumptions. First, as with any spatial analysis relying on field data, we must assume that populations were evenly distributed within the HOLC-classified spaces and within modern census tracts. There are clear violations to this—physical impediments such as parks or rivers and social impediments such as segregation or

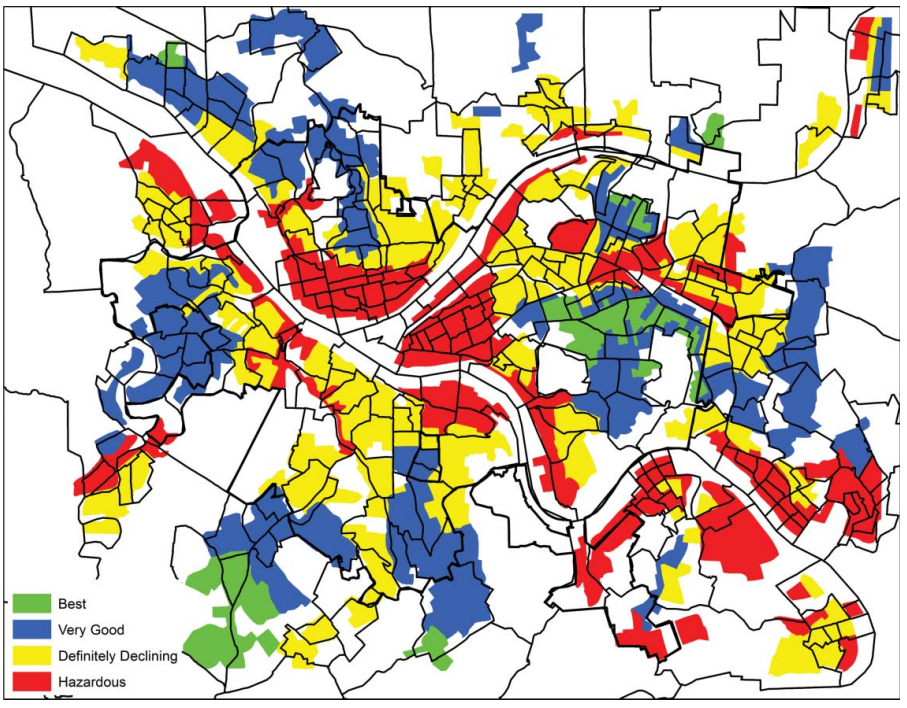

Figure 3 *1940 Census tracts overlaying the Residential Security Map. (Color figure available online.)*

divisions within a census tract—and although these are accommodated by the analysis, some simplification of population distributions is inevitable. Second, the population weights created for this analysis inevitably misappropriate some data; although the procedure comes along with some inherent error, it remains the most reasonable approach (Logan, Xu, and Stults 2014). Third, we acknowledge that causal reductionism between historic and contemporary patterns is problematic. Other influences undoubtedly shape neighborhood trajectories, but we contend that HOLC maps codify period biases about place and that these biases remain influential. Finally, we consider the RSM to be the most effective estimate of appraisal practices, providing localized, accurate representations of real estate industry behavior.

We compared the RSM with 1940 Census data, available through the National Historic Geographic Information System (NHGIS) at the University of Minnesota (Minnesota Population Center 2016). The NHGIS provides both tract-level statistics and a reconstructed tract shapefile—distilled from the 2000 Census tract boundaries and referenced tract maps from the 1940 Census. To measure the legacies of neighborhood appraisal in Pittsburgh's modern social geography, we used normalized census data from 1970 to 2000 from the Neighborhood Change Database (NCDB) published by Geolytics (Tatian 2002). This decision has two benefits. First, the 1970 to 2000 period captures the macroeconomic changes that were affecting the Pittsburgh region. These changes included deindustrialization and population loss through the 1970s and 1980s, prior to stabilization and a resurgence led by an urban growth coalition that championed higher education and medical industries (Lubove 1996). Second, Geolytics reapportioned the four censuses from this period into common geographic boundaries, allowing the longitudinal comparison of census data (Cornelius and Tatian 2002).

The attribute data for this analysis is spatially defined but the boundaries do not align perfectly; geographic discontinuities between the three sources were rectified to compare the relationships among the attribute data. For example, Figure 3 shows the 1937 map compared to the 1940 Census tract boundaries. The 1937 RSM was reconstructed into a shapefile by referencing the intersections in the map with a shapefile of modern street centerlines published by Allegheny County (Allegheny County Division of Computer Services 2016). Next, the 1940 and 2000 Census tract polygons were intersected with the graded areas from the 1937 map, splintering tracts into subsections according to their HOLC grades. Tracts that were splintered into multiple sections that each received the same grade were rejoined to create a single polygon for each tract. Because many of the intersected polygons only cover a portion of the original tract, population weights were created to adjust the count variables proportionately to their new coverage. To improve the accuracy of the population weights, large empty spaces in the city were erased from the census tract coverages prior to

intersecting them with the grade shapefile. The five 2010 Census tracts that covered Schenley Park, Frick Park, Highland Park, Allegheny Cemetery, and Riverview Park were used because they were intentionally drawn to capture unoccupied space and were drawn by the same author (U.S. Census Bureau 2010).

We examined variables that previous research indicates were relevant to determining the grade to assess the lingering impacts of neighborhood appraisal. Neighborhood characteristics from the 1940 Census such as race and immigration status, occupancy and homeownership, and building condition were weighted by the coverage area and then aggregated to the overall category level. Two additional variables were created to assess the structure of the communities: crowding (weighted, aggregated total population divided by weighted, aggregated total housing units) and density (weighted, aggregated total population divided by aggregated acreage). Finally, the average value of homes in a grade was calculated by aggregating the value of homes at the tract level (median value multiplied by number of housing units) by HOLC grade and then dividing by the weighted, aggregated total number of housing units.

Table 1 *Variables from the Neighborhood Change Database and their definition*

Variable	Calculation
Percentage black in 1970, 1980, 1990, 2000	Total black population divided by total population in each respective year
Poverty rate in 1970, 1980, 1990, 2000	As given
Average income in 1970, 1980, 1990, 2000	As given
Occupancy rate in 1970, 1980, 1990, 2000	Occupied housing units divided by total housing units in each respective year
Abandonment rate in 1970, 1980, 1990, 2000	Vacant units not for rent nor for sale divided by total housing units in each respective year
Homeownership rate in 1970, 1980, 1990, 2000	Owner-occupied units divided by occupied housing units in each respective year
Black homeownership rate in 1970, 1980, 1990, 2000	Black owner-occupied units divided by black-occupied housing units in each respective year
Average value in 1970, 1980, 1990, 2000	Aggregate value of specified housing units divided by total specified housing units in each respective year
Total housing units built before 1940 in 1970	Housing units built before 1940 weighted by tract coverage and aggregated by grade in 1970
Percentage of old units in 1970 and 1980	Housing units built before 1940 divided by the total number of housing units in 1970 and 1980
Rental rate in 1970	Renter-occupied units divided by occupied housing units in 1970
Old unit rental rate in 1970	Renter-occupied housing units built before 1940 divided by the total number of housing units built before 1940

Neighborhood stratification and the legacies of historic practices were measured using modern census data. The normalized census data from the NCDB allowed comparisons across decades and allowed identification of stable neighborhood conditions. Variables were selected because of their relevance to the historic determinants of neighborhood appraisal. Many of the variables appeared in each of the NCDB's four censuses (1970–2000):

- Demographic variables such as percentage African American, poverty rate, and average income.
- Housing variables such as occupancy rate, overall homeownership rate, homeownership rate among African Americans, and average house value.

Details about these variables are provided in Table 1. Duplicated tracts were removed for each census year, and the means and standard deviations were calculated. Each observation within each variable and year was subtracted by the mean and divided by the standard deviation. The new standardized measurement is comparable across decades because it reflects the relative position of that observation within the distribution of that year and thus controls for changes between the censuses. Tracts one standard deviation or more above the distribution or a standard deviation or less below the distribution in each of the four censuses were considered to represent a persistent, entrenched neighborhood characteristic. Persistent tracts were then counted according to their residential security grade and sorted into frequency tables. Finally, we performed chi-square tests or, when there were fewer than five occurrences in an entry on the frequency table, Fisher's exact tests to assess the relationship between the historic grade and persistence.

The percentage change in total population was calculated from 1970 to each of the other census years to assess the effect of appraisal on community stability. We assessed the physical toll of disinvestment on the condition of housing units by estimating the demolition of housing units since 1937. We compared the weighted, aggregated total number of housing units in 1940 to the weighted, aggregated total number of housing units in 1970 that were built prior to 1940 according to security grade. These were compared to the percentages of units built before 1940 in 1970 and 1980 to isolate home construction and demolition. Finally, we compared the overall rental rate in 1970 to the rental rate of units built prior to 1940 to assess whether the older, potentially lower quality units were being passed down to more itinerant, and perhaps lower income, residents.

Our efforts to measure long-term effects of neighborhood appraisal techniques in Pittsburgh are effective even when considering a few concerns. First, patterns of development, disinvestment, and decline likely vary among different cities according to the prevailing sentiments of the local real estate industry—the RSMs were constructed according to localized

Table 2 *Population characteristics by security grade, 1940*

	Red	Yellow	Blue	Green	All grades
Total population	303,013	307,141	182,507	27,958	820,619
Black population	50,270	12,339	2,536	442	65,587
Black share	16.6%	4.0%	1.4%	1.6%	8.0%
Total white population	252,606	294,732	179,977	27,512	754,827
Immigrant population	43,533	36,496	17,102	2,745	99,875
Immigrant share	14.4%	11.9%	9.4%	9.8%	12.2%
Native white population	209,073	258,235	162,875	24,767	654,952
Native white share	69.0%	84.1%	89.2%	88.6%	79.8%
Portion of total population	36.9%	37.4%	22.2%	3.4%	100%
Portion of black population	76.7%	18.8%	3.9%	0.7%	100%
Portion of immigrant population	43.6%	36.9%	17.1%	2.7%	100%
Portion of native white population	33.5%	39.1%	23.8%	3.6%	100%

characteristics—and thus it remains to be shown whether Pittsburgh's legacies are similar to those of other cities. Second, our analysis is constrained by the data that are available. We measure the similarities between modern Pittsburgh and the 1937 map but do not measure the neighborhood persistence from 1940 to 1970: We leave a thirty-year gap. Standardizing the 1940, 1950, and 1960 Censuses to the 2000 tract boundaries was not part of this project and would add additional complexity to the analysis without necessarily improving the measurements. Future research, however, could contribute to this topic by examining those data in a meaningful way.

Findings

The RSM of Pittsburgh represents the uneven geography of neighborhood evaluation. Table 2 shows that more Pittsburgh residents lived in "definite decline" (yellow) and "hazardous" (red) than in green or blue areas. Yellow and red areas, however, disproportionately included African American and immigrant communities, compared to the rates of these groups found in the safer areas.

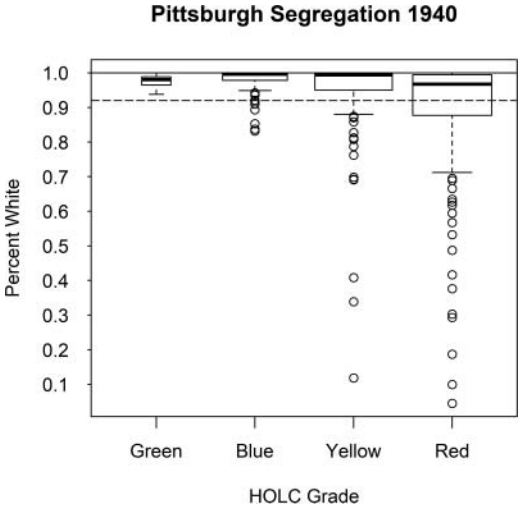

Figure 4 *Pittsburgh segregation, 1940. HOLC = Home Owners Loan Corporation.*

These uneven rates across neighborhood grades are a function of the comparatively low social status and limited economic power of non-white, immigrant groups. The overrepresentation of African Americans in the lower grades was partially driven by their forced concentration into three of Pittsburgh's neighborhoods; Figure 4 shows that many tracts were entirely composed of white people; the thick line represents the median of each distribution and all of the grades—but particularly blue and yellow—include many neighborhoods that are exclusively white, an extreme degree of segregation. The dashed line represents the city-wide proportion of whites, the level of integration. All of the green neighborhoods, over three quarters of blue and yellow neighborhoods, and over half of red neighborhoods had a greater portion of white residents than they should have had were they integrated. Indeed, those tracts with sizable African American populations, largely outliers represented by individual circles, were overwhelmingly graded either red or yellow.

Table 3 shows that housing conditions varied across the evaluation grades, with declining conditions (either in need of major repairs or uninhabitable) from green to red. Many units in poor condition were likely still occupied, based on the high occupancy rates in each of the grades. Household composition also varied according to grade. Although crowding was similar throughout the city, population densities varied significantly by grade. Owner occupancy rates and average house prices are a reflection of community stability and economic power and were highest in blue and green areas.

The 1940 Census data confirm what the RSM and social surveys about Pittsburgh in the late 1930s described: It remained a segregated city with large disparities in neighborhood and housing quality. We contend that the ideology codified by the RSM maintained the city's stratified social geography decades into the future. Between 1970 and 2000, communities with the largest proportions of African Americans remained concentrated in red and yellow—historically underresourced and undervalued—areas. Figure 5 shows clear spatial patterns, including persistently African American population clusters in Manchester

Table 3 *Housing conditions by security grade, 1940*

	Red	Yellow	Blue	Green	All grades
Occupancy rate	98.0%	97.9%	96.9%	94.7%	97.5%
Poor condition	14.2%	8.7%	5.5%	2.4%	9.7%
Abandonment rate	0.1%	0.2%	0.3%	0.7%	0.2%
Owner occupancy	24.5%	36.6%	43.6%	43.2%	34.1%
Average value (in 1939 dollars)	$2,677	$3,951	$6,631	$11,356	$4,384
Crowding rate (population per unit)	3.80	3.75	3.54	3.51	3.71
Density (population per acre)	26.02	18.92	12.99	10.08	18.36

to the west, the Hill District in the center, and Homewood/Larimer to the east. Two of these clusters are historic large African American communities identified earlier. Of the single tracts, four of the five are public housing communities, built in the 1940s and 1950s, which were built on steep, undeveloped hillsides and have remained isolated since (Trotter and Day 2010). Middle-class African Americans able to buy homes bought in the Upper Hill District (the rightmost tract on the center cluster) or in Beltzhoover (the single tract in the bottom left). Many of these persistent communities have faced generations of discrimination, neglect, and destruction from both private and public sectors.

Similarly, communities with the highest poverty levels in each of the four census periods were concentrated in red and yellow areas. The tracts with the highest average incomes were concentrated in green and blue areas. Each relationship was assessed using chi-square tests that identified significant associations (Table 4). The opposite criteria for each of these categories (lowest proportions of black residents, lowest poverty levels, and lowest average incomes) identified too few tracts (seven or fewer) for a test to be conducted.

Red and yellow areas suffered greater and more sustained population losses than blue or green areas. Figure 6 shows that from 1970 to 1980, all graded areas in Pittsburgh lost population at a similar rate. Between 1980 and 2000, however, population loss in red and yellow areas of the city outpaced those in the green and blue areas. The relative instability of originally redlined communities is a function of the economic sorting encouraged by the differential access to mortgage finance. Wealthier Pittsburghers were able to access the areas of the city that were appraised as more valuable and likely worked in more stable, nonindustrial careers. When Pittsburgh's working class was undercut by deindustrialization, those communities migrated to find opportunity. Appraisal policies that devalued economically integrated neighborhoods supported a geography that would be affected by deindustrialization unevenly.

Cumulative disinvestment affects modern-day housing dynamics. Persistent conditions were significantly associated with the historic appraisal grades shown in Table 5. Tracts with the persistently highest homeownership rates—even among African American residents—were disproportionately located in areas graded either green or blue. Similarly, tracts with the highest average home values in each census were concentrated in areas historically considered the most valuable. A map of these tracts (see Figure 5) reveals a few key clusters: The largest—and only—urban cluster includes parts of Pittsburgh's desirable East End; the other two clusters are both wealthy, first-ring suburbs. An outlier to this pattern is the lone tract in the center of the map, remarkable because it does not align with the Upper Hill District, the longtime home of wealthier African Americans. The relationship between value and historic status is not a perfect match but is, nonetheless, highly significant. Neighborhood appraisal reinforced the value of these communities. In 2015, seven of Pittsburgh's ninety neighborhoods received half of all mortgage dollars lent in the city; six of the seven neighborhoods were historically graded either green or blue, and the seventh has benefited from a recently revitalized brownfield (Rue 2015).

Cumulative disinvestment has a negative impact on the physical quality of homes. Table 6 shows that redlined areas lost 45,712 units (a 28.3 percent decrease), compared to green and blue areas, which lost 2,674 units (a 4.5 percent decrease). The significant destruction of units was not offset by a large construction of new units: In 1970, 67.5 percent of housing units in redlined areas were built before 1940, compared to 57.9 percent of units in green and blue areas, a significant difference (p value = 0.000). Redlined areas experienced a significantly greater reduction in old units until 1980 compared to green and blue areas (11.7 percent and 5.9 percent declines, respectively). Yet again, despite the greater reduction in units, historically redlined areas still did not receive new investments or construction of housing units. In 1980, the percentage of old units in redlined areas actually increased to 70.6 percent, whereas nonredlined areas saw a small decline in the portion of old units to 56.9 percent, a significant difference (p value = 0.000).

Pittsburgh communities affected by disinvestment had greater demolition rates of old units than nonredlined areas, yet their housing stock was composed of a greater portion of old units. Older units are perhaps more vulnerable to a wide variety of maladies—poor insulation, lead paint, structural deficiencies—and are more common in disinvested areas, meaning that they perhaps did not receive the repairs, renovations, or updates of homes in fully financed markets. If the housing quality disparity exists, who is affected? In 1970, redlined areas had a greater portion of renters—

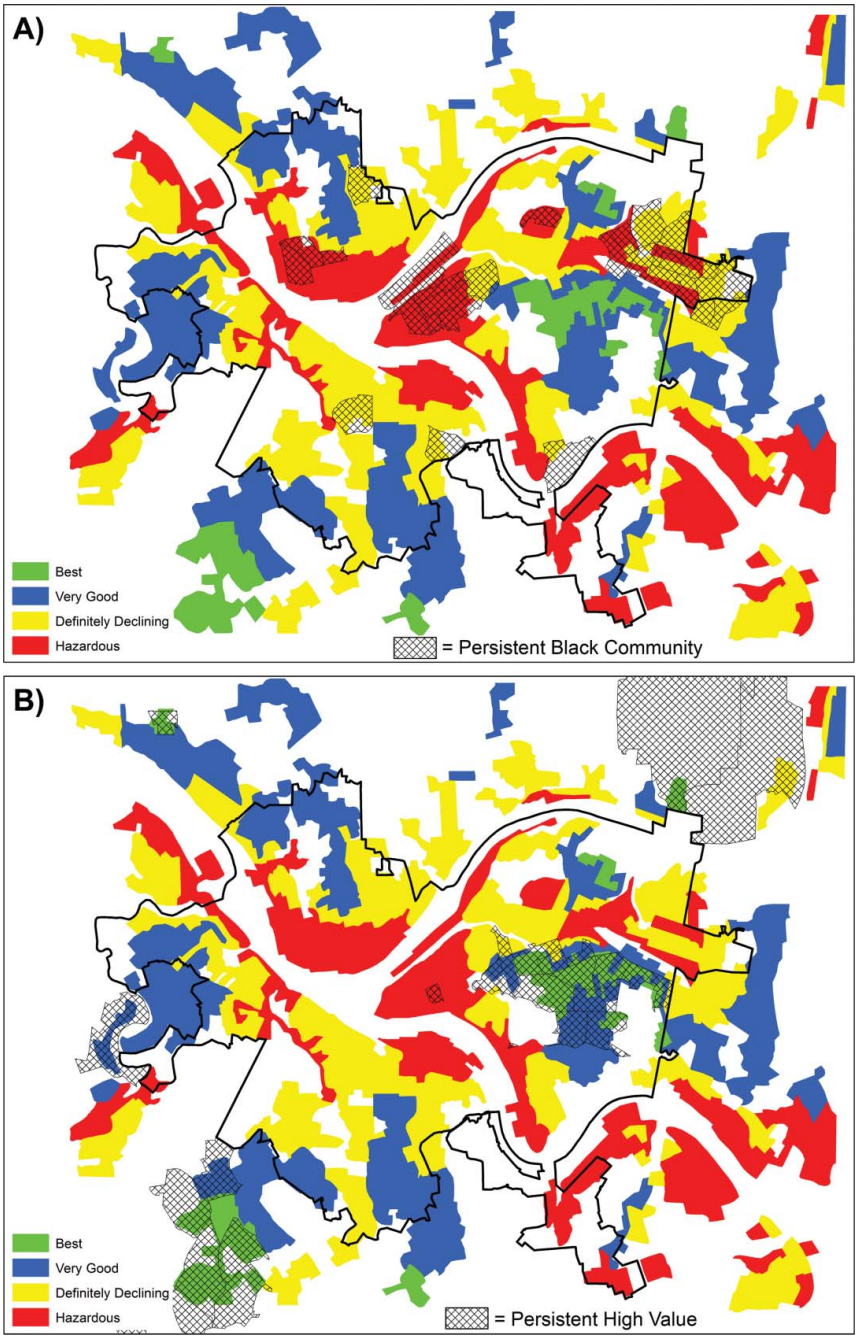

Figure 5 *1937 Home Owners Loan Corporation appraisals and persistent conditions from 1970 to 2000. (A) Persistently black tracts from 1970 to 2000. (B) Persistently wealthiest tracts from 1970 to 2000. (Color figure available online.)*

who perhaps lack the wealth and stability of homeowners—than nonredlined areas (43.4 percent compared to 38.3 percent), a significant difference (p value = 0.004). The old units, perhaps most vulnerable to poor condition, were more often rented regardless of the grade but were particularly likely to be rented in redlined areas. On average, 70.3 percent of old units were rented in red and yellow areas compared to 59.9 percent in green and blue areas.

Table 4 *Summary of independence tests for demographic variables, 1970–2000*

Variable	Relationship	*p* value
Persistently black	Concentrated in red/yellow	0.000
Persistently high poverty	Concentrated in red/yellow	0.001
Persistently high income	Concentrated in green/blue	0.000
Persistently low income	Proportionate, small sample	0.502

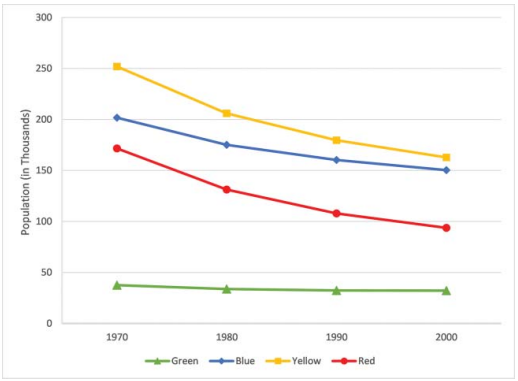

Figure 6 *The uneven decline of population in Pittsburgh by Home Owners Loan Corporation grade, 1970 to 2000. (Color figure available online.)*

Table 5 *Summary of independence tests for housing variables, 1970–2000*

Variable	Relationship	*p* value
Persistent low occupancy	Exclusively in red/yellow	0.006
Persistent low ownership	Proportionately frequent	0.204
Persistent high ownership	Disproportionately in green/blue	0.002
Persistent high black ownership	Disproportionately in green/blue	0.001
Persistent high value	Concentrated in green/blue	0.000

Discussion

Assessing Pittsburgh's socioeconomic profile in 1940 confirms that the HOLC map reflects the social divisions—segregation, disparities in housing condition, gaps in wealth—of the city. The divisions informed appraisers' judgments about value and investment security, directing investment away from underresourced communities and toward the most stable, privileged ones. Using these assessments, the lending market buttressed and entrenched the neighborhood characteristics that they observed into the modern period. Despite the city's current rhetoric of renewal, Pittsburgh is still constructed around a geography very similar to its past: Poor and black communities are concentrated in areas that suffered from divestment, whereas the affluent class and homeowners live in areas supported by a historic advantage. Historic policies and ideologies that guided geographic lending decisions continue to have impacts on people, neighborhoods, and the physical condition of homes for decades after their introduction.

From a critical perspective, determining the legacy of state policy provides more information about the production of urban space. First, as Lefebvre (1991) argued, objects often carry traces of the matériel and time involved in their creation. In this case study, relating historic appraisal practices to persistent conditions shows how Pittsburgh's social geography was codified by local real estate experts through the RSMs. These maps functioned to create the city that they attempted to describe, as presumptions over neighborhood risk and value served to steer resources and people into some neighborhoods and away from others. Using the RSM as an artifact provides an empirical approach to estimating historic appraisal standards. Controversy surrounds the impact and spread of the maps but not their construction—research has consistently identified them as localized representations of real estate markets and prevailing ideology. Third, by relating spatial information from otherwise disparate sources, new connections are possible. The application of GIS also maintains a focus on neighborhoods, urban structure, and context—a conversation about systemic forces beyond individual anecdotes or actions. Finally, by assessing the persistence of neighborhood conditions in the context of stratification at the city level, we approach neighborhood development from a perspective that understands neighborhood investment and characteristics as a relative, zero-sum competition (Bartelt et al. 1987).

This geographic information system (GIS)-based framework for assessing legacies of redlining and appraisal practices advances research about the RSMs, historic sources of uneven development, and the ideological construction of urban space. Prior empirical research on HOLC and the maps has led to regression models that assess the determinants of the grade (Crossney and Bartelt 2005b; Hillier 2005; Greer 2013) and assessments about the relationship between HOLC grades and mortgage patterns in the late 1930s (Hillier 2003; Crossney and Bartelt 2005a; Brennan 2015). Our study shows that discussions about redlining, HOLC, and appraisal should also attend to the rhetoric of appraisal. We treat the maps as the product of appraisers' behaviors rather than the cause and hence focus on the impact of appraisals on urban development. This approach raises questions about the future spatial effects of urban policies, particularly how current place-based strategies for neighborhood revitalization might create long-term effects for the

Table 6 *Difference of means test of old unit variables by security grade, 1970–2000*

	M (red, yellow)	95% CI		Mean (green, blue)	95% CI		*p* value
1970 percentage old units	0.6748	0.6483	0.7013	0.5787	0.5438	0.6136	0.0000
Demolition rate 1970–1980	−0.1171	−0.0857	−0.1485	−0.0585	−0.0152	−0.1017	0.0150
1980 percentage old units	0.7064	0.6724	0.7404	0.5685	0.5297	0.6073	0.0000
1970 rental rate	0.4339	0.4134	0.4606	0.3826	0.3494	0.4159	0.0040
1970 old unit rental rate	0.7032	0.6781	0.7283	0.5992	0.5642	0.6341	0.0000

affected communities and what policies are needed to bridge the gaps and create social mixing between long-isolated and disadvantaged communities and persistently privileged ones.

Our method supports a longitudinal assessment of urban geography, employing GIS techniques to evaluate modern demographics in the context of historic place-based policy. We relate previously disparate geographic information—the historic policy and modern Census data—by identifying common spatial coverage, allowing measurements and comparisons to be made across time. Further, we evaluate geographic patterns within the context of the citywide distribution. For instance, we are not concerned with absolute changes in the poverty rate; instead, we identify positional change (or persistence) in the distribution of poverty throughout the city. This offers the capacity to measure neighborhood stratification from decade to decade.

This spatial assessment of Pittsburgh's stratification provides a method to discuss appraisal ideology and the consequence of RSMs to uneven neighborhood development. The RSM of Pittsburgh represents the legacy of appraisal ideology and behavior and is also an informative record of stark socioeconomic divisions within the city. Between 1970 and 2000, Pittsburgh and the surrounding region had undergone a transformation to becoming a postindustrial service-led economy centered on educational, financial, and medical services. Our analysis shows that the rhetoric of Pittsburgh's transformation masks persistent sociospatial ruptures.

The historic HOLC map provides information about neighborhood conditions and appraisal ideology—surveyors collected rigorous neighborhood data and then made judgments accordingly. The divisions and social patterns that map makers reinforced in 1937 have remained unchanged despite Pittsburgh's resurgence and economic transformation (Dieterich-Ward 2015). It seems that there are persistent and entrenched geographic effects from the ideological construction of space and uneven access to investment. The GIS-based framework identified significant associations between Pittsburgh's historic neighborhood grades and its modern geography; neighborhoods have held their relative status and position within Pittsburgh into the modern period. We do not attribute the observed persistence of Pittsburgh's geography to HOLC's categorization of space: This method is not equipped to draw such a conclusion. It is clear, however, that HOLC's construction of Pittsburgh's housing market is relevant to stratification in the present day—the relationship should not be discounted. Further research is necessary to model the influence of historic redlining and modern neighborhood outcomes. Finally, it is clear that intervening federal and state policies that were meant to eliminate housing discrimination, create more equitable patterns of development, or promote economic integration have not undone the geographic structure that characterized Pittsburgh in 1940. Our conclusions support contemporary findings on urban inequality that argue that historic disparities continue to influence the inheritance of wealth, housing precarity, and neighborhood investment (Sharkey 2013; Hyra and Prince 2015; Desmond 2016). Despite Pittsburgh's recent postindustrial revival, the city remains defined and organized according to a Depression-era version of itself. ■

Acknowledgments

We thank the editor and anonymous reviewer for their constructive comments. Drs. Kristen Crossney, Waverly Duck, and Randy Walsh provided valuable criticism on the research on which this article is based.

ORCID

Michael R. Glass http://orcid.org/0000-0003-3522-1519

Literature Cited

Bartelt, D. W., D. Elesh, I. Goldstein, G. Leon, and W. Yancey. 1987. Islands in the stream: Neighborhoods and the political economy of the city. In *Neighborhood and community environs*, ed. I. Altman and A. Wandersman, 163–85. New York: Springer Science.

Brennan, J. F. 2015. The impact of depression-era homeowners' loan corporation lending in greater Cleveland, Ohio. *Urban Geography* 36 (1):1–28.

Cornelius, C., and P. A. Tation. 2002. *Appendix J: Description of tract mapping methodology*. Somerville, NJ: Geolytics.

Crossney, K. B. 2017. Who's at-risk? A case study of the demographic and socioeconomic characteristics of census tracts experiencing predatory and abusive mortgage lending in Philadelphia. *Geoforum* 81:129–43.

Crossney, K. B., and D. W. Bartelt. 2005a. Legacy of the Home Owners' Loan Corporation. *Housing Policy Debate* 16 (3–4):547–74.

———. 2005b. Residential security, risk, and race: The Home Owners' Loan Corporation and mortgage access in two cities. *Urban Geography* 26 (8):707–36.

Desmond, M. 2016. *Evicted: Poverty and profit in the American city*. New York: Crown.

Dieterich-Ward, A. 2015. *Beyond rust: Metropolitan Pittsburgh and the fate of industrial America*. Philadelphia: University of Pennsylvania Press.

Division of Computer Services. 2016. *Allegheny County—Street centerlines 201608. Shapefile*. Pittsburgh, PA: Pennsylvania Spatial Data Access.

Division of Research and Statistics. 1937. Pittsburgh, PA: Confidential survey file. Home Owners' Loan Corporation. RG 195. National Archives.

Fahey, J. H. 1934. The government's program for the organization of the nation's home-financing system. *Federal Home Loan Bank Review* 1 (October):1–14.

Federal Home Loan Bank Board. 1935a. Minutes of the HOLC and FHLBB. RG 195, Entry 14. National Archives.

———. 1935b. Neighborhood standards as they affect investment risk. *Federal Home Loan Bank Review* 1 (August):404–6.

———. 1935c. A practical technic for making a real property survey. *Federal Home Loan Bank Review* 2:45–47.

———. 1936. Security maps for the analysis of mortgage lending areas. *Federal Home Loan Bank Review* 2 (August): 389–91.

Fullilove, M. T. 2004. *Root shock: How tearing up city neighborhoods hurts America, and what we can do about it*. New York: One World/Ballantine Books.

Gotham, K. F. 2000. Racialization and the state: The Housing Act of 1934 and the creation of the Federal Housing Administration. *Sociological Perspectives* 43 (2): 291–317.

Graves, S. M. 2003. Landscapes of predation, landscapes of neglect: A location analysis of payday lenders and banks. *The Professional Geographer* 55 (3):303–17.

Greer, J. 2013. The Home Owners' Loan Corporation and the development of the residential security maps. *Journal of Urban History* 39 (2):275–96.

Harriss, C. L. 1951. *History and policies of the Home Owners Loan Corporation*. Cambridge, MA: NBER.

Hillier, A. E. 2003. Redlining and the Home Owners' Loan Corporation. *Journal of Urban History* 29 (4): 394–420.

———. 2005. Residential security maps and neighborhood appraisals. *Social Science History* 29 (2):207–33.

Hirsch, A. R. 1998. *Making the second ghetto: Race and housing in Chicago 1940–1960*. Chicago: University of Chicago Press.

Hirt, S. A. 2014. *Zoned in the USA: The origins and implications of American land-use regulation*. Ithaca, NY: Cornell University Press.

Hyra, D., and S. Prince. 2015. *Capital dilemma: Growth and inequality in Washington, D.C.* London and New York: Routledge.

Jackson, K. T. 1985. *Crabgrass frontier*. New York: Oxford University Press.

Klein, P. 1938. *A social study of Pittsburgh*. New York: Columbia University Press.

Lefebvre, H. 1991. *The production of space*. Malden, MA: Blackwell.

Logan, J. R., Z. Xu, and B. J. Stults. 2014. Interpolating U.S. decennial census tract data from as early as 1970 to 2010: A longitudinal tract database. *The Professional Geographer* 66 (3):412–20.

Lubove, R. 1996. *Twentieth-century Pittsburgh: The post-steel era*. Vol. 2. Pittsburgh, PA: University of Pittsburgh Press.

Massey, D., and N. Denton. 1998. *American apartheid*. Cambridge, MA: Harvard University Press.

Minnesota Population Center. 2016. National historical geographic information system: Version 11.0 [Database]. Minneapolis, MN: University of Minnesota.

Molotch, H. 1976. The city as a growth machine: Toward a political economy of place. *American Journal of Sociology* 82 (2):309–32.

Nelson, R. K., L. Winling, R. Marciano, N. Connolly, et al. 2017. Mapping inequality. In *American panorama*, ed. R. K. Nelson and E. L. Ayers. Accessed September 8, 2017. https://dsl.richmond.edu/panorama/redlining/#loc=4/36.71/-96.93&opacity=0.8&text=bibliograph.

Neumann, T. 2016. *Remaking the rust belt: The postindustrial transformation of North America*. Philadelphia: University of Pennsylvania Press.

Rue, R. 2015. *21st annual mortgage lending study*. Pittsburgh, PA: Pittsburgh Community Reinvestment Group.

Rutan, D. Q. 2016. Legacies of the residential security maps: Measuring the persistent effects of redlining in Pittsburgh, PA. Undergraduate thesis, University Honors College, University of Pittsburgh, Pittsburgh, PA.

Satter, B. 2009. *Family properties: How the struggle over race and real estate transformed Chicago and urban America*. New York: Metropolitan Books.

Sharkey, P. 2013. *Stuck in place*. Chicago: Chicago University Press.

Stuart, G. 2003. *Discriminating risk: The U.S. mortgage lending industry in the twentieth century*. Ithaca, NY: Cornell University Press.

Tatian, P. A. 2002. CensusCD neighborhood change database (NCDB): 1970–2000 tract data: Data users' guide: Short form release. Washington, DC, and Somerville, NJ: Urban Institute, in collaboration with GeoLytics.

Trotter, J. W., and J. N. Day. 2010. *Race and renaissance: African Americans in Pittsburgh since World War II*. Pittsburgh, PA: University of Pittsburgh Press.

Twohy, J. 1939. Speech before the New York State League of Savings and Loan Associations. Presented at the New York State League of Savings and Loan Associations, December 14. National Archives and Records Administration, RG 195 Entry 1 Box 13.

U.S. Census Bureau. 2010. 2010 *Census tract boundaries: Shapefile. Allegheny County*. Washington, DC: U.S. Census Bureau.

Woods, L. L. 2012. The Federal Home Loan Bank Board, redlining, and the national proliferation of racial lending discrimination, 1921–1950. *Journal of Urban History* 38 (6):1036–59.

DEVIN Q. RUTAN is a Researcher at the University of Pittsburgh, Pittsburgh, PA 15260. E-mail: devin.q.rutan@gmail.com. His research interests include spatial analysis, housing, and urban history.

MICHAEL R. GLASS is a Lecturer II at the University of Pittsburgh, Pittsburgh, PA 15260. E-mail: glass@pitt.edu. His research interests include neighborhood identity, housing policy, and urban change.