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Racial Discrimination and Economic Factors in Redlining of Ohio Neighborhoods

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Abstract

We examined the influence of racial and ethnic identity of residents and housing market economic conditions on redlining. Data were extracted from archival area description forms from the Home Owners' Loan Corporation for 568 Ohio neighborhoods from 1934–1940. Logistic regression analysis was used to analyze the relationships between neighborhood characteristics and redlining. Bivariate results indicated a strong association between the presence of African American residents and neighborhood redlining (OR = 40.9, 95% CI 22.9–72.8). Multivariable analysis demonstrated that some neighborhood characteristics were contributors to the decision to redline, including homes in poor condition (OR = 4.3, 95% CI 1.2–15.1), home vacancy (OR = 1.4, 95% CI 1.1–1.6), and housing prices (per thousand dollars) (OR = 0.7, 95% CI 0.4–1.2). Adjusting for these and other factors, the presence of African American residents remained a powerful predictor of redlining (OR = 13.8, 95% CI 4.4–42.8). Racial discrimination was the overriding factor in decisions to redline neighborhoods.

Keywords: Race; Ethnicity; Housing; Discrimination; Neighborhoods; Segregation

Introduction

The term “redlining” historically refers to the systematic exclusion of individuals, households, or companies, by banks and other lending entities, from receiving home loans based on their geographic residence in low-income, racial or ethnic minority, or racially changing neighborhoods (McKnight 1995). In many instances, redlining refers to literal red-ink lines drawn around the perimeter of such neighborhoods in cities across the United States on maps created by the government-sponsored Home Owners' Loan Corporation (HOLC) during the 1930s and 1940s (see [Figure 1A](#); Redlining Map of Cleveland, Ohio).

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Such red outlining or shading of areas denoted those neighborhoods as determined to be unsuitable for mortgage lending. Andrew Holmes and Paul Horvitz (1994) described redlining practices as conferring refusal of mortgage funding loans to one or more persons in a neighborhood, regardless of that individual person's determined creditworthiness or sociodemographic characteristics, but redlining can also include alterations of the terms and conditions of credit or alterations of lending standards and thresholds.

Historical Debate on the Role of Race in Redlining

The Fair Housing Act of 1968 made race-based discrimination in home lending illegal (Massey and Denton, 1993). In the decades since, scholars in the fields of law, economics, consumer finance, and sociology have not reached full consensus regarding the influence of racial and ethnic prejudice in driving decisions to exclude (i.e., redline) specific neighborhoods from receiving home loans. For example, in consumer finance, explanations for differences in neighborhoods' historical access to home loans center on differential geographic concentration of high financial risk, substandard housing quality, lending pattern comparisons, and geographic variation in the supply and demand of mortgage funds (Aalbers 2007; Bradbury et al., 1989; Jones and Maclennan, 1987; Michney and Winling, 2019; Schill and Wachter, 1994). However, Louis L. Woods (2012), in a prior historical analysis, found that the Federal Home Loan Bank Board (a board of directors for the HOLC) established standards for lending that were based largely on the demographic (including racial and ethnic) characteristics of residents. Other recent research has also demonstrated that in many cities HOLC did provide access to home loans to African Americans (Michney and Winling, 2019).

Our study seeks to address gaps in these prior analyses including their tendency to draw from single municipalities, anecdotal evidence, bank reported lending rates, or a broad organizational decision guidance rather than a comprehensive corpus of written records of the decision to redline each neighborhood. For example, public records indicate that some states used property value arguments—namely, that the purchasing of property by Black families would devalue the nearby properties of other homeowners—to justify the codification of race-based zoning ordinances. From the 1923 National Association of Real Estate Brokers textbook: “The colored people certainly have a right to life, liberty and the pursuit of happiness but they must recognize the economic disturbance which their presence in a white neighborhood causes and forego their desire to split off from the established district where the rest of their race lives” (McMichael and Bingham, 1923, pp. 181-182).

In the absence of focused evidence of racial discrimination at the level of individual neighborhoods, considerable political, judicial, and scientific debate has continued as to whether these components of history were racist—either directly or indirectly through federal support of already-present racial prejudice—or, rather, “natural” decisions of economic markets. Sociological research incorporating the legacy of segregation posits that residential segregation—the physical separation of individuals across neighborhoods by race—is the crux of racial minorities' cumulative accrual of disadvantages since the start of the twentieth century (Massey and Denton, 1993). White families' suburban relocation in response to the migration of Black families into urban neighborhoods, exacerbated by public and private lenders' refusal to insure home mortgages for White families in predominantly Black neighborhoods, engendered complex opportunity structures (e.g., opportunity to build home equity, opportunity to access high-performing schools; Kirwan Institute 2013). The division of residence by race is thus thought to have geographically concentrated economic and social resources, systemically and reciprocally allocating them over time along lines of privilege (Bonilla-Silva 1997) and rendering race and class as inextricably linked.

Despite widespread agreement among social theorists and scientists that structural racism acts as a causal agent to present disadvantage among communities of color, research across legal, economic, and finance disciplines has consistently defended the principle of *ceteris paribus*, or *all things being equal*, making the seemingly logical assumption that because no person in a redlined neighborhood would receive a loan (regardless of their race or ethnicity) the practice of redlining was, by definition, non-discriminatory. Richard Rothstein (2017) in *The Color of Law* reviews how such principles have shaped several consequential legal rulings. Rothstein's work has aimed to demonstrate that segregation was openly and explicitly a government-sponsored policy, outlining important points of legal and historical controversy. Chief Justice John Roberts, in the majority opinion on a school segregation case in 2007, stated "Where [racial imbalance] is a product not of state action but of private choices, it does not have constitutional implications" (Rothstein 2017, p. xiv). Justice Anthony Kennedy made a similar prior argument in a 1992 school segregation opinion: "The vestiges of segregation ... may be subtle and intangible but nonetheless they must be so real that they have a causal link to the *de jure* violation being remedied. It is simply not always the case that demographic forces causing population change bear any real and substantial relation to a *de jure* violation" (*Freeman v. Pitts* 1992).

Thus, both contemporary and historical discourse on neighborhood redlining has suggested that the federal government is not bound to work toward remediation of deprived school, housing, or neighborhood environments unless it can be demonstrated that there exists a causal link between government-sponsored discriminatory policy and the circumstances of racial and ethnic minorities. In the case of mortgage lending, there is a strong need for a definitive empirical analysis of whether original decisions to redline neighborhoods, thereby creating segregation, were motivated by racial prejudice. If the decision to deny lending to racial and ethnic minorities at the level of neighborhoods was uniformly discriminatory and carried out in a systematic manner by a federal agency, then dozens of pivotal legal and policy decisions which have defended area-defined lending decisions as matters of economic viability alone would need to be re-examined.

Current Study

In their 1896 *Plessy v. Ferguson* decision, the U.S. Supreme Court provided states with the right to, as described by John A. Powell and colleagues (2021), "regulate black bodies in white spaces, through state-enforced segregation" and codified structural racism as a legal practice. The redlined shapes on HOLC maps are an important visual signifier of the institutional lending policy promoted by the Federal Housing Authority, carried out by the HOLC, and legitimized by the *Plessy* decision (Ware 2021). In this article, we aim to provide further support for claims that 1930s processes and decisions of redlining were an explicit policy of government via the Federal Housing Authority and its assign, the Home Owners Loan Corporation. We have sought to rigorously quantify data appearing on the area description forms that documented decisions to redline. Powell and colleagues (2021) noted that the measurement and inferences around racial residential segregation have faced challenges in making causal inferences. Our work extends prior archival understandings to include statistical analyses and comparisons of how the racial and economic factors observed in neighborhoods, in combination with government policy, resulted in repeated and ongoing housing discrimination on the basis of race.

Methods

We conducted a cross-sectional study to determine the relative importance of racial and economic factors in decisions to redline neighborhoods in Ohio. Data for this study were drawn entirely from historical documents produced by government agencies and their assigns.

Historical Materials

We examined archival maps and area description forms (ADFs) from the Home Owners Loan Corporation produced between 1934 and 1940 for major cities in Ohio. The HOLC was a national agency operating across the United States, created in the aftermath of the Great Depression to stabilize the nation's housing market. ADFs are one- or two-page forms summarizing characteristics of a neighborhood such as its population (e.g., residents' occupation, proportion of foreign and Black residents) or buildings (e.g., age, type and size, construction), and also include short paragraphs highlighting the neighborhood's risks and assets.

ADFs were, in nearly all cases, completed by a single individual from a pool of "competent local real estate brokers, appraisers, and mortgage lenders" (Home Owners Loan Corporation 1939). The original organization of the forms was by city. For example, the seventeen forms from Warren, Ohio are grouped together under a Table of Contents that includes a three page "Explanation" of purposes and methods, wherein an unnamed "Field Agent" met with and corroborated findings on the forms with a panel of four named local real estate officials. The Warren Explanation includes the statement: "These maps and descriptions have been carefully checked with competent local real estate brokers and mortgage lenders, and we believe they represent a fair and composite opinion of the best qualified local people."

Several library and university resources have worked to make HOLC archival documents available and accessible to the public, including The National Community Reinvestment Coalition (Mitchell and Franco, 2018) and Mapping Inequality (Nelson et al., 2022). Maps and ADFs for this study were collected from The Ohio State University Libraries (2013) digital collection. A team of researchers reviewed each of the maps, ADFs, and accompanying HOLC materials to create a data abstraction plan and coding structure.

Data and Measures

A total of 568 neighborhood areas across twelve Ohio metropolitan areas (cities or counties) were included in the study. All available forms from these cities were included; although maps are available, ADFs from Columbus and Cincinnati have never been located and thus could not be included in this analysis. At the time of our initial review and data abstraction we determined there were important characteristics of the Ohio forms, rendering Ohio a good choice for investing time and resources in data abstraction and review. First, ADFs were available for twelve cities of varied sizes in diverse regions of the state. Second, the data fields on the ADF forms were very consistent for the twelve cities; Ohio used only three form types and the forms contained almost identical data fields (see Table 1). Lastly, data entered on the Ohio forms were largely complete and free of missing fields. The HOLC appraisers, loan officers, city and county officials, and real estate professionals recorded data on the ADFs and classified each neighborhood area in each city into four strata (A, B, C, D), with D-rated neighborhoods being "redlined" and deemed unsuitable for lending of any kind.

Table 1. Form Type by Metropolitan Area, N = 568

Metropolitan Area	Form Type		
	1	2	3
Akron	66	0	0
Canton	1	27	0
Cuyahoga	190	1	0
Dayton	0	0	44
Hamilton	1	21	0
Lima	0	0	24
Lorain	0	0	15
Portsmouth	0	18	0
Springfield	0	26	0
Toledo	0	76	0
Warren	0	0	17
Youngstown	0	41	0
Total	258	210	100

Form Types

There were three main types of ADFs utilized in Ohio by the HOLC. Most cities used only one type of form (e.g., 190 of the 191 forms for Cuyahoga County were type 1 forms). Details of the form types by metropolitan area are shown in Table 1. Differences across forms in the organization, numbering, labeling, and presence/absence of data fields necessitated a rigorous form reconciliation process. A data dictionary was constructed to map the common data elements across the three forms, and a common data model was then created. Measures included in the analysis reported in this article were common to all three form types. Minor differences in category labels between form types required careful mappings to the common data model. For example, the response choices for the “housing repair” variable used the term “terrible” on form types 1 and 2, but not on form type 3. The “terrible” repair category, which had a low cell count, was combined with the “poor” repair category across all three form types in the common data model. A full audit trail of each coding decision was maintained throughout the project, and coding memos and structure are available from the authors upon request. A cross-tabulation analysis of form type by whether neighborhoods were redlined was conducted, and there was no apparent association ($\chi^2 = 4.55$, $df = 2$, $p = .103$).

Data Entry

The common data model was documented in a data dictionary used by all study personnel working on data extraction. Staff were trained to use the common data model and data were entered into the REDCap system to ensure efficiency of data management and allow for programmed field validation in the data entry form (Harris et al., 2009). All data were double-entered, and a series of post-entry data checks were instituted including manual audits, consistency checks, and examination of frequency distributions. Data inconsistencies were resolved by returning to source documents and discussion in team meetings.

Dependent Variable: Redlining

The dependent variable in our analysis was redlining, measured as a dichotomous indicator (redlined, yes or no) recorded from the security grade indicated on both the ADF and the maps (which were internally consistent for all areas).

Race and Ethnicity

For each neighborhood, the percentage of foreign families and Black families was coded from the respective ADFs. None of the three ADF types includes sections for raters to describe the U.S.-born White population. While it might have been possible to make an assumption that the sum of the percentages of foreign families and Black families subtracted from 100% would be equal to the percentage of White families, we have elected to maintain closest fidelity to the form content by abstracting only the data reported on the forms into study variables. Data on the forms for these fields had been originally entered by hand as numerical percentages. On forms where a range was given (e.g., 20%-30%) the midpoint of the range was utilized for the study database. In addition to the continuous percentages, binary indicators of the presence of foreign families or Black families were also derived. It should be noted that on all form types the data field on the form was listed as “Negro” or “Negro families” or “% Negro” which we have elected to instead represent in this article as “Black families.” The phrase “foreign families” on the forms is routinely accompanied by added textual explanation with clear delineations of those families from ethnic backgrounds deemed to be “undesirable.” The foreign nationalities and ethnic categories listed as “undesirable” or described verbatim as “infiltrating” neighborhoods in that field or in accompanying comments included Irish, Polish, Slavic, Lithuanian, Czech, Italian, Hungarian, and Jewish.

Additional Variables

For occupation, each ADF included a phrase or statement indicating the type of workers living in the neighborhood. These phrases were categorized into two levels, white collar (e.g., executives, sales professionals) and blue collar (e.g., factory workers).

Housing quality was assessed on all ADFs using an average age, in years, of the neighborhood’s buildings. Where a range was given, the midpoint of the range was used. The repair condition of housing was described as “Excellent,” “Very good,” “Good,” “Fair,” or “Poor” on the forms. The type of housing construction was described as “frame,” “frame and brick” or “brick and stucco.”

Housing market indicators in each ADF included percentage residential unit occupancy, percentage of home ownership, the current market sales demand at the time the form was completed (0 = “Excellent,” 1 = “Good,” 2 = “Fair,” 3 = “Poor,” 4 = “Slow,” or 5 = “Very Poor”), and the availability of mortgages for those seeking to make a home purchase in the area (1 = “Ample,” 2 = “Fairly Ample,” 3 = “Limited,” 4 = “Very Limited,” 5 = “None”). All forms included multiple indicators for housing prices, but pricing variables were inconsistently present with differences occurring across forms and some fields missing for some areas. Our approach was to take the midpoint of the housing price range for the last date appearing on the form. For example, if the last data on a form was 1939, \$4,000 to \$5,000, we used a value of \$4,500 for the housing price variable in our analyses.

To determine how closely the created housing price variable represented the data from years where home price data was reported on forms but not incorporated in our models, we estimated the bivariate association between the created last date median price variable and the 1929, 1933, 1935–1939 upper and lower price values. Thus, this was a test of how

closely our created variable related to other price variables on the forms. Pearson correlations ranged from $r = 0.73$, $p < .001$, $n = 179$ (1936 lower boundary) to $r = 0.99$, $p < .001$, $n = 339$ (1938 upper boundary).

Statistical Analysis

Descriptive statistics and frequency distributions were evaluated to examine the extent to which data met analysis assumptions. The housing price variable was right-skewed. We conducted the analyses using both a log-transformed housing price variable and the untransformed housing price variable. No meaningful differences were found so we have opted to report results from the untransformed analyses for interpretability of coefficients. Logistic regression analysis was used to analyze the relationships between the recorded neighborhood characteristics and the outcome of whether a neighborhood area was redlined. A structural model depicting the analysis plan is presented in [Figure 2](#). Missing values were handled using listwise deletion due to the sparse number of missing values in our study variables. Only two variables had greater than 2% missing data: average price (6.3%) and mortgage availability (6.3%). Between-city comparisons were not possible because some cities had twenty-five or fewer neighborhoods or five or fewer redlined neighborhoods.

Results

Descriptive statistics for all study variables are presented in [Table 2](#). The results of the bivariate analysis indicated a strong association between the presence of Black families and whether a neighborhood was redlined, with non-redlined neighborhoods having less than 0.1% Black families on average. This pattern was similar for foreign families, with not-redlined neighborhoods having just 10.1% foreign families. Other bivariate analyses indicated that redlined neighborhoods were less likely to have white collar workers in residence, had older homes, more homes in poor repair, more frame homes, lower home ownership, lower home prices, and lower mortgage availability.

Results in [Table 3](#) display bivariate (by race) and multivariable logistic regression models predicting redlining according to recorded neighborhood characteristics. In the bivariate analysis (Model 1), neighborhoods with any Black families present had more than forty times higher odds of being redlined. In the multivariable analysis (Model 2), the presence of Black families retained an exceptionally powerful influence on whether or not a neighborhood was redlined after controlling for housing quality, the state of the housing market, occupation, and the presence of foreign families. Neighborhoods with Black families had nearly fourteen times higher odds of being redlined.

Other neighborhood characteristics also influenced the decision to redline, including homes in poor condition (OR = 4.2), scarce mortgage funding (OR = 3.7), higher levels of home vacancy (OR = 1.4), and housing prices (OR = 0.7). The overall explanatory power of the multivariable model for predicting which neighborhoods were redlined is high, with a Nagelkerke pseudo R-squared of 0.8. This further suggests that the model evaluated in this study fits the data well, and that there is little unexplained variance due to factors not included in the model.

These quantitative findings are further corroborated by statements made in narrative form in the notes section of the ADF documents. Verbs such as “infiltrate” and “invade” are regularly present, referring to the movement of Black families into neighborhoods. An example from one of the forms states, “Area has one colored family but local authorities are endeavoring to obtain a removal,” referring to government efforts to force Black families to

Table 2. Neighborhood Characteristics by Redlining Status (N = 568)

	Redlined (n = 100)	Not Redlined (n = 468)	P-value
Area Demographics			
% Foreign families	28.4 (27.5)	10.1 (18.8)	<0.001
Any foreign families present	27.6%	72.4%	<0.001
% Black families	22.8 (29.0)	0.1 (0.8)	<0.001
Any Black families present	70.1%	29.9%	<0.001
<i>Occupation type</i>			
Blue collar	85.0%	23.6%	<0.001
White collar	15.0%	76.4%	
Area Housing Quality			
Average age of buildings (y)	32.3 (11.7)	17.9 (9.1)	<0.001
<i>Structure (dis)repair</i>			
Excellent or very good	0.0%	10.7%	<0.001
Good	3.0%	52.0%	
Fair	52.0%	36.2%	
Poor or terrible	45.0%	1.1%	
<i>Structure construction type</i>			
Frame	94.9%	72.2%	<0.001
Frame and brick	4.0%	21.2%	
Brick and stucco	1.0%	6.6%	
Area Housing Market			
% Building occupancy	96.3 (4.2)	97.0 (6.95)	0.35
% Home ownership	56.6 (18.9)	78.9 (13.5)	<0.001
Building sales demand	2.6 (1.3)	1.1 (1.1)	<0.001
Average price (dollars)	2254.9 (1084.6)	6559.2 (6769.4)	<0.001
Mortgage availability	4.4 (0.9)	1.88 (1.1)	<0.001

Note: For continuous variables, means are presented followed by standard deviations in parentheses. P-values are t-tests comparing mean values. For categorical variables, column percentages indicate the distribution according to whether neighborhoods were redlined. P-values are presented for Pearson's chi-squared tests of difference.

leave certain neighborhoods. In one example, the rater expresses a clear sentiment of regret about the presence of Black, Jewish, and Italian families:

Informed realtor's opinion is that this section should have been, at the outset, developed for colored occupancy as an overflow outlet for the strong movement that has progressed into the northeastern part of Cleveland. However, no concerted effort was made and the present occupancy has resulted from the normal characteristic of colored infiltration into Jewish and Italian neighborhoods with the obsolescence of property due to lack of maintenance. The apparent future for this area will be an increasing occupancy ratio by Jewish, Italian, and colored with a steady fall in price values (1939, Area D-12, East Side of Cleveland, Ohio).

In two further examples from areas in and around Cleveland, the raters wrote:

Proximity to industry is area's best claim and it will retain present population for a few years at least, without marked increase of negro infiltrations (1939, Area D-2, West Side of Cleveland, Ohio).

Table 3. Analysis of Redlining Status by Neighborhood Characteristics (N = 568)

	Odds Ratio [95% CI]	P-value
<i>Model 1</i>		
Any Black families present	40.9 [22.9, 72.8]	<0.01
<i>Model 2*</i>		
Any Black families present	13.8 [4.4, 42.8]	<0.01
Any foreign families present	1.1 [0.3, 3.9]	0.83
Occupation type	7.4 [1.8, 31.1]	0.01
Average age of buildings (y)	1.1 [1.0, 1.1]	0.03
Structure disrepair	4.3 [1.2, 15.1]	0.02
Structure construction type	0.9 [0.3, 2.6]	0.86
% Building occupancy	1.4 [1.1, 1.6]	<0.01
% Home ownership	1.0 [0.9, 1.0]	0.01
Building sales demand	1.1 [0.7, 1.7]	0.77
Average price (thousands of dollars)	0.7 [0.4, 1.2]	0.20
Mortgage availability	3.7 [2.0, 6.9]	<0.01
Nagelkerke pseudo-R ² = 0.80		

Note: Listwise deletion resulted in a multivariable sample size of 534 for Model 2.

About two years ago strong effort began to decrease the colored occupancy of this area and has resulted in the moving of 33 families (only 50 remaining) some of whom were moved at the city's expense. In each case the removal of a colored family caused the occupancy of a white family in this neighborhood. There is also a tendency towards improvement in the physical appearance of the community during this same period (1939, Area D8, Maple Heights, Ohio).

The language used in these statements appears consistently throughout ADFs and offers explicit evidence of the devaluing of African American residents directly and unequivocally because of their race. Additional rater language such as "The better people are slowly moving out" or statements such as "The foreign-born people continue to come into this section at a slow but steady pace as the better native American people emigrate in about the same ratio. Some negroes are also trickling in ..." incontrovertibly distinguish Black native-born Americans as inferior to "better" (i.e., White) native-born Americans.

Discussion

This study abstracted quantitative archival data from Area Description Forms from Ohio neighborhoods. We found, beyond the effect of other neighborhood-level variables, that neighborhoods with Black families had a nearly fourteen times higher likelihood of being redlined. These results suggest that the presence of Black families was a primary factor in the decision to redline neighborhoods, far beyond the effects of other factors including housing quality, housing market status, and the presence of foreign families in those neighborhoods. Key strengths of our study include a large sample size, utilization of primary documents from multiple cities, quantification of a wide range of factors hypothesized to influence redlining decisions, and the integration of corroborating qualitative evidence. Below, we present our findings in the context of historical knowledge and prior

research examining redlining, discuss the enduring consequences of redlining for health and social wellbeing, and examine study strengths, limitations, and potential implications for future work.

Though the historic role of racial prejudice in national lending decisions continues to be debated, as does the degree to which the HOLC's appraisal scheme was utilized by other entities in their lending decisions, our study findings provide clear and direct evidence that the specific presence of African American families in a neighborhood was a powerful determinant of whether or not that neighborhood would be redlined and subsequently excluded from receiving home loans. While we detected a bivariate association between redlining and the presence of foreign families, this association disappears when accounting for the presence of Black families and other market and housing characteristics. This suggests a possible difference between xenophobic prejudice and racial prejudice in decisions to restrict the flow of capital into neighborhoods. Area description forms contained statements of prejudice against both ethnic and religious minorities, and further work examining these differences is necessary.

Our finding of direct racial discrimination in neighborhood redlining evidences racial discrimination as a core component of federal government policy during the time when HOLC appraisers, loan officers, city and county officials, and real estate professionals recorded information on Area Description Forms and designated the suitability of neighborhood areas for lending. This practice of denying property rights is an indisputable symptom of institutional racism in America, rooted in core principles of American enslavement and racial segregation. Under early policies of the Federal Housing Authority, Black families and individuals in entire neighborhoods across multiple cities were denied access to loans for property ownership. Even if, as other authors have suggested, the HOLC did not originally create the practice of racially motivated housing and lending decisions, the agency appears to have systematically perpetuated racial discrimination.

While other researchers have more closely studied the conditionality of individual factors in combination with neighborhood factors in redlining (Ross and Tootell, 2004; Tootell 1996), our study has some important distinctions from this prior work. Geoffrey M. B. Tootell and colleagues () found no evidence of lending discrimination after controlling for neighborhood factors. While our study examines data from a different time period, our results underscore racial discrimination as a key component of the decision to redline. As has been recently established in high-profile research examining racial bias in economically derived models of health care utilization (Obermeyer et al., 2019) efforts to "control" for neighborhood factors implicitly assume away the component of variation that is, in fact, traceable to racial discrimination at the neighborhood level. Our findings also contrast with those of Kenneth P. Brevoort (2011) who showed that neighborhood income, rather than neighborhood racial composition, was associated with credit card redlining. Racially motivated decisions around 1930s lending cannot be directly compared to credit card lending in more recent decades, but future research conducting a more detailed examination of the contours and determinants of additional variables, especially housing price changes over time and the terms and characteristics of loans, is warranted.

Our study findings contribute additional critical knowledge designating institutional racism, and the federal policies that supported it, as a fundamental cause of persisting, neighborhood-patterned social and health disparities. The eight decades following the federally backed extension of racial bias and cartographic efforts demonstrate a geographic patterning of resource disinvestment across the 239 cities assessed by the HOLC. Examining 1940 HOLC neighborhood boundaries together with contemporary U.S. Census tract and Ohio Department of Health data, the Kirwan Institute (2015) matched the spatial distribution of Cleveland, Ohio's highest rates of infant mortality, premature births, percentages of children with elevated blood lead levels, and adults with diabetes to the

geographic boundaries of the neighborhoods the HOLC redlined in 1940. Parallel findings of the relationship between historical mortgage disinvestment and poorer contemporary health outcomes have been published in data from Detroit, Pittsburgh, and all urban areas of the United States (McClure et al., 2018; Motairek et al., 2022; Rutan and Glass, 2017). Restricted lending in redlined neighborhoods may have also contributed to the inability of residents to finance repairs and conduct home maintenance, creating reinforcing feedback loops of residential disadvantage that have been disproportionately present in African American communities.

Research has consistently demonstrated how current situations of racial residential segregation and neighborhood deprivation are powerfully associated with health and mortality (Dalton et al., 2017; Kind and Buckingham, 2018; Kind et al., 2014; Singh 2003; Sudano et al., 2013; Williams and Collins, 2001). For example, in data from Cleveland, neighborhood deprivation has been shown to be a more powerful predictor of cardiovascular events than clinical measurements (Dalton et al., 2017). In Figure 1B, we provide an illustrative comparison of the Area Deprivation Index with the HOLC map in Figure 1A. These similarities in findings collectively suggest that historic decisions shaping the geography of mortgage lending have influenced stable, long-term geographic patterns of disinvestment and inequity that have manifested as cascading civic, social, and public health consequences for millions of individuals.

Strengths, Limitations, and Implications for Future Work

Key strengths of our study offer important contributions to prior research empirically examining the role of racial discrimination in redlining decisions. First, our study includes data from multiple municipalities across all regions of an entire state, while other studies have focused only on single municipalities. Second, our study includes data directly

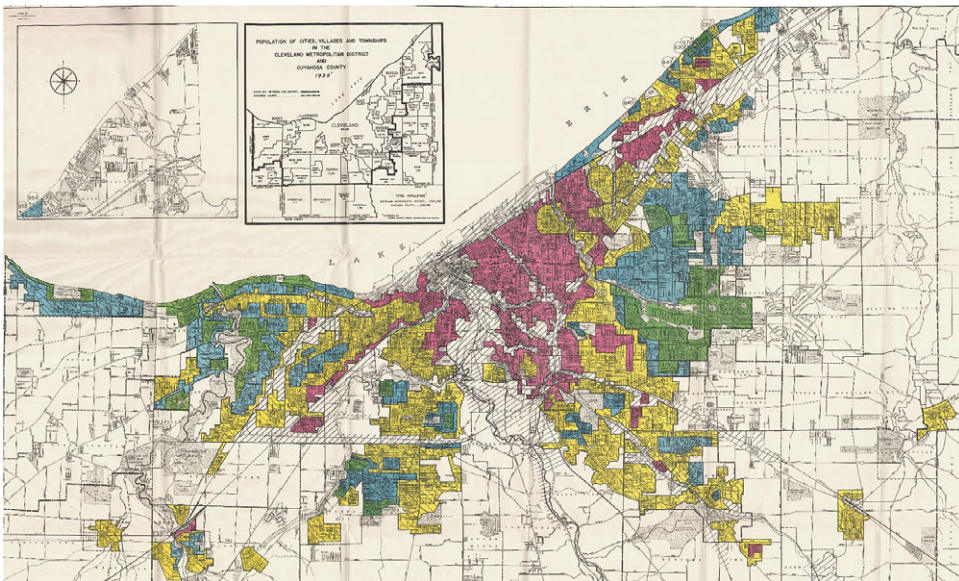


Fig. 1A. Home Owners Loan Corporation Map of Redlined Areas in Greater Cleveland from 1940. Map reprinted from a National Archives collection whose access and use is “Unrestricted,” according to the Archival Research Catalog for ARC Identifiers 720357 7and 3620183 (NARA website: <http://www.archives.gov/research/catalog/>)

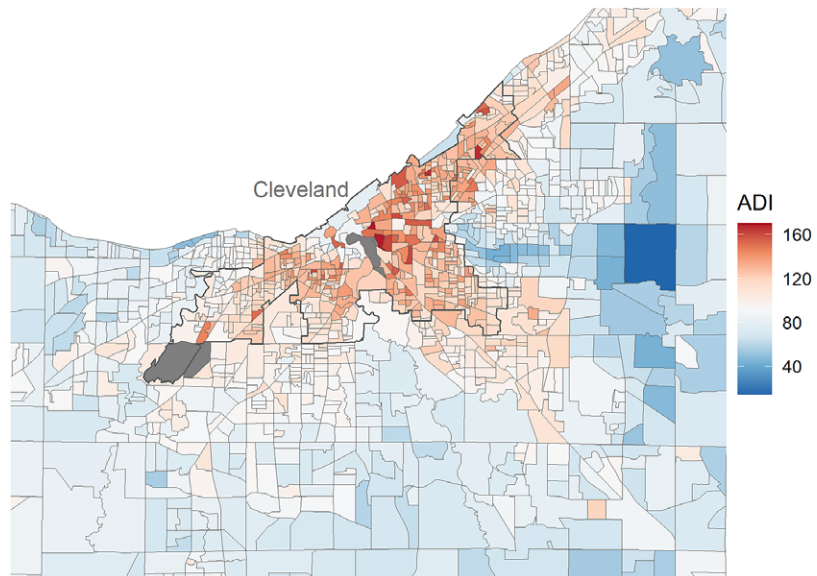


Fig. 1B. Cuyahoga County, Ohio Block Group Area Deprivation Index in 2019. Map created using data from the American Community Survey and open-source packages: tigris, sf, sociome, tidycensus, tidyverse. This original image is released by the authors as Creative Commons Attribution License (CCAL) CC BY 4.0.

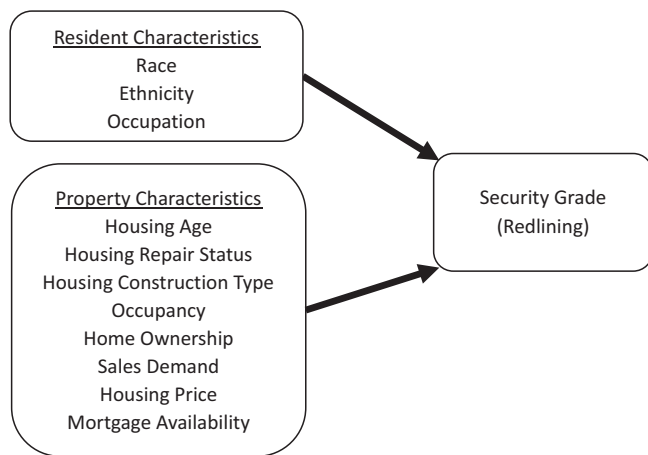


Fig. 2. Structural Model of Factors Influencing the Decision to Redline a Neighborhood

abstracted and quantified from more than 500 ADFs, quantifying variables related to Ohio redlining decision-making processes in the 1930s. Third, our analyses account for a wide range of housing and area-based characteristics available to individual HOLC raters at the time of the redlining decision.

Our analysis is limited to specific metropolitan areas within the state of Ohio. A possible gap in inference may be that in cities outside of Ohio, non-racial factors were predominant. However, Ohio is a large and diverse state that has long been a bellwether of political and economic conditions for the United States. We have established that federally initiated lending policy was applied uniformly across twelve urban areas in a way that was racist and

discriminatory. Amy E. Hillier (2003) correctly points out that for a single city, ADF estimates and census estimates were in some cases only loosely correlated. This suggests that the realtor, then, was making a rater-based assessment of what those neighborhood conditions were. Though this implies that rater measurements were not consistent with other organizational assessments, our study highlights the consequences of rater-based decisions made on behalf of the HOLC because our analyses only use the data upon which exclusionary decisions were made at that time. In other words, exclusionary decisions during those years were based on raters' perceptions and not on Census data. In addition, as in our study, small cell counts can also prevent proper estimation of associations within a single city; our inclusion of data for multiple cities in a single state is an important advance beyond Hillier's (2003) work.

Our study did not include indicators beyond those present on HOLC forms. Because the HOLC area description forms do not contain data on residents' education, income, or wealth, the specific influence of those factors was not possible to model in our analysis. We note that occupation type is a possible surrogate marker among 1930s households, and 15% of the redlined neighborhoods (see Table 2) were classified by HOLC raters as having residents who were predominantly white collar. Similarly, Model 2 (Table 3) shows that occupation type was importantly associated with redlining, but that the association with race was stronger and persisted after addition of occupation type to the model. While our study includes measures like the age and condition of housing, form data may not reflect property alterations such as improvements or renovations made to housing (irrespective of when the property was built). The absence of these additional socioeconomic and housing indicators is a limitation of our study.

Indications of the proportion of U.S.-born White families are generally not recorded on the forms with any regularity. This omission from the ADFs limits our ability to directly include a neighborhood variable representing White families in our analyses. The systematic exclusion of data on U.S.-born White families is consistent with prior theoretical analyses which have observed a paradox whereby Whiteness (and normalized advantages held by White borrowers in lending markets) is ubiquitous but simultaneously inconspicuous or invisible (Goetz et al., 2020; Lipsitz 2011). However, our findings further suggest that while racism toward Black families was the overriding factor in redlining decisions, xenophobia toward immigrant families was also part of the reasoning and neighborhood rating process.

Some scholars have suggested that the risk assessment maps were not widely distributed to federal or private lending entities at the time and thus not meaningfully impactful (Hillier 2003). However, Woods (2012) reviewed primary text from the 1938 Federal Housing Authority Underwriting Manual which shows clearly that the HOLC's risk appraisal techniques were highlighted as "aids to judgement" for national insuring offices in decision-making regarding lending across residential communities (Government Printing Office 1938, p. 638).

Additionally, while our study provides a high level of evidence for racial discrimination as a critical factor in the decision to redline 1930s Ohio neighborhoods, there exists an endogeneity problem that cannot be fully overcome without a study design that would allow for temporal causal inference. It is possible that neighborhoods previously redlined (even for reasons not associated with the racial composition of the neighborhood) were over time differentially selected by African Americans because they were denied home purchase in other neighborhoods, were forced to move out of neighborhoods as a matter of race-based government policy, or viewed these neighborhoods at one point in time as more affordable or desirable in some other way. Future work could address this limitation through examining Area Description Forms generated for the same neighborhoods in successive years, through the use of an appropriate instrumental variable, or possibly

through further qualitative analysis and quantification of the racially motivated comments recorded on the ADFs, of which we have provided only a few examples. Our skepticism regarding the temporality of decision-making (i.e., whether the decision of which neighborhoods would be redlined was already made before Area Description Forms were completed) is tempered by further review of the primary documents. Indeed, the very first page from nearly all sets of forms includes a variant of the following verbatim explanation:

The intent of this Residential Security Map is to portray graphically the present desirability of neighborhoods from a residential viewpoint. The purpose of the accompanying Area Description Forms is to give the interested observer a complete historical and statistical background for each neighborhood, not only substantiating its present standard, but also forecasting its future trend of desirability.

Lastly, a common contention is that HOLC likely made only a small portion of home loans, which might suggest that the influence of HOLC redlining was modest. This contention is directly contradicted by data presented in the summaries preceding several of the Ohio ADFs. For example, the introduction to the Toledo, Ohio forms indicates that the share of loans made by HOLC was far from trivial:

On July 31, 1938, the Corporation had 6,466 loans for \$20,044,600 in the city, which was equal to 48% of the number and 55% of the dollar amount of residential mortgages held by institutions.

Data from the Youngstown form packet also contained this information and indicated that as of September 30, 1938, a total of 4,371 (\$13,738,100) of 11,300 residential mortgages were HOLC loans. Most of the Ohio form packets contained no such information on the proportion of loans held by HOLC and additional research on lending records would be necessary to extend and further validate our findings. The full implications of our findings will need to be considered by policy makers, future judicial proceedings, and other parties seeking to rebalance nearly a hundred years of home lending and neighborhood inequity. Previously plausible hypotheses that more benign factors were involved must now be set aside in favor of the clear finding of federally sponsored racial discrimination in neighborhood mortgage lending.

Conclusion

Our study finds that redlining in the 1930s was a continuation of other racially discriminatory real estate practices in the United States. Beyond redlining, racial discrimination in real estate was common in Ohio in the form of restrictive covenants, exclusionary zoning laws, and right of refusal clauses written in the bylaws of local home owners associations and subdivisions, many of which persist to this day (Reece 2021; Ware 2021). In 1896 the decision in *Plessy v. Ferguson* held that racial segregation was legal under a “separate but equal” doctrine. Our quantitative results in combination with the excerpted passages from the 1930s ADFs clarify that local officials, under the supervision and direction the largest federal government home lending entity in Ohio at the time, the HOLC, aggressively worked to implement a lending policy of racial exclusion and separation. An understanding of this history is fundamental to building a transformation of community development systems that will be able to overcome contemporary economic and health challenges faced by Black families and urban communities in the United States (Reece 2021).

Home ownership is a crucial way by which individuals and families build wealth, health and social connections. Contemporary and historical racial disparities in home lending have been thoroughly documented and determined to be present even after adjustment for individual borrower characteristics (Munnell et al., 1996). Redlining practices appear to offer a historical explanation of why the patterning of seemingly disparate community problems—segregation, education, health, social, crime—overlap so much. Our study provides the first published quantitative evidence for an entire state’s specific neighborhoods that racial prejudice was overwhelmingly associated with decisions by the HOLC, a United States federal agency, to redline neighborhoods. These decisions occurred at a pivotal moment in United States history and have been linked to eighty years of urban disadvantage ranging from disproportionate and persistent poverty to infant and maternal mortality. Coupled with our study findings, the lingering damage to communities and ongoing health and social burdens experienced in racially segregated communities suggest that, at minimum, we need to re-examine pivotal legal and policy decisions. Pursuit of effective solutions for remedying the lasting damage to communities should be a goal of researchers and policymakers alike.

Acknowledgements

Jintao Liu provided biostatistical input to prior analysis informing this work.

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Anupama Cembali served as a student researcher and avid contributor to the project.

Tristan Smith served as a student researcher and avid contributor to the project.

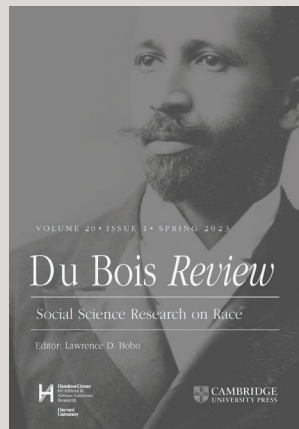
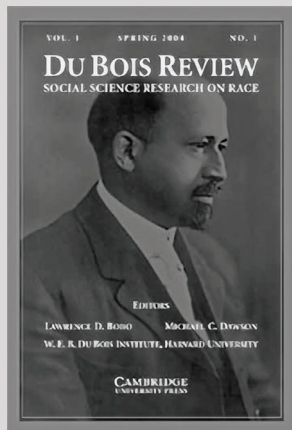
Sarah Shick served as a graduate student researcher and avid contributor to the project.

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Cite this article: Perzynski, Adam, Kristen A. Berg, Charles Thomas, Anupama Cembali, Tristan Smith, Sarah Shick, Douglas Gunzler, and Ashwini R. Sehgal (2023). Racial Discrimination and Economic Factors in Redlining of Ohio Neighborhoods. *Du Bois Review: Social Science Research on Race*, 20: 293–309. <https://doi.org/10.1017/S1742058X22000236>

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