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The Effects of the 1930s HOLC "Redlining" Maps*

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Abstract: In the wake of the Great Depression, the Federal government created new institutions such as the Home Owners' Loan Corporation (HOLC) to stabilize housing markets. As part of that effort, the HOLC created residential security maps for over 200 cities to grade the riskiness of lending to neighborhoods. We trace out the effects of these maps over the course of the 20th century and into the early 21st century by linking geocoded HOLC maps to both Census and modern credit bureau data. Our analysis looks at the difference in outcomes between residents living on a lower graded side versus a higher graded side of an HOLC boundary within highly close proximity to one another. We compare these differences to "counterfactual" boundaries using propensity score and other weighting procedures. We find that areas that were the lower graded side of HOLC boundaries in the 1930s experienced a marked increase in racial segregation in subsequent decades that peaked around 1970 before beginning to decline. We also find evidence of a long-run decline in home ownership, house values, and credit scores along the lower graded side of HOLC borders that persists today. Our results provide strongly suggestive evidence that the HOLC maps had a causal and persistent effect on the development of neighborhoods through credit access.

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I. Introduction

There is a growing recognition that place matters in determining socioeconomic success in the United States. Where you grow up is highly consequential for academic performance, economic mobility, and longevity.[1] There are also striking differences in these same outcomes by race due to the historical legacy of slavery and segregation. It is therefore not surprising that researchers have long been interested in the possible role of residential segregation by either race or income in explaining the wide disparities in outcomes by location. Our study focuses on one potentially important channel that could drive both place- and race-based differences, namely access to credit.

Our setting is a historical period in which there were fundamental changes in the financing of home ownership and the allocation of credit across narrowly defined geographic areas. Specifically, we examine the effects of the residential security maps drawn during the 1930s by a Federal agency known as the Home Owners' Loan Corporation (HOLC). In the aftermath of the Great Depression, the government undertook reforms to limit foreclosures and stabilize the housing market. The maps, which were drawn for over 200 cities, were commissioned in order to document the relative riskiness of neighborhood lending. Neighborhoods were classified based on detailed information about housing age, occupancy, prices, and other related characteristics but also non-housing characteristics such as the racial and ethnic makeup of neighborhoods. As a result, it has been hypothesized that the HOLC maps contributed to institutionalized racial discrimination in lending practices among financial institutions (Jackson, 1980) and may have contributed to modern-day differences in neighborhood development. Since the worst rated neighborhoods were drawn in red and often had high shares of black residents, these maps have been associated with the so-called practice of "redlining" in which borrowers are denied access to credit due to race or ethnicity. Indeed, concerns over the practice of redlining in later decades prompted the Federal government to intervene with legislation, most notably the 1968 Fair Housing Act (FHA) and the 1977 Community

[1] See Reardon et al (2016), Chetty et al (2014), and Chetty et al (2016).

Reinvestment Act (CRA), policies which were designed to expand access to lending markets for families living in low and moderate-income neighborhoods.[2]

The ability to access credit is often viewed as a fundamental pathway to economic opportunity for low-income households. Credit access facilitates home ownership, investment in human capital, and entrepreneurial activities.[3] Policies that improperly restrict credit are potentially objectionable on the grounds of both equity and efficiency. Moreover, entire neighborhoods that are deprived of credit could suffer from insufficient investment and become magnets for an array of social problems related to poverty.

We systematically analyze the impact of the available HOLC maps on a broad range of outcomes (racial segregation, home ownership, house values and credit scores), over the entire historical period (1940 to 2010) since the maps were drawn, and using digitized maps for the full set of 140 cities for which maps are available. This project is feasible because of the release of several unique data sets. The Digital Scholarship Lab at the University of Richmond provided us with geocoded renderings of the original HOLC maps for 149 cities, representing 89 percent of the population of the 100 largest cities in 1930. We merge digitized information from the HOLC maps with geocoded data from the 100 percent 1910 to 1940 U.S. decennial Censuses, as well as census block level data from the 1990 to 2010 U.S. Censuses and the annual 1999 to 2016 Federal Reserve Bank of New York / Equifax's Consumer Credit Panel (CCP) and census track level data from the 1950 to 1980 U.S. Censuses. Overall, this provides a rich set of data at a high level of geographic detail on characteristics such as race, homeownership, house values, earnings, population, and, in later years, credit scores and detailed financial information.

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[2] It is worth noting that the practice of redlining remains an active concern in some cities (see e.g. Washington Post 5/28/15 and New York Times 10/30/15). Some recent lawsuits involve lending practices in New York City, Philladelphia, Buffalo, Chicago, Milwaukee, Miami, and Los Angeles, and there are on-going investigations at the Consumer Financial Protection Bureau and Department of Justice.

[3] Among voluminous literatures, see for example, Cameron and Taber (2004), Stinebrickner and Stinebrickner (2008), Lovenheim (2011), and Lochner and Monge-Naranjo (2011) on skill investment; Evans and Jovanovic (1989), Black and Strahan (2002), and Banerjee et al (2017) on entrepreneurship; Zeldes (1989), Deaton (1991), and Carroll (2001) on consumption; Bernanke et al (1999), Bassetto et al (2015), Greenstone et al (2014), and Breza and Kinnan (2017) on economic activity; and Lee and Lin (2017), Rosenthal and Ross (2014), and Baum-Snow and Hartley (2016) on urban development.

Our project has several goals. First, we document the demographic and economic characteristics of neighborhoods prior to the mid-1930s when the actual maps were drawn. As we describe in greater detail below, the HOLC graded neighborhoods on a scale of A (least risky) to D (most risky).[5] We find a clear monotonic relationship between economic characteristics associated with credit worthiness measured prior to the drawing of the maps and the eventual grade. The differences are particularly acute between A, B and C, but, perhaps somewhat surprisingly, less so between C and D, the two riskiest neighborhood types. By contrast, racial composition is roughly the same in neighborhoods A to C but strikingly different in neighborhood D, those shaded in red. While previous research (Hillier, 2005; Fishback, 2014) has shown similar patterns for Philadelphia and New York, our descriptive results constitute the first systematic evidence across a full range of U.S. cities of the extent to which the maps were correlated with measures of creditworthiness and race.

Our second, and more ambitious, goal is to estimate the causal effects of the HOLC grades on the evolution of neighborhoods over time. Given that our analysis takes place in a non-experimental setting, our methodology must address confounding factors for valid inference. Perhaps the most critical concern is that the maps may have simply reflected and codified pre-existing differences in neighborhoods, but didn't actually cause any changes in lending practices. We address this concern through a multi-pronged approach.

The first part of our strategy relies on multiple levels of differencing. We begin by tracking changes over time in the difference in outcomes between neighbors that live on either side of a HOLC boundary within a very tightly defined geographic band, typically a few city blocks. Comparisons of spatially proximate neighbors safeguards against confounding factors like access to labor markets, public transportation, or other features and amenities of local areas, that might influence the growth of neighborhoods differentially.

[5] Large parts of cities were also unclassified because they contained fewer residential properties.

However, we do not believe that a border design alone is fully satisfying given that there were likely pre-existing differences even among nearby neighbors that were well known to contemporary real estate professionals. A classic example would be railroad tracks that might have marked a clear border between a good and a bad neighborhood (i.e. "living on the wrong side of the tracks"). Similarly, and critical for our identification, we show that there was a rising trend in the difference in racial segregation along the HOLC borders between 1910 and 1930. This renders a simple regression discontinuity strategy not fully credible. To address this concern, we compare our "treated" neighborhood boundaries with a set of counterfactual neighborhood boundaries that look like the treated boundaries pre-period using propensity score weighting or synthetic control methods. We show that patterns in racial segregation and other characteristics in our weighted counterfactual boundaries are virtually identical to the treated boundaries during the period before the maps are drawn but begin to diverge immediately afterwards.

We use two other alternative approaches that do not rely on constructing counterfactual boundaries to address pre-trends. First, we can eliminate pre-trends if we focus only on HOLC borders that were predicted to be the least likely borders based on our pre-period propensity score analysis. Second, we can exclude specific borders with large pre-trends, specifically those that overlap with railroads and rivers.

We find that the HOLC maps affected at least four dimensions of neighborhoods: the degree of racial segregation as measured by the fraction of black residents, home ownership rates, home values, and credit scores. However, there are some important distinctions across neighborhood boundary grades and over time.

First, we find that areas graded "D" become more segregated than C rated areas over the 20th century as the fraction of black residents gradually rose from 1930 until about 1970 or 1980 before starting to decline thereafter. We also find similar patterns and effects on segregation in "C" neighborhoods that bordered "B" neighborhoods, even though there were virtually no black residents in either neighborhood type prior to the maps. That fact, and the implication that there were no pre-trends in racial segregation along the C-B boundaries, gives us further comfort that we are identifying causal effects. That the pattern begins to revert starting in the 1970s is at least suggestive that FHA, CRA, and perhaps other civil rights laws introduced around this time may have played a role in reversing the increase in segregation caused by the HOLC maps. Nevertheless, a small difference in racial segregation along both the C/B and D/C borders remains in 2010, almost three quarters of a century later.

We also find that the maps had effects on homeownership rates and values. Intriguingly, the effects on housing markets dissipate over time along the D-C boundary but remain highly persistent along the C-B boundaries where pre-existing racial differences were small to nonexistent. We explore a variety of potential explanations for these differences by HOLC border type but arrive at no definitive conclusions. One interesting possibility is that policies enacted later in the century such as the CRA perhaps successfully targeted D (but not C) rated areas.

The paper most similar to ours, Appel and Nickerson (2016), find that the HOLC drawn borders affected home prices in 1990.[6] More generally, our paper is similar to other recent papers (e.g. Hornbeck 2012, Hornbeck and Keniston 2016, Feigenbaum et al, 2017 and Shertzer et al., forthcoming), that document how an important intervention, in our case access to household credit, can have large and strikingly persistent effects on the growth and development of local communities. Nevertheless, given that our framework is non-experimental, further research that can confirm these findings using alternative research strategies or other data would be useful in bolstering our claim of causality. The rest of the paper proceeds as follows: section II provides a description of the HOLC, the maps and the related literature; section III describes the data and descriptive facts; section IV shows our methodology; section V presents our results, and section VI concludes.

II. The HOLC and the City Survey Program

[6] Their analysis differs from ours in several important respects. First, they use a regression discontinuity strategy and rely on the assumption that there were no pre-existing differences (or trends) along HOLC borders. Second, they combine all HOLC border types in their analysis and assume that the effects are the same across all of them. Third, they do not examine effects on any outcomes aside from home prices. Fourth, they only examine their outcome in one year, 1990 and do not trace out the pattern of effects over the entire 1940-2010 period. Other previous studies such as Hillier's (2005) seminal study of Philadephia and Fishback's (2014) on New York focus on individual cities.

Soon after the Great Depression began, house prices fell precipitously and a foreclosure crisis emerged (White 2014). To take one prominent and well-measured city as an example, foreclosure rates in New York City rose from essentially zero throughout the 1920s, to as high as 7 percent in 1935, and averaged about 2-3 percent per year during the early and mid-1930s (Ghent 2011). As part of the New Deal, the Roosevelt administration compelled the recently established Federal Home Loan Bank Board (FLHBB) to develop a number of programs intended to minimize this foreclosure risk and to stabilize housing markets. Foreclosures were not only devastating to borrowers but were also very costly to lenders.[7] The programs that were developed operated mainly through the Home Owners' Loan Corporation (HOLC) and the Federal Housing Administration (FHA), and included more favorable financing conditions for new and existing loans. In particular, there was a movement away from providing short duration loans of 3-5 years with balloon payments, to fully amortized 20 year loans. In addition, the programs provided federal mortgage insurance and set up a secondary market for securitized loans. Several recent papers describe the residential real estate environment at the time and evaluate the effectiveness of various HOLC and FHA initiatives to deal with the foreclosure crisis.[8]

One of these initiatives was the introduction of a systematic appraisal system that, among other goals, encouraged lenders to consider neighborhood characteristics when making their lending decisions. To promote this idea, the HOLC drew residential "security" maps intended to provide information to lenders about local credit conditions as part of its City Survey Program.[9] The maps were drawn based on the input of local brokers and appraisers, as well as surveys of home prices, the quality of the housing stock, and the demographic and economic characteristics of the neighborhood (Jackson 1980, Hillier 2005).

[7] Nicholas and Scherbina (2013) find that the recovery rate was around 74 percent.

[8] Wheelock (2008), White (2014), Fishback et al (2011), Rose (2011), and Ghent (2011) provide overviews of the various government responses to the housing bust of the 1930s.

[9] The FHA also drew maps with four gradations at around the same time. See Jackson (1980) and Light (2011) for an informative discussion of how FHA risk maps were created and the instructions provided to undewriters to evaluate areas. Unfortunately, those maps are less readily available. That said, at least for Chicago, differences between the FHA and HOLC maps are fairly minor. Our estimates will capture the sum of any HOLC and FHA effect where the boundaries line up and just the HOLC where they differ.

Neighborhoods were graded on a scale of A (least risky/most stable) to D (most risky/least stable),[10] with households living in lower ranked neighborhoods likely facing more difficulty accessing formal lending markets compared to an otherwise identical household in a higher ranked community. The FHA and FHLBB appraisal manuals were candid in how they wanted to differentiate grades. Hillier (2005) quotes the 1937 FHLBB Appraisal Manual as describing neighborhoods as:

- Grade A = "homogeneous," in demand during "good times or bad."
- Grade B = "like a 1935 automobile-still good, but not what the people are buying today who can afford a new one"
- Grade C = becoming obsolete, "expiring restrictions or lack of them" and "infiltration of a lower grade population."
- Grade D = "those neighborhoods in which the things that are now taking place in the C neighborhoods, have already happened."

The term "redlining" is thought to derive from the red shading that marks the lowest ranked D neighborhoods (although see Fishback 2014). Those neighborhoods tended to have a heavier concentration of African-Americans and recent immigrant groups.[11] Indeed, the 1930s FHA manuals explicitly emphasize "undesirable racial or nationality groups" as one of the underwriting standards. The C-graded neighborhoods were colored in yellow, the B-graded neighborhoods in blue and the A-graded neighborhoods in green. It is unclear how long the maps were used but FHA manuals continued to include race and nationality thru at least the 1940s. The 1968 FHA and 1977 CRA legislation outlawed the use of

[10] Large parts of cities were also unclassified, likely because they contained fewer residential properties.

[11] The 1934 FHA manual includes race as one of the underwriting standards to be applied to new loans: "The more important among the adverse influential factors (of a neighborhood's character) are the ingress of undesirable racial or nationality groups…All mortgages on properties in neighborhoods definitely protected in any way against the occurrence of unfavorable influences obtain a higher rating. The possibility of occurrence of such influences within the life of the mortgage would cause a lower rating or disqualification." See http://archives.ubalt.edu/aclu/pdf/Plex48.pdf. Adverse appraisal factors listed in the 1934 and later manuals include "inharmonious racial and nationality groups" along with the presence of smoke, odors, fog, heavily traffic and noisy roads, and railroads. As noted in Jackson (1980), prominent appraiser textbooks from the early 1930s already warned that an increase in "undesirable ethnic groups" led to house price declines.

security maps because it was believed to unfairly target low and moderate-income neighborhoods that tended to be heavily minority.

[Insert Literature Review]

III. Data and Descriptive Facts

HOLC maps

The Digital Scholarship Lab at the University of Richmond has provided us with geocoded renderings of the original HOLC maps for 149 cities.[12] Figure 1 shows their location and demonstrates that we have extensive geographic coverage. These cities comprise 89 percent of the population living in the 100 largest U.S. cities in 1930 and 1940, including 9 of the largest 10, 17 of the largest 20, and 30 of the 42 cities with populations above 200,000.[13]

The HOLC maps for three prominent cities -- New York, Chicago, and San Francisco – are displayed in Figure 2. The highly detailed nature of the geocoding allows us to identify groups of neighbors that are geographically close (i.e. that live within a few city blocks of each other) but separated by HOLC's boundaries. The large set of boundaries separating neighborhood types, especially evident in the New York City and San Francisco maps, illustrate the kind of variation we utilize for our main identification strategy where we only use data on households living in a narrow band along the borders.

In order to execute our research design, we need a dataset that includes the neighborhood characteristics of the areas immediately on each side of an HOLC map boundary over time. We begin by assigning a boundary ID to each straight line segment of a boundary that is ¼ mile in length or longer. Next we draw buffer areas that extend either 1/4 or 1/8 mile on each side of the boundary creating a rectangular

[12] See Appendix for details on the cities.
[13] Of the 20 most populous cities, we are missing Los Angeles (#5), DC (#11), and Cincinnati (#17). About 30 percent of the total U.S. population lived in the largest 100 cities in 1930 and 1940.

area on each side. We call these areas boundary buffers. Each boundary has two buffers which we refer to as the lower graded side (LGS) and higher graded side (HGS).

1910 to 2010 Censuses

We match the geocoded maps to Census housing and population characteristics, such as homeownership, house values, housing age, race, population, and other characteristics. Paradoxically, for our purposes, the earliest years, 1910 to 1940, provide the best data for classifying boundary buffers because of the availability of 100 percent population counts with street addresses for the majority of household head respondents. We use our geocoded address-level Census data and tabulate each variable by taking means of all observations which fall inside of a boundary buffer, excluding buffers with fewer than 3 observations. Our procedure starts with the 73, 72, 99, and 82 percent of household heads with street addresses in the 1910 to 1940 Census files. We successfully match between 60 and 80 percent per Census to modern street locations.[14] That allows us to locate 49, 50, 79 and 62 percent of 1910 to1940 Census respondents and ultimately assign them to HOLC neighborhoods.[15]

Beyond 1940, micro data has not been released so we rely on Census aggregates.[16] As far as we know, the most compact geographic aggregate currently available for 1950 to 1980 are census tracts, demographically and economically homogenous areas of between 1,500 and 8,000 people. Because census tracts can change over time, we overlay the tract boundaries from each decade with the boundary buffer shapes. We then take the tract population weighted means of any tract for which 15 percent or more of the area of the tract lies within the boundary buffer. That 15 percent threshold balances a tradeoff between sample size and measurement precision. Therefore, we show that our results are robust to reasonable alternative census tract inclusion thresholds in the appendix.

[14] Given our empirical strategy based on using boundary differences described below, we see no reason why differential rates of address reporting or successful geocoding across Censuses should affect our estimates.
[15] We analyzed how specific characteristics influenced the probability of geocoding and found that __________.
[16] Census micro data is released with a 72 year lag.

Starting in 1990, the Census provides smaller geographic tabulations called blocks, which contain on average roughly 100 people. Some variables, notably house value, house age, and foreign born population, are only reported at the block group level, which are aggregates of blocks and typically contain between 600 and 3,000 people.[17] Regardless, since Census blocks and block groups are much smaller than census tracts, we use a 50 percent threshold –i.e. the census block population weighted means of all blocks for which the area of the block is more than 50 percent within the boundary buffer. The panel of boundary buffer tabulations that we create for each decade from 1910 through 2010 forms the basis of our analysis.

1999-2016 New York Fed Consumer Credit Panel/Equifax (CCP)

We supplement our Census-based boundary buffer panel with modern credit bureau data from the New York Fed Consumer Credit Panel/Equifax (CCP). The CCP, which covers roughly 5 percent of the population, provides block-level data on credit scores and a rich set of detailed measures on household liabilities between 1999 and 2016.

Summary Statistics

Table 1 provides summary statistics for our key variables of interest by neighborhood grade. Columns (1) to (4) report means for all households irrespective of their proximity to the borders. This largest sample encompasses 543 neighborhoods with an A grade, 1,351 with a B grade, 2,156 with a C grade, and 1,399 with a D grade. Panel A shows the share of African Americans over time across neighborhoods. For example, in 1930 before the maps were drawn, African Americans comprised about 16 percent of the residents living in D-rated neighborhoods but only 2 percent of those living in C-rated neighborhoods. By 1980, African Americans accounted for 46 percent of residents in D-rated neighborhoods and 28 percent of residents living in C-rated neighborhoods. By 2010, these rates had converged to 38 percent and 30 percent respectively. The time patterns for selected years are shown graphically in Panel A of Figure 3.

[17] For context, in 2000 (2010), there were over 8 (11) million blocks, 208,790 (217,740) block groups, and 65,443 (73,057) census tracts.

Comparable statistics for those living in a buffer zone of a quarter mile along the B-C and C-D boundary are shown in columns (5) to (8). If we consider the C-D boundary buffer in columns (7) and (8), as might be expected, the gap in the share of African Americans is somewhat less striking compared to when we look at all residents in a neighborhood. For example, in 1930, the gap in the C-D boundary buffer is 6.4 percentage points (3.5 percent in C and 9.9 percent in D). This compares to a gap of 13.7 percentage points when we look at all residents in 1930. After the maps were drawn the racial gap in the one quarter mile boundary buffer grows as high as 15.1 percentage points in 1970 (30.3 percent in C and 45.4 percent in D). By 2010 the gap is only 3.5 percentage points (39.2 percent in C and 42.7 percent in D).

It is worth highlighting that before the maps were drawn the share of African Americans living in B and C neighborhoods was relatively small and even smaller in the B-C buffer zone. For example, in 1930, the gap was less than a percentage point. By 1970 it had grown to just under 5 percentage points. Columns (9) to (12) shows the comparable estimates for those living along the one eighth mile boundary buffers.

In Panel B of Table 1 and Panel B of Figure 3 we show comparable statistics for home ownership. In 1930, before the HOLC, the gap in home ownership in the C-D one quarter mile buffer zone (columns 7 and 8) was about 3.6 percentage points and was 5.9 percentage points in the B-C buffer zone. By 1960, these differences had increased to 5.1 and 8.0 percentage points, respectively. By 2010, the gaps along the C-D boundary buffer zone had fallen to just 2.0 percentage points but remained elevated along the B-C boundary at 7.0 percent. In Panel C of Table 1 and Panel C of Figure 3 we show the analogous patterns for house values. Panels D and E of Table 1 show the patterns for the fraction foreign born and for modern day credit scores. In brief, we find that house value and credit score gaps along these borders exist even today and that they are larger among the B-C borders than the D-C borders. The share of immigrants have equalized along the C-D borders after growing faster in C areas in the middle of the century. In contrast, the immigrant share along the B-C borders has remained higher in the C areas for the entire 1910 to 2010 period.

Determinants of HOLC Grades

Table 2 shows a series of regressions that associate neighborhood grades with pre-HOLC 1930 housing and demographic characteristics, as well as changes between 1920 and 1930 when available. Columns (1) and (2) report marginal effects from an ordered logit where D is coded as 4 and A is coded as 1. Columns (3) to (8) are marginal effects of the probability of moving between continuous grades: i.e. A versus B, B versus C, or C versus D, respectively. All specifications include city fixed effects and are weighted by the log of the population of the HOLC neighborhood in 1930. City-clustered standard errors are shown in parentheses.

Like Hillier (2005) and Fishback (2014), who were only able to examine single cities, we find a clear monotonic relationship between grades and nearly all the key economic and housing covariates that are available in the Census whether considered individually or, as in the table, simultaneously.[18] Similar to these previous studies, we also find that a neighborhood is substantially more likely to be graded D than C if the African-American share is higher, even after conditioning on a set of housing and economic characteristics and city fixed effects.[19] We also find that a higher homeownership rate, log home value, log rent, occupational earnings, radio ownership, and literacy are associated with a higher HOLC grade. To take one example, the results in column (2) implies that a 10 percent increase in homeownership rates raises the probability of a higher single grade by 7.6 (0.7) percent.

These results are to be expected given what we know about the appraisal process from a small sample of forms that were recorded at the time, called "Area Description Files." They show that homeownership, vacancy, housing age, housing quality, and economic and demographic characteristics of neighbors were key factors used to grade neighborhoods. Appendix figure A1 shows the area description

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[18] We find weaker evidence that recent changes in housing and household characteristics between 1920 and 1930 affected HOLC grades. These coefficients are suppressed in Table 2 for space but are available on request. However, it is plausible that changes between 1920 and 1930 are not the correct time frame for evaluating appraisals that were taking place in the mid-1930s.

[19] Interestingly, we find that the share African-American has the opposite sign when we examine grade determination among A versus B neighborhoods and B versus C neighborhoods.

file for Tacoma, Washington which was graded D. This example highlights the pivotal influence of race in determining the HOLC grade. The notes at the bottom of the document under clarifying remarks states: "This might be classed as a 'low yellow' area if not for the presence of the number of Negroes and low class Foreign families who reside in the area." It is worth noting that the fraction of African Americans in Tacoma was 2 percent.

In Table 2, we find that the marginal effect of most of our observable housing and employment variables is roughly the same for grade determination between B versus C (columns 5 and 6) and C versus D (columns 3 and 4). For example, in the sample of C and D neighborhoods, a 10 percent increase in the homeownership rate increases the probability of a C grade by 4.5 (0.5) percent. Likewise, in the B-C sample, a 10 percent increase in the homeownership rate increases the probability of a B grade by 4.8 (0.6) percent. Interestingly, B grades areas are more likely than C grades in areas with a higher share of African Americans.

IV. Identification and Methodology

In this section we describe our primary empirical strategy. Our approach is very much guided by the historical narrative that suggests that the appraisal process underlying the residential security maps explicitly considered existing characteristics of neighborhoods and their trends when drawing the borders. This is confirmed by the area description files mentioned earlier (see appendix Figure A1). Therefore, we use multiple approaches to try to overcome this obstacle to identification.

Differencing

We begin by considering a straightforward difference-in-difference (DD) strategy and then discuss the problems with this approach and how we further refine our strategy. The basic idea is to compare changes over time in neighborhood level outcomes, pre- and post- the construction of the HOLC in places that are spatially proximate but on different sides of an HOLC boundary. Along the line segments that make up these boundaries, we can compare nearby neighbors that live within a tightly defined distance from the boundary – what we refer to as boundary "buffers." The benefit of focusing on differences within buffers is that we can remove potentially important, but typically hard to measure, factors that influence residents on both sides of a border. In our case, neighbors living within hundreds of feet of each other, but on opposite sides of a border, are likely facing the same access to labor markets, public transportation, retail stores, perhaps schools, and other local area amenities. This strategy is highly related to a border regression discontinuity design (RD) used in previous work (see Holmes, 1998; Black, 1999; Bayer et al, 2007; and Dube et al, 2010). We discuss the problems with the RD design in our context below.

The statistical model underlying the DD estimator is:

$$y_{gbt} = \sum_{t=1910}^{2010} \beta_t 1[lgs]\gamma_t + \beta_{lgs} 1[lgs] + \gamma_t + \alpha_b + \epsilon_{gbt}$$

y_{gbt} is an outcome (e.g. share African-American) in geographic unit g, (e.g. boundary buffer) on boundary *b*, at census year *t*, $1[lgs]$ is an indicator that the buffer is on the lower-graded side of the HOLC boundary, γ_t are year dummies, and α_b are boundary fixed effects. We define boundary buffers as either 1/4 or 1/8 of a mile (about 650 feet) on each side of the HOLC boundary. Differencing across the boundary is captured by the $\alpha_b's$. Our coefficients of interest, the β_t's, capture the change in the mean outcome in year *t* relative to 1930 (the Census year before the maps were drawn). The gap in the mean outcome in year *t* is therefore β_t+β_{lgs} for years other than 1930 and β_{lgs} for 1930.

Parallel Trends Assumption Violated

The key problem with relying on the DD strategy is that the approach relies on the assumption of parallel pre-trends which does not appear to hold in our application. First, we know from anecdotal information such as the area description files that the borders were endogenously drawn based on information on where racial and housing gaps were already diverging. Second, this can be seen empirically in Figure 4, which plots the mean share of African-Americans in D relative to the mean share of African-

Americans in the C one quarter mile boundary buffers for the period 1910 through 1940. As early as 1910 and 1920, there was a 3 percentage point gap between the D/C buffers, which grew to 6 percentage points by 1930. The assumption of parallel trends appears to be violated. Similar patterns appear in other variables, such as homeownership and home values.

The anecdotal evidence and the patterns in the data along the buffer zone also suggest that an RD design will likely not satisfy the assumptions of continuity along the HOLC borders. We further verify this visually by showing a set of distance plots in Appendix Figure A2. Each dot represents the mean characteristic (regression adjusted for border fixed effects) in bins of $1/100^{th}$ of a mile of distance in each direction from the border. The dashed vertical lines represent $1/8^{th}$ mile cutoffs. It is clear that in each of the charts that even using observations based on observations that were just a city block away from the border would lead to meaningful discontinuities and render an RD design invalid.

Counterfactual Boundaries

To address the concern that the parallel trends assumption does not hold, we propose two strategies. The first strategy is to create a set of counterfactual boundaries that had similar characteristics and trends before the maps were drawn. To implement this strategy, we take advantage of what we refer to as "missing" HOLC borders. The idea is that there may have been difficulties in constructing polygons that fully reflected homogeneous neighborhoods --especially if there were small areas within larger neighborhoods that had fundamentally different characteristics. A prototypical example is a small island of, say, C type street(s) within a larger ocean of D types. We provide a stylized example of this in Appendix Figure A3. The Chicago HOLC map, shown in Panel A of Figure 2, also illuminates the plausibility of such missing borders. Among the large swath of D (red) in the heart of Chicago, there undoubtedly lies small pockets of streets that might be better labeled C (yellow) or even higher.

We identify these potential yellow areas, which we then use as control boundaries, in two ways. First, we draw ¼ mile by ¼ mile grids over each city. We then draw ¼ and 1/8 mile buffers around any of the quarter mile line segments in the grid that do not overlap with HOLC treatment boundaries. We refer to this set of potential control boundaries as our "grid" controls. See appendix Figure A4 for an example of a grid placed over New York City. Second, the HOLC often drew boundaries separating two "unique" neighborhoods with the same grade. For example, returning again to the large red area in Chicago, there are XX HOLC-defined line segments, each at least ¼ mile long, between D graded neighborhoods. We do not fully understand why the HOLC felt it necessary to draw these divisions. But we see this as evidence for the possibility that there may have been borders that were considered but ultimately rejected because they did not rise to the same level of dissimilarity as our treated borders. We refer to these same grade (e.g. B-B, C-C, or D-D) line segments as our "same-grade" controls.

Having defined the two types of counterfactual borders, we use propensity scoring methods to choose weights to minimize the pre-treatment differences in outcomes and covariates. We use the logic that if pre-treatment differences are eliminated using these weights, then it may be valid to interpret any post-treatment differences between treatment and controls as valid estimates of the causal effects of the HOLC grades. Since each set of treated boundaries has a side which has been deemed riskier by the HOLC (such as the D side of a C-D boundary), we need a similar construct for the control boundaries. We do this by randomly picking one of the sides of each control boundary to be the riskier, or lower graded side.[21] We then construct a measure of the difference across the boundary by subtracting the mean of our outcome variable on the higher-graded side from the mean of our outcome variable on the lower-graded side. We refer to these differences across the boundaries as gaps. For example, the mean share of residents that are African American on the D side minus the mean share of residents that are African American on the C side of a C-D boundary is the D-C share African American gap.

To construct the propensity score, we pool a set of control and treatment boundaries, where each boundary is an observation. For each grade type difference (e.g. C-D, B-C) we only use controls from the

[21] We show how the results differ when the side with a lower predicted grade in 1930 is assigned as the lower-graded side.

same HOLC graded areas. For example, when we estimate the effects of the D-C borders, the controls only include C-C or D-D boundaries (from the grid or same grade set of controls) and not A-A or B-B boundaries. We then estimate a probit where the dependent variable receives a value of "1" if the observation was actually treated by the HOLC and "0" otherwise. The right hand side variables include pre-existing (lagged) gaps of the outcome of interest and city fixed effects.[22] For example, when the outcome is the share African American across D-C boundaries, we use the 1910, 1920, and 1930 gaps in share African American as regressors. Estimating the propensity score in this manner means that we have a balanced panel of boundaries with no missing values on either side of the boundary from 1910 through 1930. We then use these propensity scores, or predicted probabilities of being treated, to weight the control boundaries. We do not require balance in the estimation dataset.

We also use the Synthetic Control Method (SCM) of Abadie, Diamond, and Hainmuller (2010). One issue with implementing the standard SCM is that it requires a balanced panel. This turns out to be problematic in our application because we have to shift from address level data (1910 to 1940) to tract level data (1950 to 1980) to blocks thereafter (1990 to 2010). The tract-based sample of borders in particular is much smaller. We decided to perform the synthetic control analysis in two separate specifications: using blocks from 1910 to 1940 and 1990 to 2010 and census tracts from 1910 to 1980. To highlight that the tract and block synthetic control samples are different, we draw the former results using a dashed line (e.g. Figure 6, Panel C). The balanced panel issue is the main reason we only use SCM as a robustness check.

When we turn to our results, the figures will depict separate lines for the treatment and our various "weighted" controls. We also show triple difference estimates that use Inverse Prob. Weighting (IPW) where the weight is set to 1 for the treated or [P(treated)/(1-P(treated)] for the controls.

[22] The probit models are weighted by the log population of the boundary. Because house values are not available prior to 1930, we use lagged values of share African American when we estimate the probit for house values. We have also tried nearest neighbor matching but found our samples are generally too thin once we limit the neighbors to the same city as the treatment.

Exploiting Borders Drawn to Close a Polygon

A second, and perhaps simpler approach to resolving the problem of a lack of parallel trends takes advantage of the possibility that some HOLC treatment boundaries might have been more idiosyncratic in nature and were simply drawn in order to close a polygon. Consider the example of a "misaligned" border in Appendix Figure A3. The northern part of the neighborhood contains largely "red" blocks and the Southern area contains largely "yellow" blocks. In this case it may not have been entirely clear where exactly to draw the Southern border and the HOLC agents may have just chosen a major street to define the neighborhood. These types of "treated" boundaries may not have reflected any kind of discontinuous change in creditworthiness and as such would likely have a small pre-trend gap.

We identify these more idiosyncratic boundaries by computing the propensity score – or predicted probability of being treated -- for each HOLC boundary and then using only those borders whose propensity score is below the median. As we show later, this subsample of treated borders exhibits virtually no pre-trends. While this strategy is simple and straightforward it may reduce power and introduce a form of selection based on the observables used to construct the p-score, though this may be no different than what is done in standard heterogeneity analysis which select subsets of the data.

V. Main Results

We start by describing the results for racial segregation along the C-D boundaries. The D side of these neighborhoods and buffer zones are the areas that might be literally thought of having been "redlined". For this particular analysis, we use the full set of empirical approaches. We then turn our attention to the B-C boundaries and thereafter to the other outcomes.

Racial segregation in redlined areas

We begin our description of the results in Table 3 where we consider the D-C gap in the share of African Americans. In column (1) we use entire neighborhoods (not just the buffer boundaries) and do not include city fixed effects. As might be expected based on what we previously showed in Panel A of Figure 3, the D-C gap in the share African American is quite large in 1930 at 13.5 percent rise to 25 percent in 1960 and then fall to 8.1 percent by 2010. Adding city fixed effects (column 2) has little impact. The advantage of using buffer zones becomes apparent when we move to column (3), which limits the analysis to households living within ¼ mile of the C-D boundaries where the households are presumably much more similar but continues to include city fixed effects. In this specification, the D-C gap starts at just 6.7 percent in 1930, rises as high as 14.6 percent by 1970 and thereafter falls to under 4 percent as of 2010. These estimates are lowered somewhat but are not appreciably different when we include border fixed effects (column 4). In this last specification, we restrict variation to within borders and compare resident living, at most, a half mile apart. Nevertheless, even with this specification we know that that there are significant pre-trends as we showed in Figure 4.

Estimates from Differencing Strategy

In column (5), we show the estimates obtained from using our weighted grid counterfactuals based on the propensity score analysis. Note that these estimates almost perfectly capture the pre-trends in the treated boundaries. For example, the grid counterfactuals have a D-C gap in African American share of 6.6 percent compared to 6.5 percent in the treated boundaries. However, after the maps were drawn, the treated and control estimates begin to diverge sharply. This can be seen most clearly in panel A of Figure 5. This figure constitutes the first of our main findings on the effects of the maps on segregation. We find that while the D-C gap in the share African American rises to 11.7 percent by 1970 in the treated group, the same gap in the control group actually falls towards 0 by 1950. By 2010, the analogous estimates are 3.4 (0.8) percent and 0.8 (0.3) percent.

Column (6) of Table 4 and Panel B of Figure 5 show “triple difference” estimates that take the difference between the treated and control groups (benchmarked to equal 0 in 1930). Here we see the gap opens up in 1940, widens appreciably in 1950, mostly flattens out through 1970 at about 10 to 13 percentage points and then begins to converge back, thereafter. However, as of 2010, there still remains an economically relevant 2.7 (1.2) percentage point gap, over 70 years after the maps were drawn.

Figure 6 shows the robustness of our results when using a) a narrower 1/8 mile boundary buffer, b) the same grade control group instead of the grid control group, and c) the synthetic control method rather than the propensity score and inverse probability weighted regressions. The results are all quite similar.[24]

Estimates from Low Propensity Score Borders

Recall that our second strategy for identification is to attempt to identify borders that may have been more idiosyncratic in nature, perhaps in order to arbitrarily close a polygon. We attempt to hone in on this sample by dividing the treated C-D borders into 2 groups: those below the median propensity score, and those at or above the median.[25] We demonstrate the credibility of this research design in Appendix Figure A5 where we show a distance plot for the African American share similar to what we showed in Panel A of Figure A2, only now we only included those C-D borders with below median propensity score. Using this approach we have essentially created a smooth continuous function of the racial gap at the border.

The results are shown in Figure 7. The black line simply reproduces the baseline estimate for the treated group of borders from Figure 5, Panel A and shows the evolution of the D-C gap in the share African American. The blue line shows how this gap evolved for *the actual HOLC treated borders that were least likely to have been predicted to have an actual HOLC border*. Perhaps the most important point to make is that there is no longer a pre-trend for these borders –the gap in 1910, 1920 and 1930 is essentially zero. Nevertheless, for the low propensity borders, we still see a large and meaningful rise in a gap in segregation that peaks at about a 7.6 percentage point difference in 1970 before falling to below 1 percent in 2010. The estimates for this group of borders might be interpreted as a lower bound on the true causal estimates.

[24] As we noted earlier SCM require a balanced panel. Because we shift between census tracts for 1950 to 1980 and blocks for 1990 and onward, we create different samples for the 1950-80 period (highlighted by the dashed lines in the figure). Propensity scoring does not require a balanced panel so each census uses whatever border segments are available for that year.

[25] The below median point estimates are also shown in column (7) of Table 3.

We can contrast this pattern with the gray line which depicts the borders most likely to have been treated based on observables. The gap in the share African American rose sharply in those borders between 1910 and 1930 and reached 15 percent by 1940 just after the maps were drawn and surged to over 25 percent by 1950 before also falling sharply in more recent decades.

We also considered more directly trying to capture the phenomenon of "closing the polygon" by looking only at neighborhoods that had "multiple" different grade treated boundaries and then using only the boundary that had the lowest propensity. Unfortunately, the sample of such boundaries is too small. We can get part way to this more ideal sample by doing the same exercise as in Figure 7 but conditioning on boundaries that are part of multiple treated boundary neighborhoods. These results, which are virtually the same as the ones in Figure 7, are shown in Appendix Figure A6.

Racial Segregation Patterns Along B-C Boundaries

We apply our main estimation strategy of comparing treated and counterfactual borders to the B-C boundaries and show the results graphically in Figure 8. As we noted in Section 2, the African American population was minimal in both B and C neighborhoods in 1930 so we don't expect pre-trends to be an issue for racial gaps and indeed, they are not. After the maps were drawn, however, a meaningful gap of about 4 percentage points opens up by 1950 and continually rises to a peak of over 8 percentage points by 1970 before falling back down to about 2 percentage points in 2010. These results are almost a perfect inverse V-shape. In contrast we estimate virtually a flat line around 0 for the control group of boundaries. These results are also robust to using 1/8th mile buffer zones and using the same-grade counterfactuals. This is evident in Appendix Figure A7 where we show the triple difference estimates.

Population Dynamics: White Out-flow or Black In-flow?

We now consider the extent to which the rise in the gap in the share of African American along the C-D and B-C borders was driven by the relative population movements of blacks versus whites along these buffer zones. We analyze this by looking at the evolution of gaps in the population density of both

African Americans and Whites along these borders across Census years.[26] The results are shown in Appendix Figure A8. One key finding is that there is a notable relative decline in the D-C gap in the white population that occurs from around 1940 to 1980. No such gap is observed for the C-B gap. This suggests that "white flight" may have been more prevalent in the lower graded neighborhoods.

Other Outcomes: Home Ownership, House Values and Credit Scores

We next document how the HOLC maps influenced housing markets. We concentrate on two measures: the rate of homeownership (Figure 9) and house values (Figure 10).[27] In both cases, we find a large pre-existing gap along the HOLC boundaries which we can mimic using propensity score weighting of grid segment boundaries.[28] Post-map, we find a gap opening up between the treatment and control boundaries starting in 1940 and generally persisting through 2010.

However, the size of the gap and the speed in which it dissipates varies in an intriguing way. Take homeownership, where a full 1910 to 2010 time series is available. Panel A of Figure 9 shows the pattern of effects on home ownership along the C-D boundary buffer zones. From 1910 through 1930 both the treated boundaries and the control boundaries were characterized by lower home ownership rates on the D side compared to the C side of about 3 to 6 percentage points. The fluctuations over time were also roughly parallel during this period. After the maps were drawn, however, the gap in the control boundaries closed by 1950 and remained at roughly 0 through 2010. In the treated boundaries, however, the gap stayed relatively constant at around 3 to 4 percentage points through 1980 before falling to under 2 percentage points in the 1990-2010 period. When we use the 1/8th mile buffer we find that the treated borders actually fully converge by 2010. These findings suggest that the HOLC maps led the treated neighborhoods to experience reduced home ownership in D areas relative to C areas for much of the 20th century.

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[26] We look at population density rather than population counts because of the changing geographic units in our sample across Census years. For example, Census tracts which we use from 1950 to 1980 are much larger than blocks which we use from 1990 to 2010.

[27] The next draft will add evidence on residential housing investment and the age distribution of the housing stock.

[28] Recall housing values are unavailable prior to 1930. Therefore, we use lagged values of share African American when we estimate the propensity score for house values. Moreover, the 1950 to 1980 census tract files do not contain data on house values.

But the size of the treatment-control gap is notably larger along the C-B boundary as shown in Panel B of Figure 9. In this case, there was about a 6-percentage point gap in rates of home ownership in 1930 in both treated and control boundaries. By 1950 that gap was eliminated in the control boundaries. However, in the treated areas, the gap has remained in the 6 to 8 percentage point range and in fact was higher in 2010 than it was in 1930. Similarly, the house value gap (Figure 10) remains elevated along the C-B border relative to the D-C border. As of 2010, the D-C gap stood at 2.5 percent and the C-B gap stood at 8.0 percent.

Finally, we the examine the long run effects of the HOLC designated borders on modern credit scores in Figure 11. Our data on credit scores begins in 1999 and runs through 2016.[29] As with our other variables, the cross-border gaps in the control group hovers around zero for the entire 18-year period. However, for the treated boundaries, we find statistically significant gaps of 7.4 points in the C-D boundaries and 9.5 points in the B-C boundaries. While we do not have a way to convincingly test why these border type differences arise, one interesting possibility is that policies enacted later in the century such as FHA and CRA perhaps successfully targeted D but not C rated areas. Consequently, while the D-C gaps fall after 1970, we see no such dynamic along the C-B borders.

Regional Heterogeneity

To be completed

VI. Conclusion

Prior to WWII, the primary source of credit for households was typically mortgages. The 1930s HOLC residential security maps were specifically drawn to impact access to mortgage markets based on residential location. Using a variety of approaches to control for economically relevant pre-existing trends, we document a significant and persistent causal effect of the credit maps on the composition and development of urban neighborhoods. We show that being on the lower graded side of D-C and C-B

[29] Footnote explaining how we calculate counterfactuals for credit score.

boundaries led to rising racial segregation from 1930 until about 1970 or 1980 before starting to decline thereafter. That the pattern begins to revert starting in the 1970s is at least suggestive that federal interventions like the Fair Housing Act and the Community Reinvestment Act may have played a role in reversing the increase in segregation caused by the HOLC maps. Nevertheless, a small difference in racial segregation along both the C/B and D/C borders remains in 2010, almost three quarters of a century later. Moreover, we also find that the maps had effects on homeownership rates and values. Intriguingly, the effects on homeownership, and to a somewhat lesser extent house values, dissipate over time along the D-C boundary but remain highly persistent along the C-B boundaries. One interesting possibility is that policies enacted later in the century such as CRA perhaps successfully targeted D (but not C) rated areas. Regardless, we believe our results highlight the key role that access to credit plays on the growth and long-running development of local communities.

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Figure 1: Geographic coverage of digitized HOLC maps

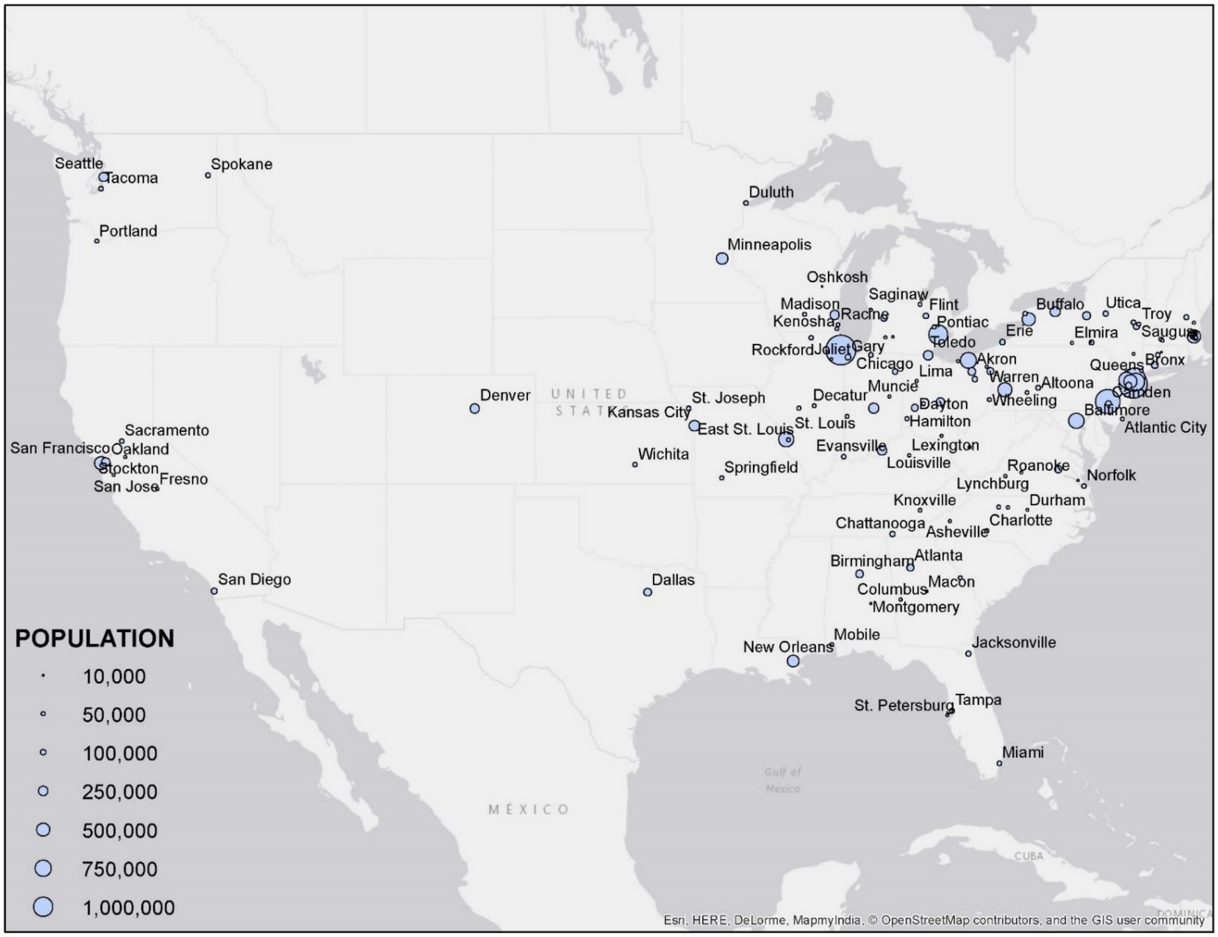
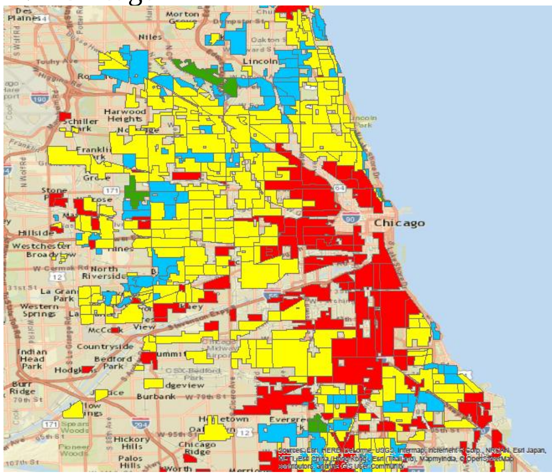


Figure 2: HOLC maps for Chicago, New York and San Francisco

A. Chicago



HOLC Grades (in order of riskiness):

A=green (least)

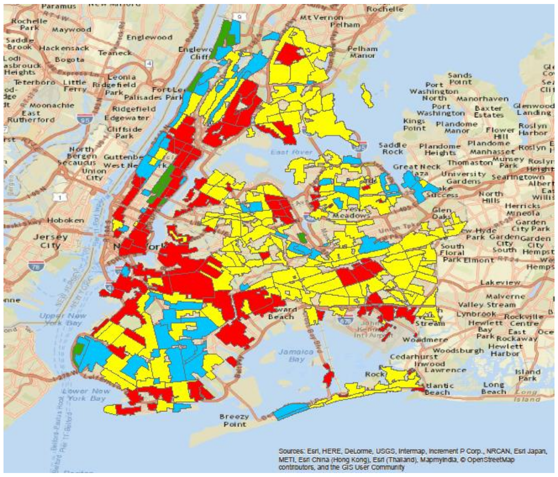
B=blue

C=yellow

D=red (most)

U=unclassified

B. New York



C. San Francisco

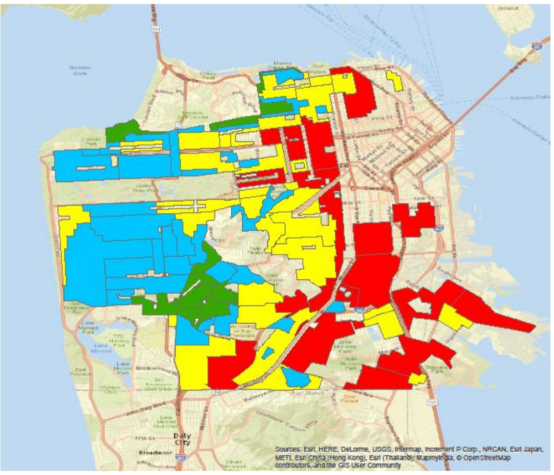
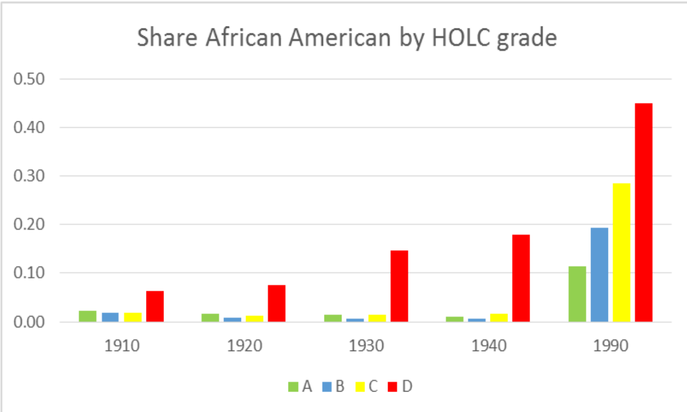
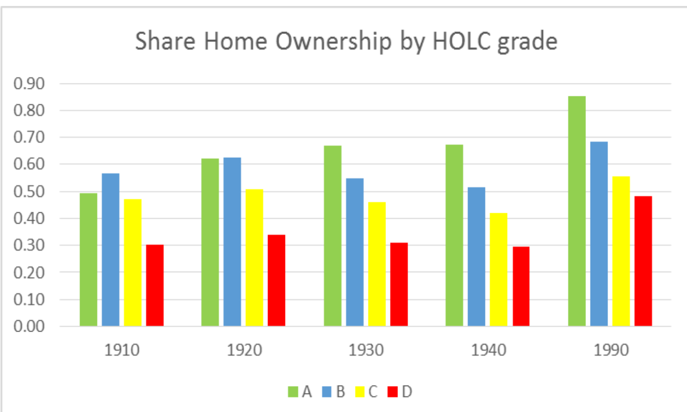


Figure 3: Changes over time in mean outcomes in neighborhoods by HOLC grade

Panel A:



Panel B:



Panel C:

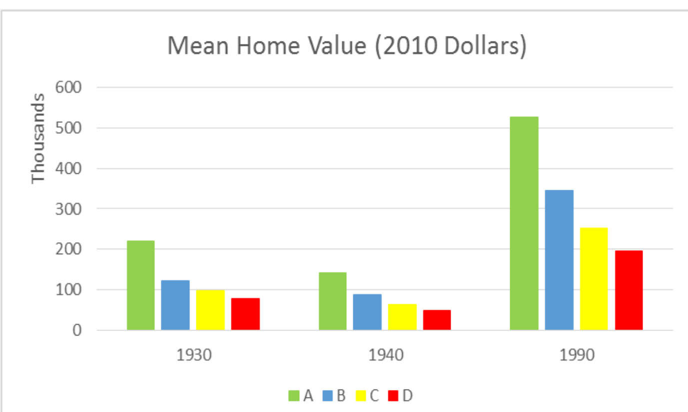


Figure 4: Parallel trends assumption does not hold along C-D boundaries

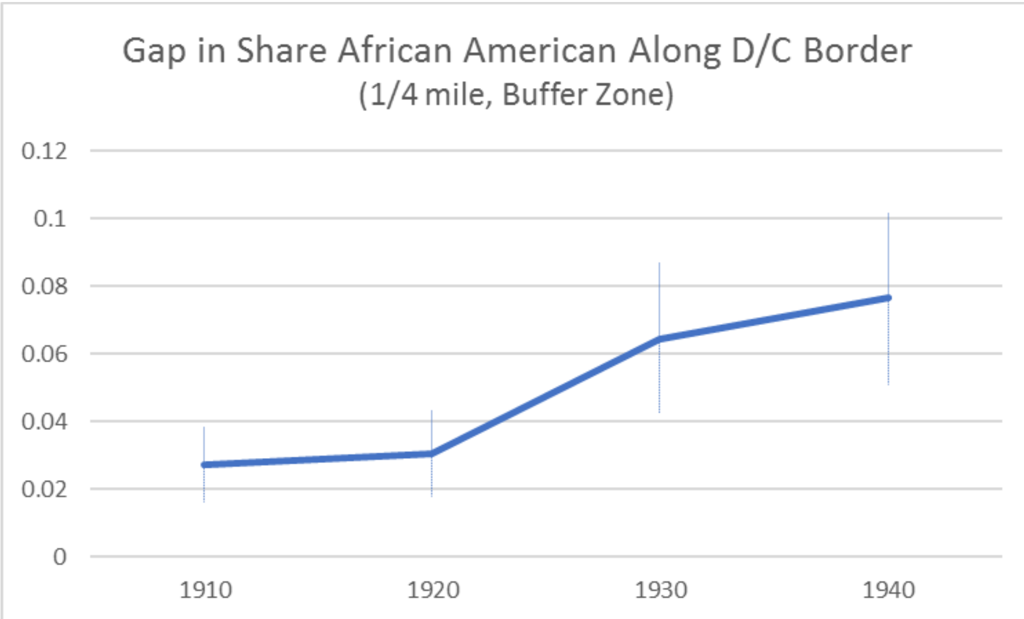
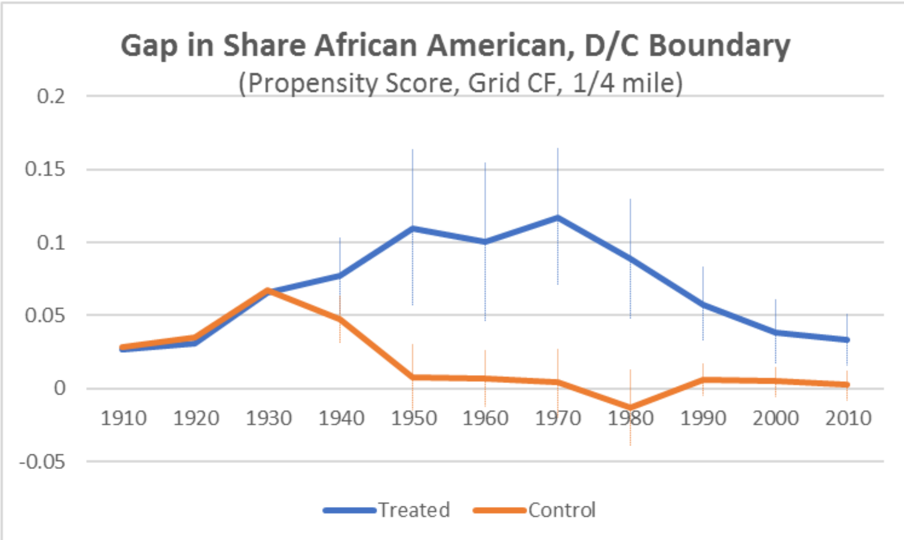


Figure 5: Effects on D-C gaps in Share African American, Treated and Grid Counterfactuals

Panel A: Treated and Grid Counterfactuals



Panel B: Triple Difference Estimates

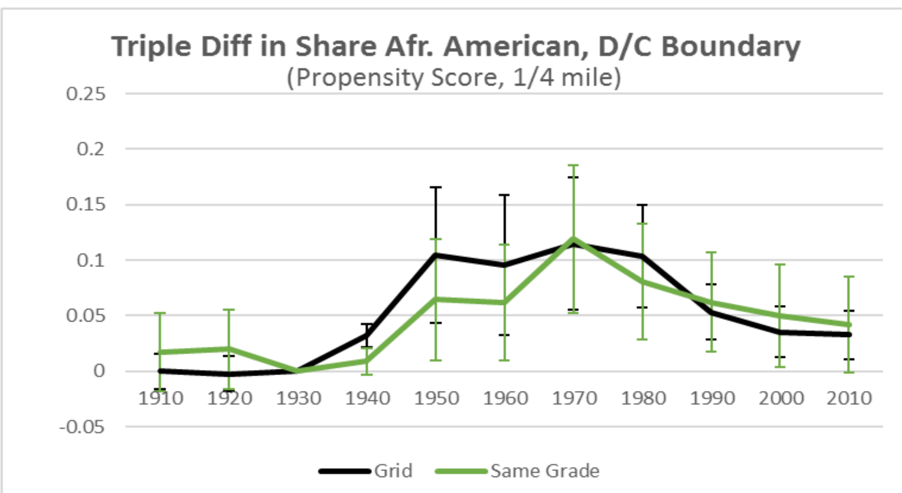
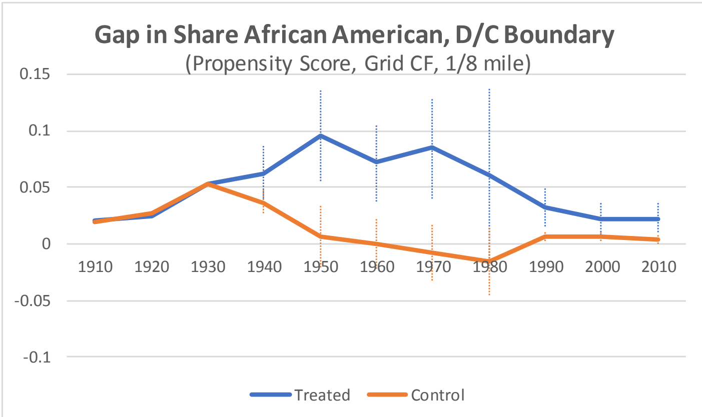
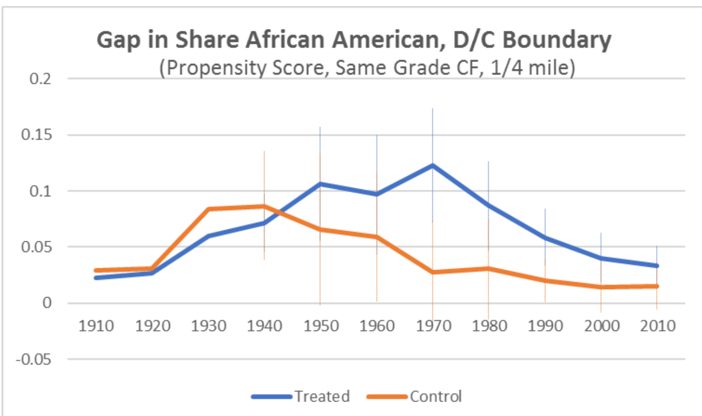


Figure 6: Robustness of Effects on D-C gaps in Share African American

Panel A: Using 1/8th mile Boundaries with Propensity Score and Grid Counterfactuals



Panel B: Using Propensity Score with Same Grade Control Group



Panel C: Using Synthetic Control Method with Grid Control Group

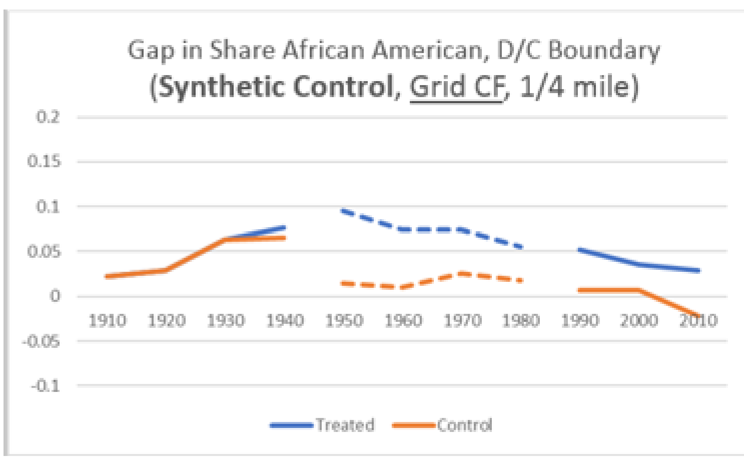


Figure 7: Effects on D-C Gaps: Comparing Low vs High Propensity for Treatment

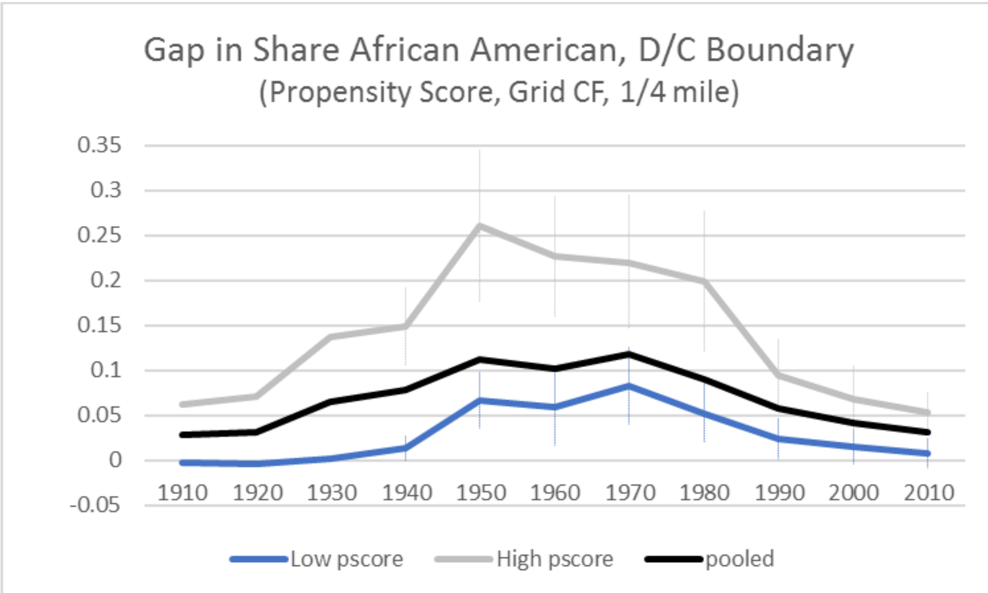


Figure 8: Effects on C-B gaps in Share African American, Treated and Grid Counterfactuals

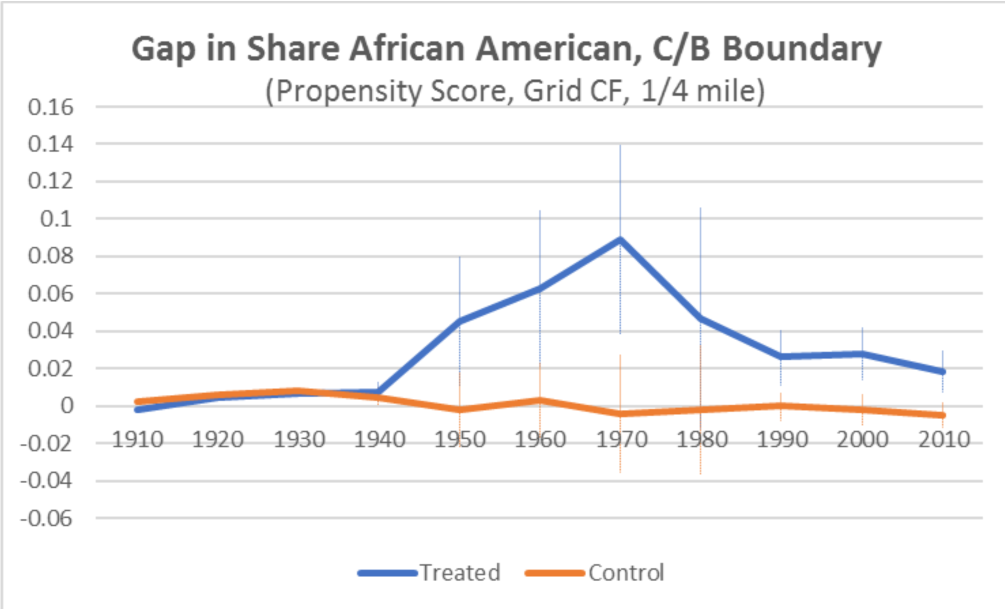
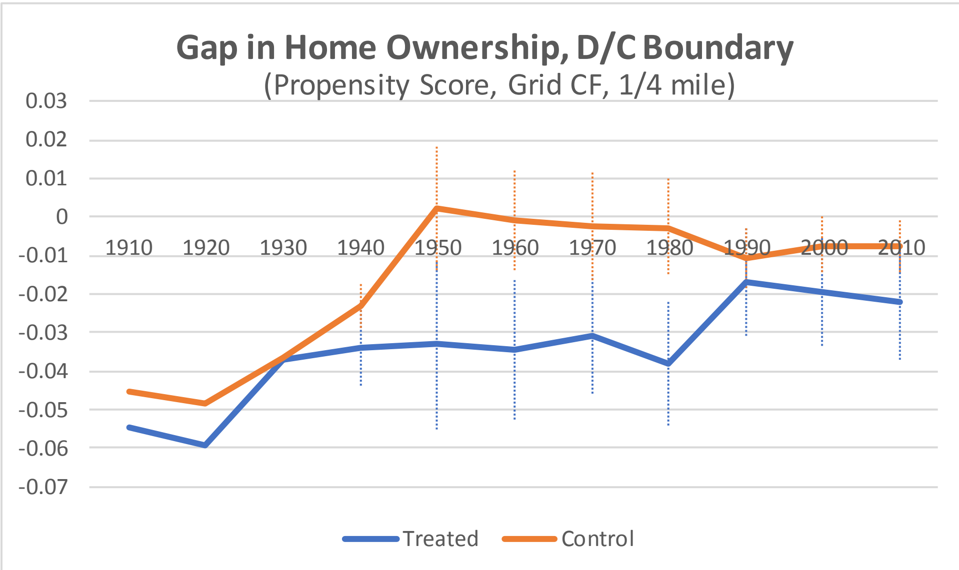


Figure 9: Effects on D-C and C-B Gaps in Home Ownership

Panel A: D-C Gaps in Home Ownership



Panel B: C-B Gaps in Home Ownership

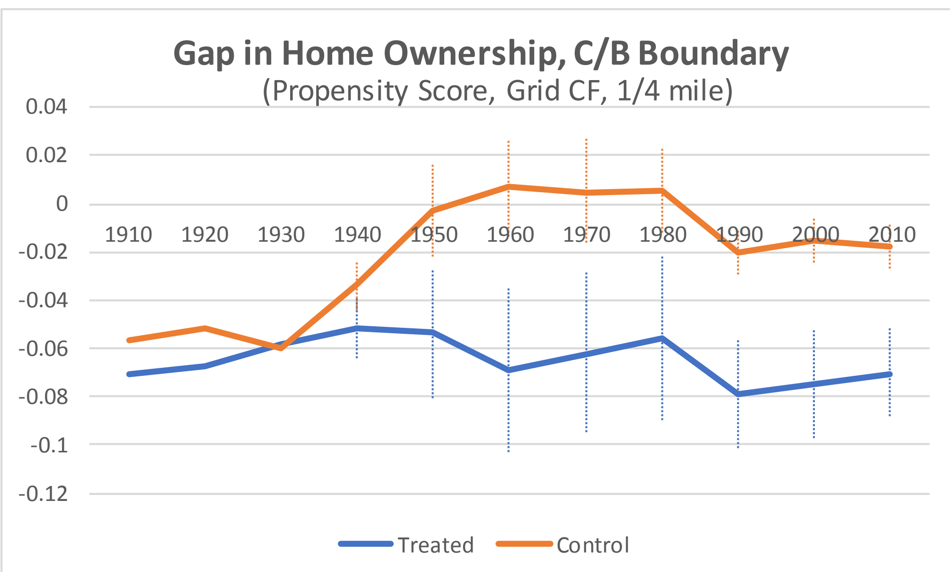
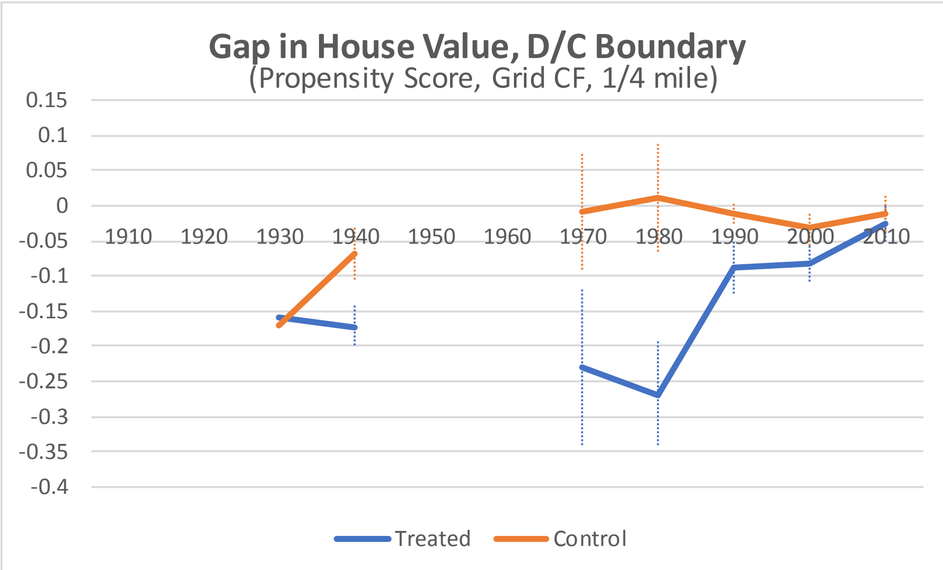


Figure 10: Effects on D-C and C-B Gaps in House Values

Panel A: D-C Gaps in House Values



Panel B: C-B Gaps in House Values

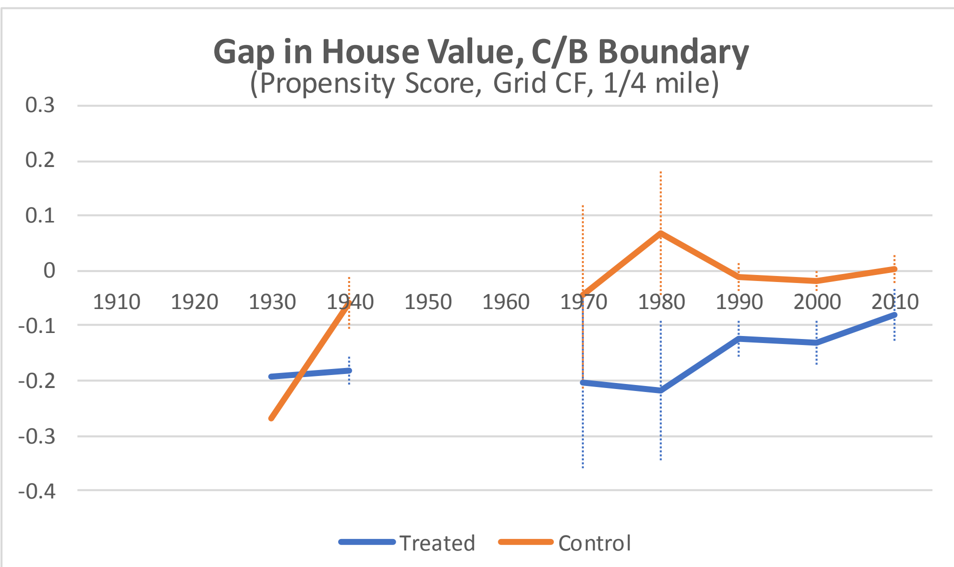
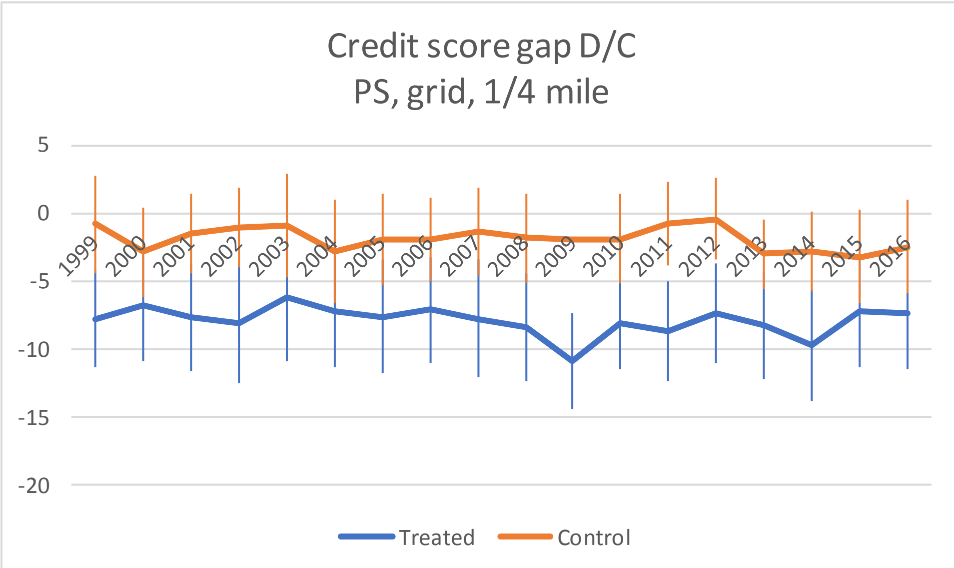
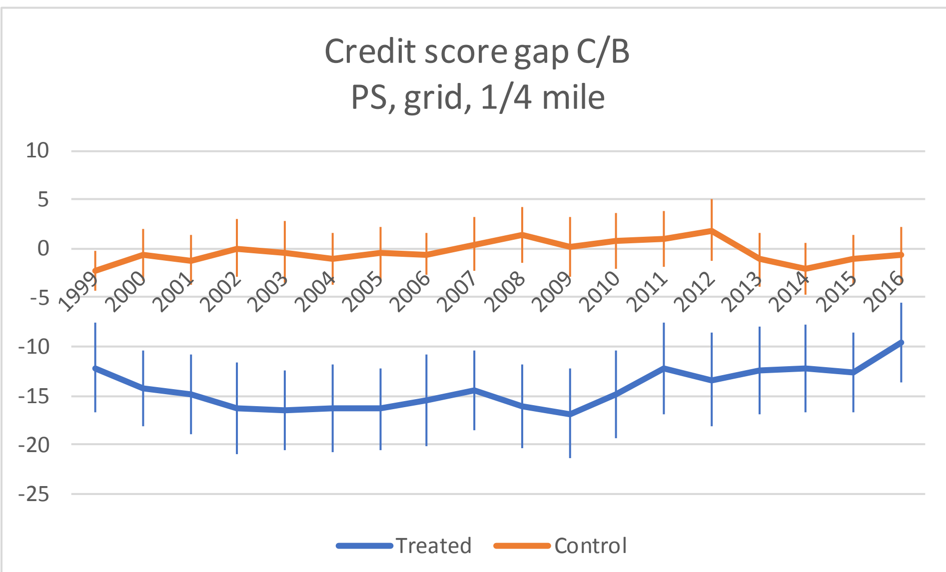


Figure 11: Effects on D-C and C-B Gaps in Credit Scores

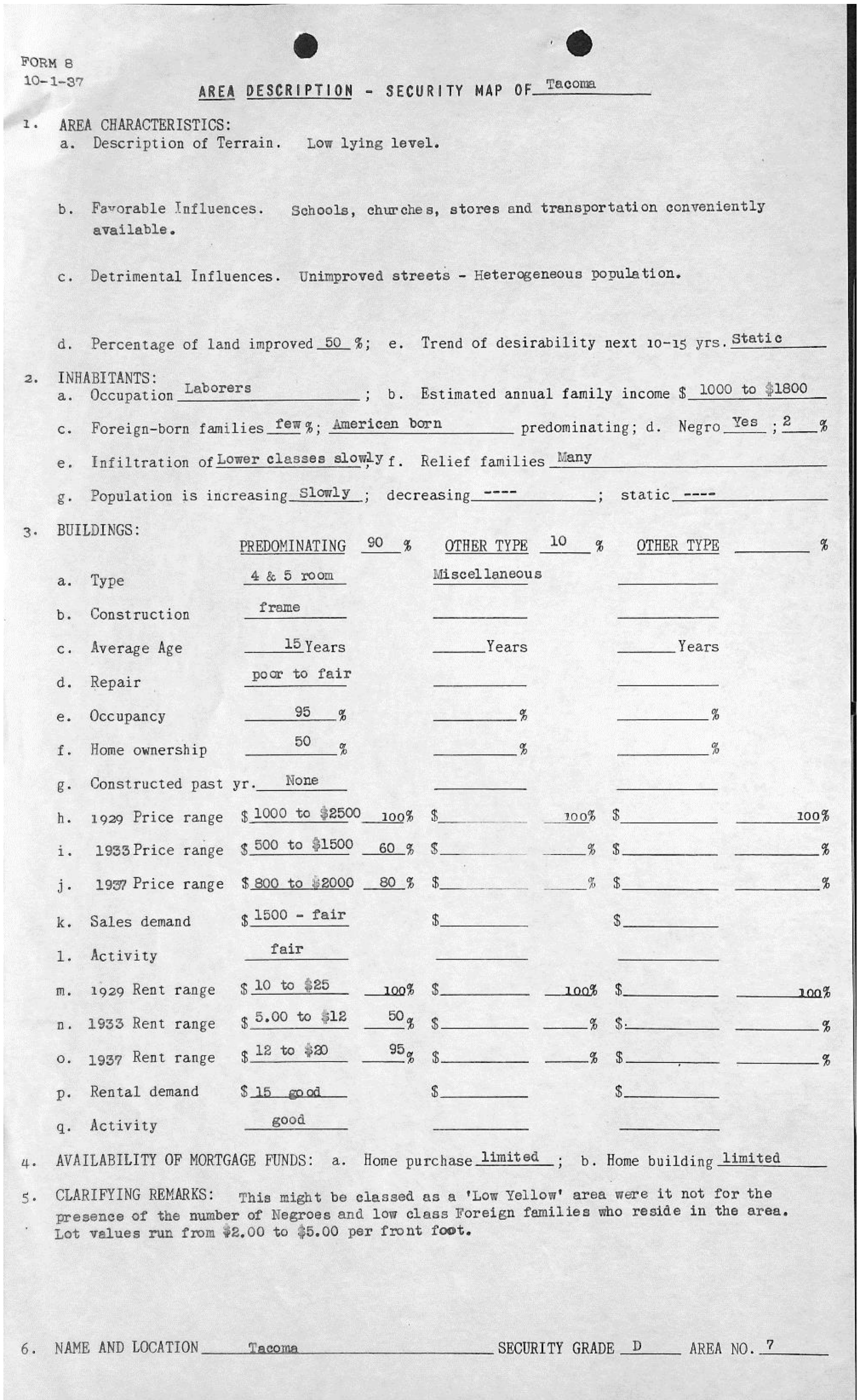
Panel A: D-C Gaps in Credit Scores



Panel B: C-B Gaps in Credit Scores



Appendix Figure A1: Area description File for Tacoma, Washington



FORM 8
10-1-37

AREA DESCRIPTION - SECURITY MAP OF Tacoma

1. AREA CHARACTERISTICS:
   a. Description of Terrain. Low lying level.

   b. Favorable Influences. Schools, churches, stores and transportation conveniently available.

   c. Detrimental Influences. Unimproved streets - Heterogeneous population.

   d. Percentage of land improved 50 %; e. Trend of desirability next 10-15 yrs. Static

2. INHABITANTS:
   a. Occupation Laborers ; b. Estimated annual family income $ 1000 to $1800

   c. Foreign-born families few %; American born predominating; d. Negro Yes ; 2 %

   e. Infiltration of Lower classes slowly f. Relief families Many

   g. Population is increasing Slowly ; decreasing ---- ; static ----

3. BUILDINGS:

	PREDOMINATING 90 %		OTHER TYPE 10 %		OTHER TYPE %	
a. Type	4 & 5 room		Miscellaneous			
b. Construction	frame					
c. Average Age	15 Years		Years		Years	
d. Repair	poor to fair					
e. Occupancy	95 %		%		%	
f. Home ownership	50 %		%		%	
g. Constructed past yr.	None					
h. 1929 Price range	$ 1000 to $2500	100%	$	100%	$	100%
i. 1933 Price range	$ 500 to $1500	60 %	$	%	$	%
j. 1937 Price range	$ 800 to $2000	80 %	$	%	$	%
k. Sales demand	$ 1500 - fair		$		$	
l. Activity	fair					
m. 1929 Rent range	$ 10 to $25	100%	$	100%	$	100%
n. 1933 Rent range	$ 5.00 to $12	50 %	$	%	$	%
o. 1937 Rent range	$ 12 to $20	95 %	$	%	$	%
p. Rental demand	$ 15 good		$		$	
q. Activity	good					

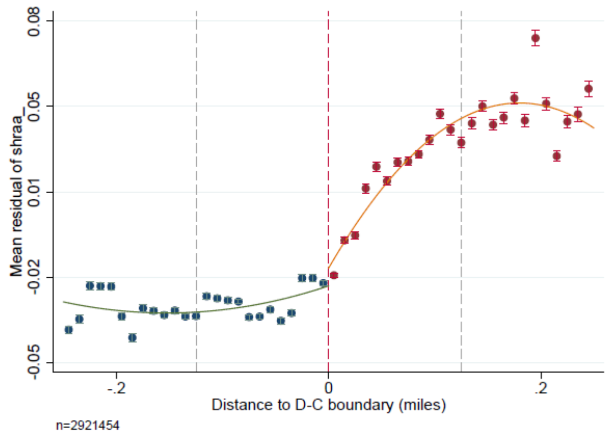
4. AVAILABILITY OF MORTGAGE FUNDS: a. Home purchase limited ; b. Home building limited

5. CLARIFYING REMARKS: This might be classed as a 'Low Yellow' area were it not for the presence of the number of Negroes and low class Foreign families who reside in the area. Lot values run from $2.00 to $5.00 per front foot.

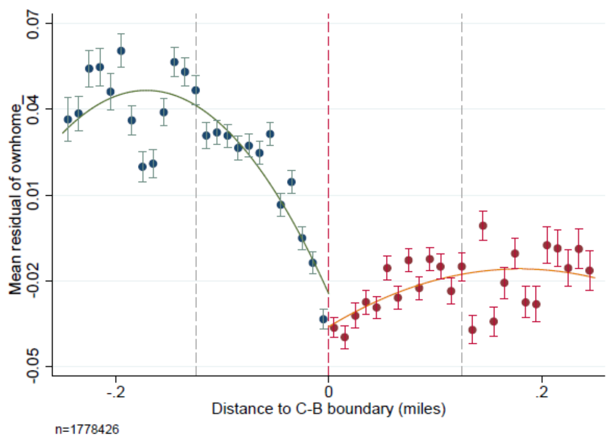
6. NAME AND LOCATION Tacoma SECURITY GRADE D AREA NO. 7

Appendix Figure A2: Distance plots around HOLC Borders

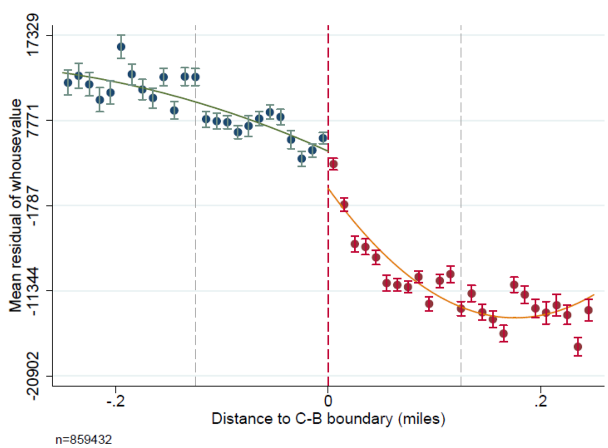
Panel A: African American Share, 1930, C-D boundaries



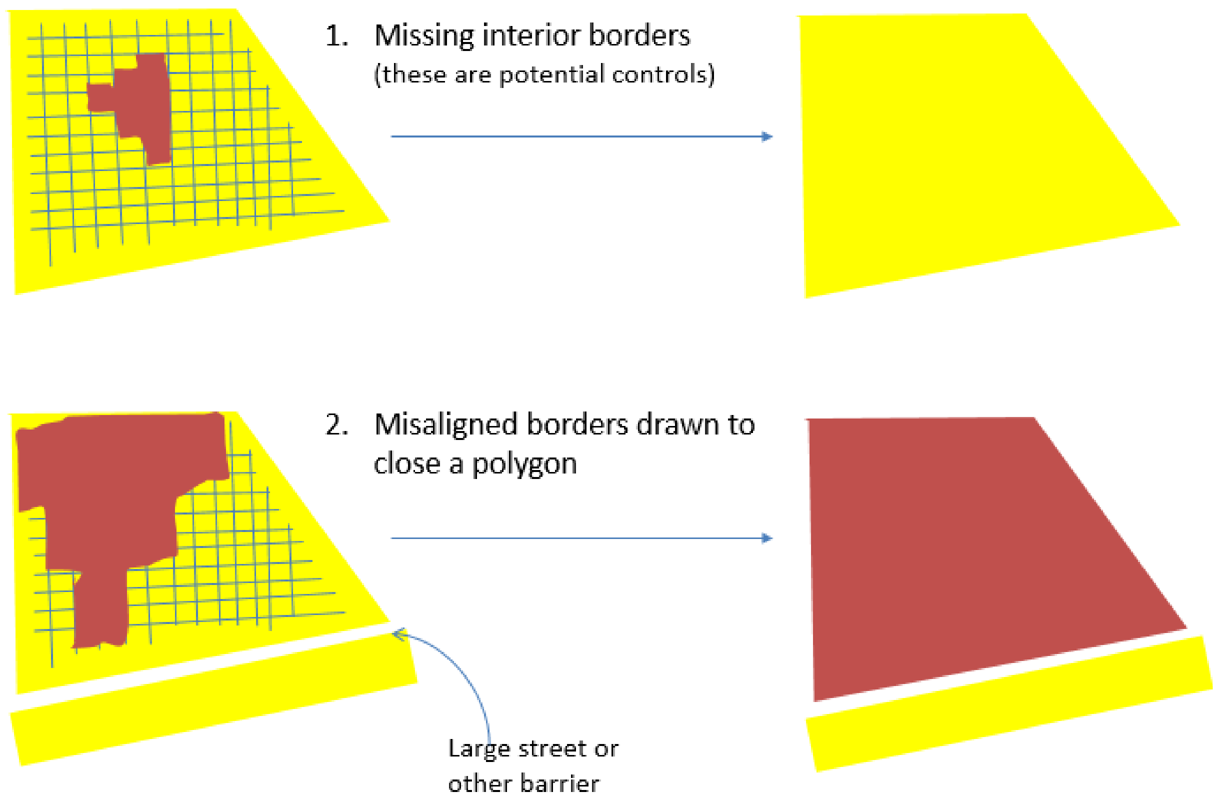
Panel B: Home Ownership, 1930, B-C Boundaries



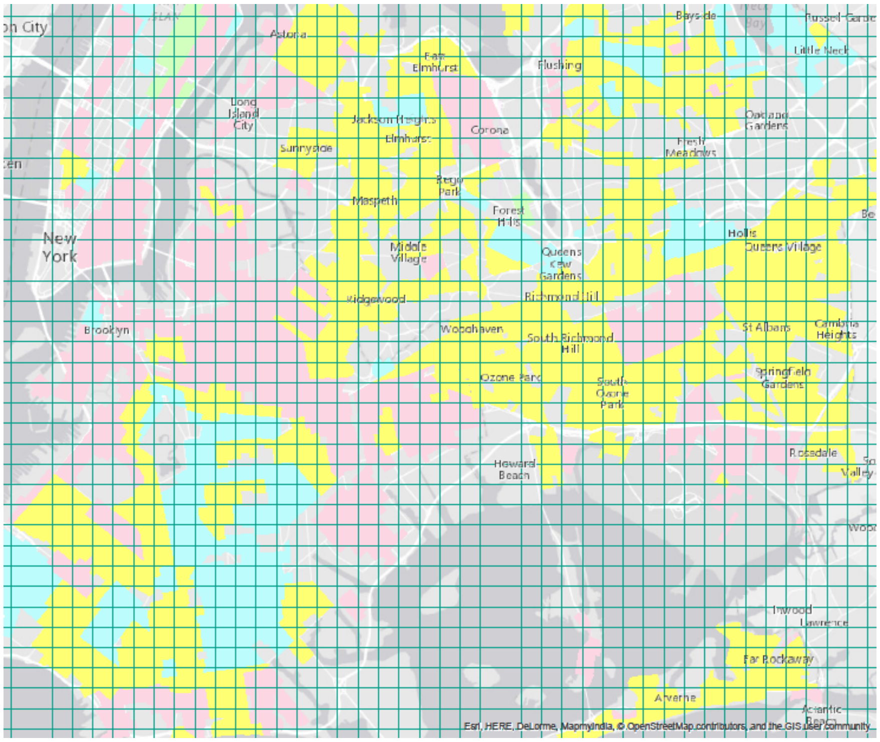
Panel C: House Values, 1930, B-C Boundaries



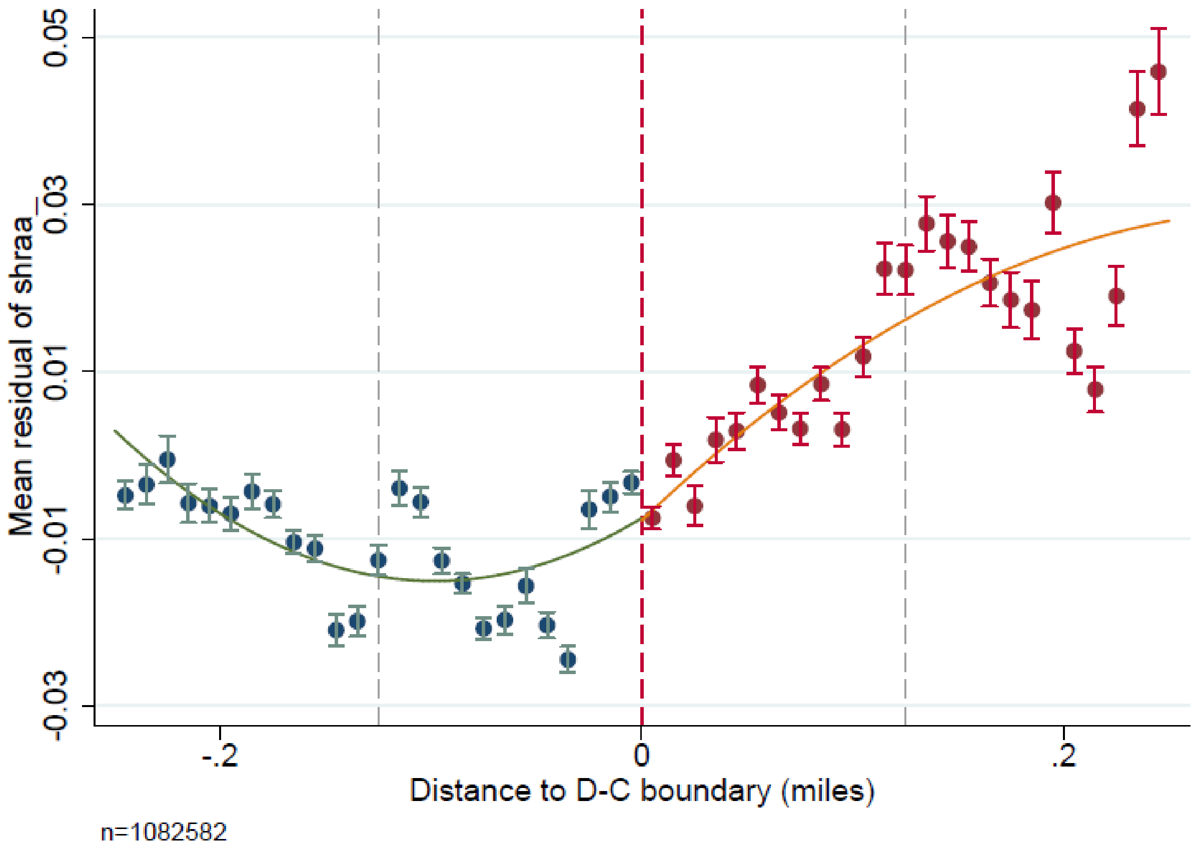
Appendix Figure A3: Missing and Misaligned Borders



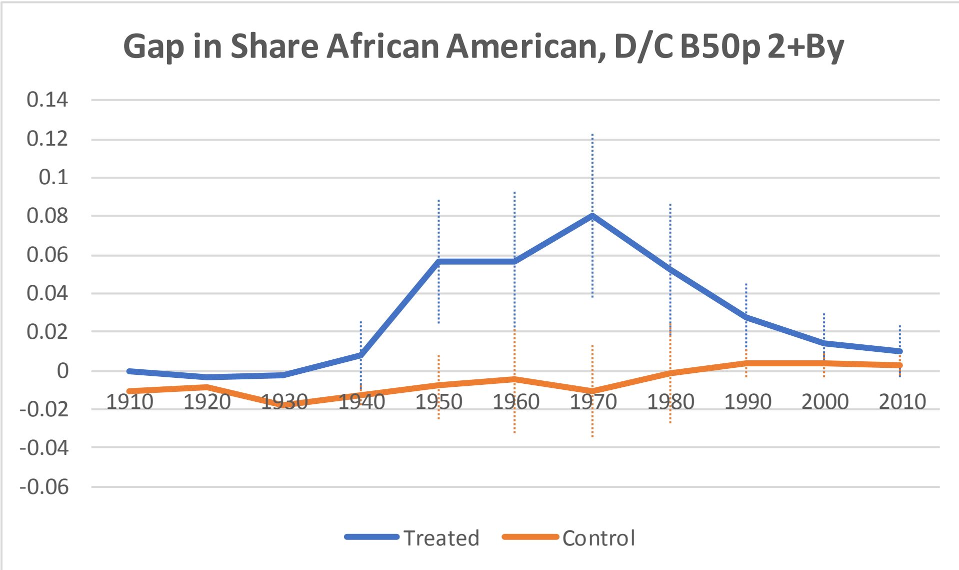
Appendix Figure A4: Example of grid placed over New York City



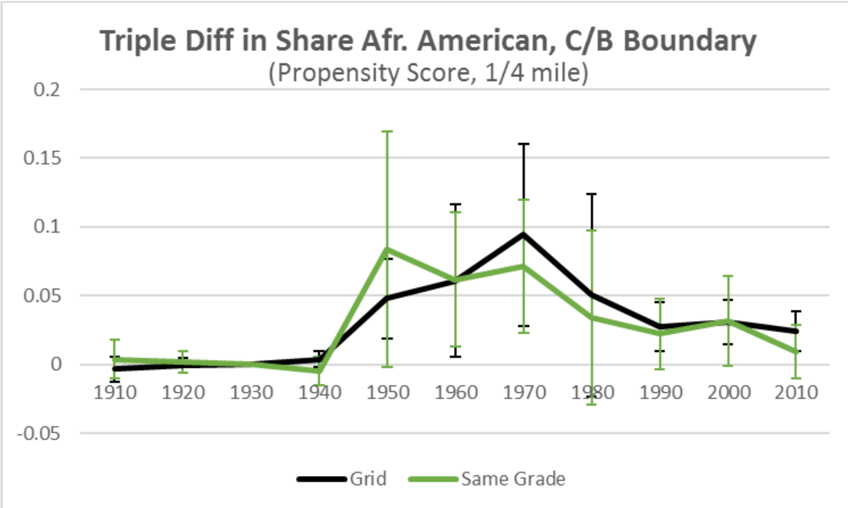
Appendix Figure A5: Distance plot of AA Share Using Low Propensity Treated

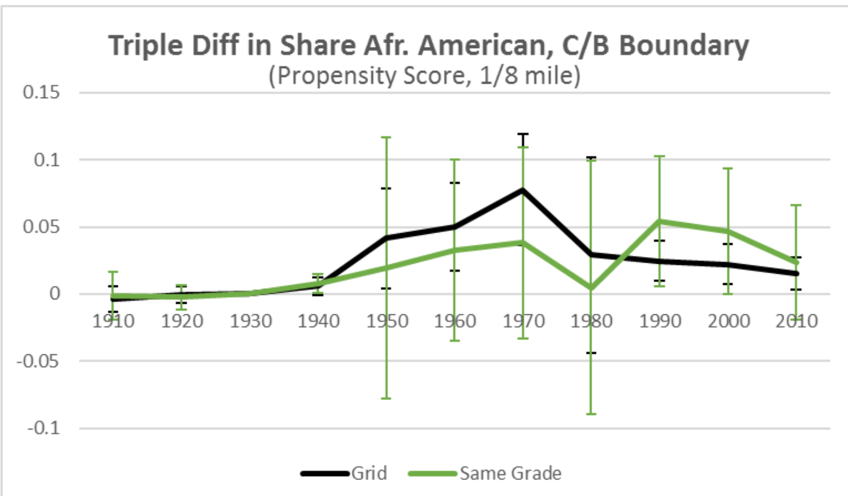


Appendix Figure A6: Effects on D-C Gap in African American Share, Multiple Boundary Neighborhoods and Low Propensity Treated



Appendix Figure A7: Effects on Triple Difference in C-B gaps in Share African American





Appendix Figure A8: Population Dynamics along C-D and B-C boundaries:

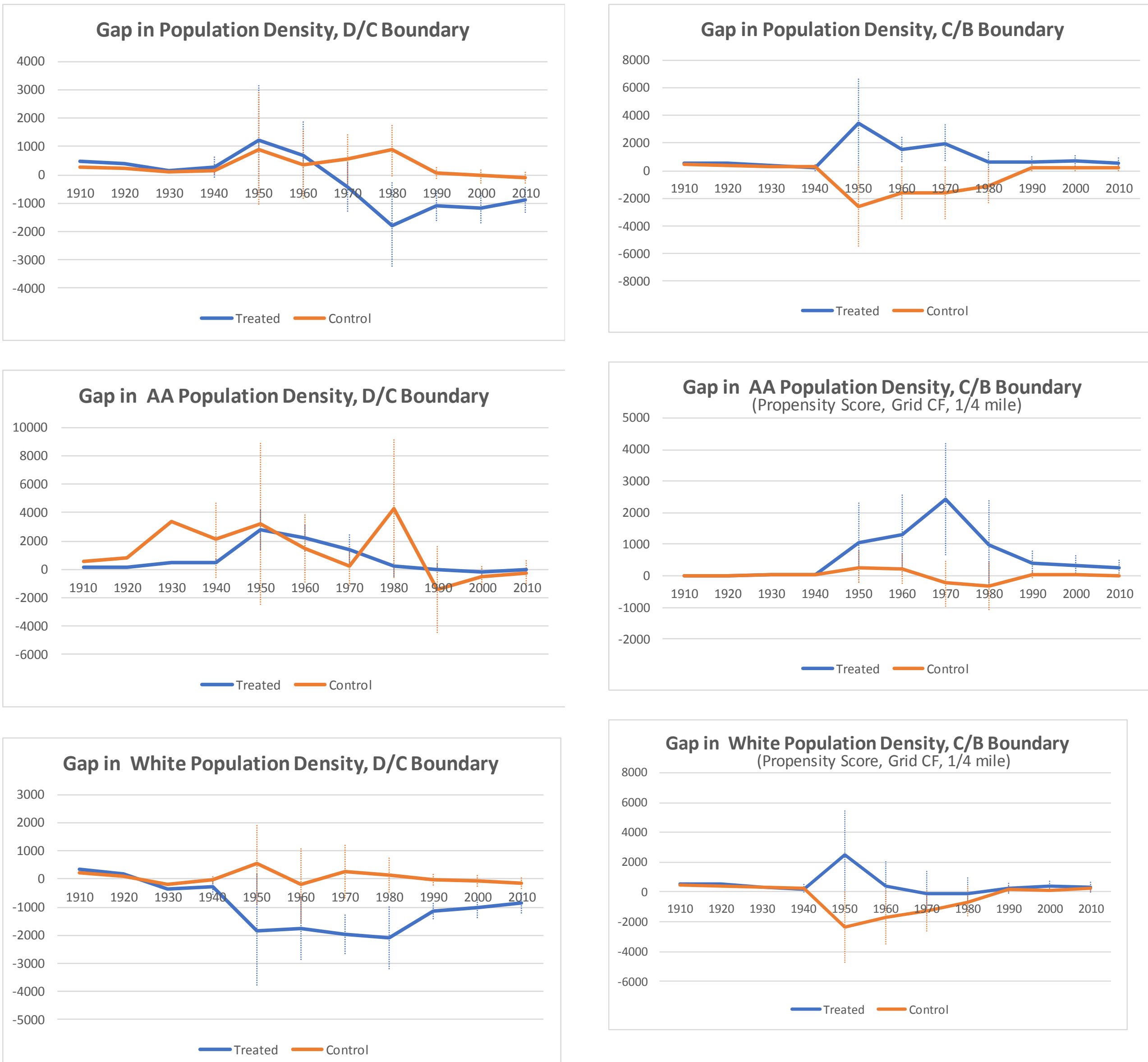


Table 1: Summary Statistics

Sample Type		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		HOLC Neighborhoods				1/4 Mile Buffer				1/8 Mile Buffer			
						B-C Boundaries		C-D Boundaries		B-C Boundaries		C-D Boundaries	
Grade		A	B	C	D	B	C	C	D	B	C	C	D
N		*543*	*1351*	*2156*	*1399*	*1965*	*1965*	*2111*	*2111*	*2000*	*2000*	*2047*	*2047*
Panel A.	year												
Share	1910	0.043	0.043	0.041	0.105	0.022	0.024	0.041	0.069	0.021	0.029	0.038	0.061
African	1920	0.026	0.018	0.028	0.095	0.010	0.015	0.030	0.061	0.011	0.015	0.029	0.055
American	1930	0.021	0.015	0.021	0.158	0.009	0.015	0.035	0.099	0.008	0.017	0.034	0.087
	1940	0.012	0.012	0.019	0.166	0.007	0.014	0.036	0.114	0.006	0.017	0.039	0.101
	1950	0.009	0.008	0.021	0.241	0.004	0.021	0.047	0.184	0.005	0.016	0.057	0.160
	1960	0.009	0.029	0.088	0.335	0.050	0.073	0.186	0.326	0.031	0.067	0.242	0.277
	1970	0.044	0.106	0.189	0.405	0.144	0.193	0.303	0.454	0.157	0.190	0.388	0.397
	1980	0.108	0.186	0.280	0.455	0.312	0.303	0.400	0.519	0.284	0.345	0.510	0.483
	1990	0.090	0.157	0.271	0.401	0.253	0.280	0.383	0.442	0.245	0.273	0.400	0.434
	2000	0.114	0.191	0.305	0.412	0.301	0.326	0.420	0.463	0.294	0.322	0.428	0.454
	2010	0.121	0.191	0.299	0.381	0.297	0.312	0.392	0.427	0.287	0.307	0.407	0.424
Panel B.													
Home	1910	0.570	0.598	0.522	0.412	0.614	0.547	0.496	0.444	0.612	0.545	0.487	0.443
Ownership	1920	0.684	0.655	0.559	0.437	0.634	0.575	0.499	0.443	0.627	0.562	0.486	0.441
Rate	1930	0.759	0.654	0.541	0.438	0.585	0.526	0.458	0.422	0.570	0.520	0.447	0.414
	1940	0.734	0.597	0.484	0.383	0.504	0.452	0.398	0.366	0.492	0.446	0.389	0.363
	1950	0.657	0.583	0.497	0.365	0.412	0.337	0.352	0.297	0.332	0.197	0.303	0.281
	1960	0.672	0.592	0.516	0.376	0.413	0.333	0.353	0.302	0.326	0.227	0.294	0.284
	1970	0.659	0.552	0.482	0.360	0.371	0.306	0.324	0.277	0.272	0.216	0.265	0.255
	1980	0.676	0.550	0.469	0.355	0.375	0.305	0.328	0.280	0.271	0.225	0.257	0.259
	1990	0.816	0.660	0.516	0.446	0.546	0.464	0.429	0.416	0.524	0.460	0.421	0.417
	2000	0.816	0.655	0.513	0.444	0.545	0.467	0.435	0.416	0.527	0.464	0.427	0.425
	2010	0.805	0.642	0.494	0.426	0.528	0.458	0.417	0.397	0.512	0.447	0.412	0.398

Table 1: Summary Statistics (continued)

Sample Type		(1) HOLC Neighborhoods	(2)	(3)	(4)	(5) 1/4 Mile Buffer, B-C Boundaries	(6)	(7) 1/4 Mile Buffer, C-D Boundaries	(8)	(9) 1/8 Mile Buffer, B-C Boundaries	(10)	(11) 1/8 Mile Buffer, C-D Boundaries	(12)
Grade		A	B	C	D	B	C	C	D	B	C	C	D
N		*543*	*1351*	*2156*	*1399*	*1965*	*1965*	*2111*	*2111*	*2000*	*2000*	*2047*	*2047*
Panel C.	year												
Home	1930	195843	129259	95226	72246	127834	104897	94237	81083	128830	107940	94116	82917
Value	1940	148187	96489	66354	48600	86855	71441	60531	51655	86868	73002	60613	52533
	1970	180854	125966	102906	76396	123666	115735	94073	82982	139920	128305	99131	96742
	1980	229991	148352	112968	85801	139111	129498	100972	83207	160663	156498	98277	93023
	1990	311722	227011	162149	136061	182157	158028	134433	122539	185774	166335	130269	123818
	2000	363810	255757	180783	156701	205430	174695	149684	136939	209620	185257	147221	139799
	2010	208050	161348	125057	111134	128815	120499	107398	103923	131236	122059	106873	104746
Panel D.													
Share	1910	0.184	0.170	0.182	0.205	0.167	0.172	0.179	0.188	0.162	0.175	0.180	0.189
Foreign	1920	0.148	0.146	0.161	0.189	0.141	0.151	0.162	0.178	0.142	0.148	0.164	0.177
Born	1930	0.106	0.120	0.152	0.160	0.138	0.146	0.158	0.163	0.135	0.142	0.159	0.163
	1940	0.078	0.097	0.123	0.126	0.115	0.123	0.129	0.129	0.114	0.118	0.128	0.128
	1950	0.117	0.118	0.133	0.109	0.164	0.171	0.158	0.146	0.207	0.207	0.186	0.166
	1960	0.099	0.108	0.113	0.087	0.159	0.154	0.132	0.112	0.203	0.191	0.155	0.145
	1970	0.081	0.094	0.098	0.077	0.140	0.145	0.109	0.091	0.210	0.188	0.116	0.114
	1980	0.084	0.101	0.113	0.096	0.158	0.182	0.115	0.115	0.211	0.234	0.147	0.143
	1990	0.088	0.128	0.151	0.147	0.117	0.126	0.108	0.108	0.104	0.118	0.108	0.101
	2000	0.081	0.107	0.126	0.116	0.109	0.117	0.112	0.112	0.104	0.111	0.112	0.111
	2010	0.086	0.113	0.137	0.129	0.115	0.125	0.119	0.120	0.114	0.119	0.121	0.121
Panel E.													
Credit	1999	717	687	654	636	663	653	638	631	660	654	636	634
Score	2016	737	704	670	652	680	672	656	648	676	670	653	652

Table 2: Assessing HOLC Grading Criteria

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ordered Logit		Probit					
Coeficients	ABCD	ABCD	CD	CD	BC	BC	AB	AB
Share AA	2.824	1.510	2.742	2.093	-2.857	-3.531	-5.514	-10.147
	(1.233)	(1.521)	(0.870)	(1.125)	(1.146)	(1.398)	(1.262)	(2.283)
Share Home Ownership	-6.600	-7.590	-3.353	-4.523	-3.966	-4.818	-3.786	-3.857
	(0.594)	(0.737)	(0.428)	(0.529)	(0.485)	(0.593)	(0.565)	(0.753)
Log House Value	-3.057	-3.319	-1.570	-1.936	-1.474	-2.005	-1.598	-1.676
	(0.225)	(0.268)	(0.239)	(0.218)	(0.178)	(0.189)	(0.195)	(0.281)
Log Rent	-0.154	-0.163	-0.095	-0.071	-0.118	-0.145	0.064	0.035
	(0.080)	(0.091)	(0.060)	(0.072)	(0.061)	(0.075)	(0.073)	(0.092)
Occscore	-4.318	-6.012	-0.514	-2.231	-1.593	-3.875	-3.004	-2.971
	(1.166)	(1.246)	(1.091)	(1.177)	(0.968)	(1.215)	(1.055)	(1.258)
Employment	-0.139	-0.148	-0.143	-0.203	-0.132	-0.170	0.030	0.051
	(0.031)	(0.038)	(0.041)	(0.049)	(0.022)	(0.037)	(0.023)	(0.030)
Radio	-6.665	-7.163	-3.812	-2.894	-3.809	-4.260	-1.336	-2.214
	(0.753)	(0.910)	(0.530)	(0.576)	(0.622)	(0.765)	(0.766)	(0.930)
Literacy	-7.825	-10.676	-7.803	-10.726	-0.649	-0.888	-4.699	-4.003
	(2.349)	(2.698)	(1.802)	(2.331)	(3.618)	(3.596)	(3.834)	(6.512)
School Attendance	4.198	6.099	1.059	1.329	2.210	4.537	1.783	2.645
	(0.811)	(1.192)	(0.729)	(0.947)	(0.661)	(1.014)	(0.721)	(1.202)
Share Foreign Born	-0.332	-1.194	-2.548	-3.139	0.466	0.172	0.681	0.609
	(1.373)	(1.757)	(0.824)	(0.968)	(1.023)	(1.139)	(1.298)	(1.832)
Includes changes*	--	X	--	X	--	X	--	X
Cities	147	146	138	137	144	142	120	102
N	4717	3928	3146	2704	3045	2506	1479	1088
Psuedo R^2	0.482	0.511	0.498	0.538	0.442	0.502	0.348	0.399

Note: This table reports estimates of the relationship between HOLC map grades and 1930 neighborhood characteristics and 1920 to 1930 trends in characteristics. Each observation represents an HOLC neighborhood. In the ordered logit specification, the dependent variable is coded such that the neighborhood graded as riskiest has the highest value (e.g. the dependent variable is coded as D=4, C=3, B=2, and D=1). All specifications include city fixed effects and are weighted by the log of the population of the HOLC neighborhood in 1930. Standard errors are shown in parentheses and are clustered by city.

Table 3: Effect of D versus C grade on Share African Americans (using grid controls)

Sample Type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	HOLC Neighborhoods		1/4 Mile C - D Boundaries					1/8 Mile C - D Boundaries				
Year			Treated	Treated	Control	Trip Diff	< Med ps Treated	Treated	Treated	Control	Trip Diff	< Med ps Treated
2010	0.081	0.079	0.038	0.034	0.008	0.027	0.009	0.023	0.022	0.004	0.019	0.001
	(0.016)	(0.012)	(0.008)	(0.008)	(0.003)	(0.012)	(0.006)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)
2000	0.106	0.103	0.043	0.038	0.012	0.028	0.015	0.025	0.022	0.007	0.016	0.005
	(0.017)	(0.013)	(0.011)	(0.010)	(0.004)	(0.012)	(0.009)	(0.008)	(0.008)	(0.002)	(0.009)	(0.008)
1990	0.130	0.126	0.061	0.057	0.013	0.044	0.027	0.034	0.032	0.006	0.027	0.010
	(0.018)	(0.014)	(0.012)	(0.012)	(0.005)	(0.013)	(0.011)	(0.009)	(0.009)	(0.003)	(0.009)	(0.009)
1980	0.172	0.159	0.114	0.089	-0.009	0.099	0.050	0.080	0.061	-0.016	0.078	0.020
	(0.028)	(0.023)	(0.030)	(0.021)	(0.020)	(0.030)	(0.017)	(0.056)	(0.040)	(0.015)	(0.043)	(0.050)
1970	0.216	0.203	0.146	0.117	-0.013	0.131	0.076	0.108	0.085	-0.008	0.094	0.074
	(0.024)	(0.020)	(0.029)	(0.024)	(0.017)	(0.035)	(0.021)	(0.034)	(0.023)	(0.013)	(0.020)	(0.035)
1960	0.250	0.234	0.132	0.101	-0.009	0.110	0.054	0.094	0.072	0.000	0.073	0.061
	(0.021)	(0.018)	(0.034)	(0.028)	(0.015)	(0.031)	(0.021)	(0.032)	(0.017)	(0.011)	(0.016)	(0.025)
1950	0.224	0.214	0.133	0.110	-0.006	0.117	0.064	0.107	0.095	0.007	0.090	0.075
	(0.020)	(0.019)	(0.030)	(0.027)	(0.011)	(0.027)	(0.017)	(0.029)	(0.021)	(0.014)	(0.022)	(0.020)
1940	0.150	0.147	0.080	0.077	0.047	0.031	0.012	0.063	0.062	0.037	0.027	0.011
	(0.015)	(0.013)	(0.013)	(0.014)	(0.011)	(0.006)	(0.007)	(0.012)	(0.012)	(0.006)	(0.005)	(0.006)
1930	0.135	0.133	0.067	0.065	0.066	--	0.001	0.053	0.052	0.053	--	-0.001
	(0.014)	(0.013)	(0.011)	(0.012)	(0.013)	--	(0.005)	(0.010)	(0.011)	(0.008)	--	(0.003)
1920	0.069	0.063	0.033	0.031	0.032	0.000	-0.001	0.026	0.024	0.027	-0.001	-0.004
	(0.009)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)	(0.004)	(0.005)	(0.006)	(0.005)	(0.008)	(0.003)
1910	0.061	0.053	0.029	0.027	0.029	-0.001	0.000	0.021	0.021	0.020	0.002	-0.004
	(0.011)	(0.009)	(0.006)	(0.006)	(0.011)	(0.008)	(0.004)	(0.005)	(0.005)	(0.005)	(0.009)	(0.003)
Cities	148	148	115	115	115	115	71	114	114	114	114	79
neighs	3535	3555	1139	1139	4280	5419	571	1062	1062	6224	7286	541
N	27814	27814	16781	16781	62334	79115	8796	15018	15018	87986	103004	7840
R squared	0.215	0.383	0.429	0.646	0.672	0.666	0.649	0.429	0.643	0.680	0.675	0.642
Fix Effects	None	City	City	Boundary	Boundary	Boundary	Boundary	City	Boundary	Boundary	Boundary	Boundary

Table A1: Geocoding Statistics

	1910	1920	1930	1940
Share of Population with a non-missing address	73%	72%	99%	82%
Share of poulation successfully geocoded	49%	50%	79%	62%
Share of non-missing addresses successfully geocoded	63%	68%	79%	74%

Table A2: City Characteristics in 1930

	1930 Census Variables													
City	Pop'n geo'd	Share AA	Home Own	House Values	Share FB	Radio Own	Att. School	Lab F Part.	Rent	Occ. Score	Earn Score	Educ Score	Emp. Rate	Read or Write
Akron_OH	188,793	0.04	0.54	6174	0.13	0.53	0.63	0.60	53	25	51	14	0.82	0.98
Albany_NY	107,893	0.02	0.40	10432	0.14	0.58	0.63	0.60	74	26	55	17	0.84	0.99
Altoona_PA	70,209	0.01	0.61	5449	0.07	0.45	0.61	0.52	54	27	59	14	0.81	0.98
Arlington_MA	31,589	0.00	0.56	9723	0.22	0.74	0.62	0.55	65	28	57	21	0.84	0.99
Asheville_NC	35,807	0.24	0.40	7839	0.02	0.32	0.59	0.61	56	24	46	17	0.80	0.97
Atlanta_GA	161,227	0.27	0.35	6780	0.02	0.31	0.61	0.63	46	24	47	16	0.84	0.97
AtlanticCity_NJ	46,508	0.23	0.30	19838	0.16	0.57	0.64	0.63	79	23	43	14	0.81	0.98
Augusta_GA	43,210	0.40	0.29	4983	0.01	0.16	0.57	0.65	39	21	41	12	0.83	0.93
Aurora_IL	39,485	0.02	0.66	6641	0.13	0.71	0.62	0.57	81	26	55	15	0.80	0.98
Baltimore_MD	635,110	0.16	0.56	5421	0.09	0.52	0.56	0.62	53	25	50	14	0.85	0.97
BattleCreek_MI	25,244	0.03	0.60	5845	0.08	0.53	0.63	0.60	72	26	55	15	0.82	0.99
BayCity_MI	36,733	0.00	0.71	2974	0.14	0.49	0.64	0.55	61	26	54	14	0.73	0.97
Belmont_MA	19,988	0.00	0.54	11678	0.22	0.78	0.64	0.55	50	28	56	24	0.88	0.98
Binghamton_NY	61,732	0.01	0.48	7888	0.13	0.50	0.65	0.63	38	25	51	14	0.84	0.97
Birmingham_AL	194,055	0.35	0.39	6109	0.02	0.31	0.57	0.60	47	24	49	15	0.86	0.95
Boston_MA	514,816	0.03	0.29	8504	0.31	0.56	0.66	0.61	69	25	49	15	0.79	0.96
Braintree_MA	12,568	0.00	0.70	5985	0.18	0.77	0.63	0.55	61	27	57	18	0.87	0.99
Bronx_NY	1,072,492	0.01	0.13	13455	0.38	0.65	0.61	0.60	71	26	54	17	0.83	0.96
Brookline_MA	38,951	0.01	0.38	21847	0.27	0.80	0.73	0.57	146	25	47	23	0.83	1.00
Brooklyn_NY	2,191,580	0.03	0.30	11738	0.34	0.59	0.61	0.60	73	26	53	16	0.82	0.95
Buffalo_NY	507,445	0.02	0.47	8354	0.21	0.56	0.62	0.58	50	26	55	15	0.80	0.98
Cambridge_MA	101,103	0.05	0.28	9470	0.29	0.56	0.63	0.61	43	25	50	16	0.80	0.97
Camden_NJ	100,093	0.09	0.51	4903	0.16	0.54	0.60	0.61	67	25	53	12	0.80	0.95
Canton_OH	83,883	0.02	0.56	6348	0.12	0.51	0.61	0.57	44	26	56	15	0.83	0.97
Charleston_WV	31,078	0.11	0.40	10311	0.03	0.46	0.63	0.59	44	26	51	20	0.84	0.98
Charlotte_NC	44,003	0.26	0.35	8803	0.01	0.37	0.53	0.64	51	23	45	15	0.84	0.93
Chattanooga_TN	81,609	0.23	0.36	5638	0.01	0.24	0.54	0.61	31	24	49	14	0.85	0.96
Chelsea_MA	39,184	0.01	0.33	6906	0.38	0.51	0.63	0.58	46	26	52	13	0.79	0.93
Chicago_IL	2,416,387	0.07	0.38	9346	0.26	0.64	0.62	0.61	89	25	53	14	0.80	0.97
Chicopee_MA	40,247	0.00	0.46	5822	0.28	0.44	0.62	0.62	27	25	51	10	0.80	0.95

Table A2: City Characteristics in 1930

	1930 Census Variables													
City	Pop'n geo'd	Share AA	Home Own	House Values	Share FB	Radio Own	Att. School	Lab F Part.	Rent	Occ. Score	Earn Score	Educ Score	Emp. Rate	Read or Write
Cleveland_OH	736,884	0.07	0.42	7305	0.26	0.48	0.65	0.60	46	25	52	13	0.78	0.96
Columbus_GA	34,395	0.28	0.23	6003	0.01	0.17	0.52	0.66	44	22	43	11	0.85	0.93
Columbus_OH	224,650	0.09	0.46	6597	0.05	0.52	0.62	0.59	43	26	54	16	0.82	0.99
Dallas_TX	182,283	0.11	0.42	6224	0.04	0.45	0.55	0.62	51	25	51	18	0.85	0.98
Dayton_OH	143,851	0.08	0.50	6285	0.06	0.58	0.62	0.60	50	26	53	15	0.83	0.99
Decatur_IL	47,825	0.03	0.56	5238	0.04	0.50	0.59	0.57	38	26	54	16	0.82	0.99
Dedham_MA	12,036	0.00	0.67	6588	0.23	0.63	0.64	0.58	60	25	53	16	0.85	0.98
Denver_CO	248,476	0.03	0.48	5421	0.11	0.53	0.63	0.58	41	26	52	19	0.81	0.99
Detroit_MI	1,058,107	0.05	0.49	8977	0.26	0.60	0.61	0.60	73	26	55	13	0.80	0.98
Duluth_MN	69,910	0.00	0.59	6155	0.23	0.53	0.67	0.57	31	26	53	17	0.77	0.99
Durham_NC	30,791	0.27	0.33	6097	0.01	0.22	0.53	0.67	36	24	47	13	0.85	0.95
EastHartford_CT	14,886	0.01	0.50	8098	0.18	0.62	0.61	0.60	33	26	53	14	0.82	0.97
EastStLouis_IL	58,444	0.17	0.45	4350	0.06	0.43	0.58	0.58	41	26	54	13	0.80	0.98
Elmira_NY	39,621	0.01	0.53	6523	0.09	0.47	0.66	0.58	38	26	54	16	0.79	0.98
Erie_PA	99,410	0.01	0.52	7731	0.15	0.51	0.61	0.56	85	26	53	14	0.83	0.97
EssexCounty_NJ	669,167	0.07	0.42	12616	0.22	0.66	0.63	0.60	51	26	53	17	0.82	0.97
Evansville_IN	75,901	0.06	0.46	4149	0.02	0.34	0.60	0.58	38	25	52	13	0.83	0.99
Everett_MA	43,906	0.02	0.44	6321	0.29	0.65	0.59	0.58	48	26	54	14	0.81	0.97
Flint_MI	102,596	0.02	0.64	5096	0.14	0.55	0.60	0.59	57	26	55	12	0.83	0.99
FortWayne_IN	93,848	0.02	0.60	6398	0.05	0.64	0.60	0.59	35	27	56	15	0.83	0.99
Fresno_CA	28,727	0.01	0.50	5075	0.21	0.38	0.67	0.56	37	26	51	19	0.79	0.96
Gary_IN	86,873	0.19	0.44	7264	0.21	0.46	0.62	0.59	62	25	54	12	0.88	0.95
GrandRapids_MI	117,085	0.02	0.64	5689	0.16	0.50	0.65	0.57	45	26	54	16	0.78	0.98
Greensboro_NC	30,773	0.24	0.47	7648	0.01	0.32	0.56	0.62	36	24	48	17	0.85	0.97
Hamilton_OH	44,014	0.03	0.55	5140	0.04	0.51	0.54	0.57	35	26	55	12	0.84	0.98
Haverhill_MA	42,292	0.01	0.46	5423	0.22	0.51	0.64	0.62	47	25	48	12	0.76	0.97
Holyoke_MA	49,464	0.00	0.27	11802	0.29	0.52	0.68	0.61	34	25	51	13	0.80	0.97
HudsonCounty_NJ	507,548	0.03	0.29	9256	0.26	0.62	0.61	0.62	84	26	54	14	0.84	0.96
Indianapolis_IN	277,757	0.10	0.44	5881	0.04	0.49	0.59	0.60	63	26	53	16	0.83	0.99
Jacksonville_FL	84,535	0.31	0.35	6927	0.04	0.29	0.58	0.61	31	24	47	16	0.84	0.97

Table A2: City Characteristics in 1930

		1930 Census Variables												
City	Pop'n geo'd	Share AA	Home Own	House Values	Share FB	Radio Own	Att. School	Lab F Part.	Rent	Occ. Score	Earn Score	Educ Score	Emp. Rate	Read or Write
JohnsonCity_NY	11,678	0.00	0.54	6128	0.07	0.53	0.61	0.66	33	25	49	10	0.83	0.99
Johnstown_PA	52,542	0.02	0.45	6238	0.14	0.40	0.61	0.54	37	25	52	14	0.86	0.96
Joliet_IL	23,480	0.03	0.51	8027	0.16	0.60	0.62	0.57	44	26	55	17	0.82	0.99
Kalamazoo_MI	36,932	0.01	0.66	6181	0.11	0.58	0.66	0.57	45	26	54	18	0.83	1.00
KansasCity_MO	319,031	0.09	0.44	6600	0.07	0.52	0.64	0.61	52	26	52	17	0.85	0.99
Kenosha_WI	45,374	0.00	0.60	7686	0.24	0.63	0.68	0.58	46	25	53	12	0.78	0.96
Knoxville_TN	48,395	0.12	0.42	5279	0.01	0.29	0.56	0.60	42	26	52	16	0.83	0.97
Lexington_KY	35,158	0.27	0.37	6057	0.01	0.31	0.60	0.60	30	23	44	16	0.81	0.96
Lexington_MA	7,490	0.00	0.75	9028	0.20	0.75	0.64	0.55	215	25	50	19	0.87	0.98
Lima_OH	37,340	0.03	0.47	4914	0.04	0.47	0.62	0.58	43	26	55	15	0.84	0.99
Lorain_OH	39,324	0.02	0.62	5137	0.28	0.41	0.62	0.58	46	25	54	11	0.81	0.94
Louisville_KY	241,349	0.13	0.45	5459	0.03	0.37	0.57	0.59	57	25	51	15	0.82	0.98
Lynchburg_VA	31,821	0.23	0.47	5290	0.01	0.24	0.57	0.62	31	24	47	14	0.80	0.95
Macon_GA	18,559	0.34	0.28	4976	0.01	0.18	0.55	0.64	68	23	45	14	0.81	0.95
Madison_WI	51,536	0.00	0.56	8778	0.09	0.65	0.66	0.57	64	27	54	21	0.82	0.99
Malden_MA	53,282	0.01	0.47	6168	0.28	0.66	0.61	0.58	47	26	54	16	0.81	0.98
Manchester_NH	61,731	0.00	0.37	5502	0.29	0.41	0.62	0.64	53	25	49	12	0.79	0.97
Medford_MA	56,087	0.01	0.54	7536	0.23	0.73	0.60	0.57	59	27	56	17	0.84	0.98
Melrose_MA	19,787	0.00	0.67	7033	0.17	0.78	0.65	0.54	65	27	57	22	0.84	1.00
Miami_FL	69,057	0.19	0.35	5993	0.12	0.27	0.58	0.61	60	24	48	17	0.75	0.97
Milton_MA	12,285	0.00	0.69	12359	0.21	0.81	0.68	0.56	50	25	51	21	0.85	1.00
Milwaukee_WI	242,173	0.02	0.46	6719	0.20	0.65	0.66	0.59	52	26	55	14	0.83	0.98
Minneapolis_MN	363,688	0.01	0.51	6070	0.17	0.62	0.67	0.59	53	26	53	18	0.83	0.99
Mobile_AL	47,529	0.33	0.41	4997	0.03	0.22	0.56	0.60	48	23	46	14	0.84	0.94
Montgomery_AL	26,798	0.32	0.33	6288	0.02	0.24	0.57	0.63	29	23	46	16	0.86	0.93
Muncie_IN	34,855	0.06	0.51	4314	0.01	0.47	0.57	0.56	31	26	54	14	0.82	0.99
Muskegon_MI	28,208	0.01	0.61	4640	0.14	0.55	0.66	0.59	43	26	54	15	0.79	0.99
Needham_MA	6,709	0.00	0.73	10936	0.20	0.78	0.66	0.54	63	27	55	22	0.85	0.98
NewBritain_CT	61,671	0.01	0.38	9356	0.31	0.41	0.64	0.61	36	26	54	13	0.83	0.92
NewCastle_PA	41,741	0.02	0.60	5402	0.16	0.42	0.62	0.53	39	26	54	14	0.78	0.94

Table A2: City Characteristics in 1930

	1930 Census Variables													
City	Pop'n geo'd	Share AA	Home Own	House Values	Share FB	Radio Own	Att. School	Lab F Part.	Rent	Occ. Score	Earn Score	Educ Score	Emp. Rate	Read or Write
NewHaven_CT	136,643	0.03	0.35	10769	0.25	0.55	0.64	0.60	45	26	53	16	0.81	0.96
NewOrleans_LA	378,493	0.27	0.30	7107	0.04	0.23	0.58	0.60	48	23	47	14	0.81	0.95
NewYork_NY	1,420,354	0.11	0.04	42199	0.38	0.46	0.62	0.66	88	23	45	15	0.83	0.94
NewportNews_VA	25,862	0.34	0.38	4028	0.04	0.33	0.55	0.60	27	26	55	14	0.90	0.96
Newton_MA	16,306	0.01	0.57	12314	0.25	0.69	0.67	0.58	95	25	49	18	0.82	0.98
NiagaraFalls_NY	65,818	0.01	0.50	7505	0.33	0.59	0.65	0.59	43	26	55	14	0.84	0.95
Norfolk_VA	76,526	0.29	0.40	5795	0.04	0.38	0.60	0.60	38	25	50	17	0.84	0.96
Oakland_CA	218,891	0.03	0.53	6026	0.19	0.60	0.66	0.57	46	27	55	18	0.80	0.98
Oshkosh_WI	15,475	0.00	0.64	5568	0.12	0.57	0.67	0.55	45	25	51	16	0.79	0.99
Philadelphia_PA	1,623,342	0.11	0.55	6372	0.20	0.57	0.60	0.62	94	25	51	14	0.82	0.97
Pittsburgh_PA	518,768	0.07	0.46	8994	0.16	0.55	0.61	0.58	65	25	50	15	0.80	0.98
Pontiac_MI	47,428	0.04	0.54	6186	0.14	0.53	0.60	0.62	70	25	53	13	0.73	0.98
Portland_OR	42,912	0.01	0.49	5709	0.16	0.58	0.67	0.61	40	26	51	19	0.79	0.99
Portsmouth_OH	32,464	0.04	0.51	5353	0.02	0.40	0.58	0.57	35	26	55	14	0.83	0.98
Poughkeepsie_NY	34,674	0.03	0.39	9636	0.14	0.59	0.61	0.59	46	26	54	16	0.83	0.97
Queens_NY	837,973	0.02	0.51	9986	0.25	0.76	0.60	0.60	84	27	56	17	0.86	0.98
Quincy_MA	65,037	0.00	0.56	6658	0.25	0.72	0.59	0.58	44	27	58	18	0.86	0.98
Racine_WI	58,532	0.01	0.60	7300	0.21	0.69	0.68	0.58	59	26	56	14	0.83	0.98
Revere_MA	32,016	0.00	0.46	5797	0.27	0.64	0.62	0.56	48	26	55	15	0.79	0.95
Richmond_VA	140,735	0.25	0.37	7659	0.02	0.39	0.60	0.61	48	25	50	16	0.84	0.97
Roanoke_VA	42,518	0.19	0.47	5681	0.01	0.28	0.58	0.58	34	24	50	12	0.84	0.97
Rochester_NY	284,366	0.01	0.58	8052	0.23	0.57	0.67	0.60	68	26	54	16	0.80	0.96
Rockford_IL	77,126	0.01	0.53	7600	0.22	0.62	0.61	0.60	92	26	55	14	0.81	0.98
Sacramento_CA	71,415	0.01	0.50	5698	0.16	0.56	0.66	0.59	40	26	53	18	0.80	0.97
Saginaw_MI	47,237	0.03	0.64	4296	0.15	0.56	0.63	0.57	37	26	54	15	0.78	0.98
SanDiego_CA	117,541	0.02	0.49	6409	0.15	0.55	0.64	0.53	34	25	51	19	0.74	0.99
SanFrancisco_CA	485,501	0.01	0.39	8247	0.27	0.51	0.64	0.61	71	26	52	18	0.82	0.98
SanJose_CA	42,403	0.00	0.60	5193	0.18	0.58	0.69	0.53	47	25	51	18	0.74	0.95
Saugus_MA	12,578	0.01	0.75	4866	0.20	0.74	0.60	0.57	47	27	57	15	0.82	0.98
Schenectady_NY	65,710	0.01	0.51	8295	0.20	0.59	0.68	0.58	43	27	58	18	0.84	0.97

Table A2: City Characteristics in 1930

	1930 Census Variables													
City	Pop'n geo'd	Share AA	Home Own	House Values	Share FB	Radio Own	Att. School	Lab F Part.	Rent	Occ. Score	Earn Score	Educ Score	Emp. Rate	Read or Write
Seattle_WA	265,620	0.01	0.53	5422	0.21	0.55	0.67	0.59	47	26	54	18	0.82	0.99
Somerville_MA	93,503	0.00	0.36	7044	0.29	0.64	0.60	0.59	46	26	54	15	0.82	0.97
SouthBend_IN	77,632	0.03	0.62	6006	0.14	0.52	0.60	0.60	71	26	53	14	0.76	0.98
Spokane_WA	70,583	0.01	0.62	3768	0.14	0.52	0.65	0.58	33	26	53	18	0.80	0.99
Springfield_IL	57,261	0.04	0.57	5425	0.09	0.50	0.62	0.60	45	25	52	15	0.78	0.98
Springfield_MO	41,132	0.02	0.52	4162	0.02	0.28	0.61	0.54	24	26	54	17	0.81	0.99
Springfield_OH	55,778	0.11	0.48	5413	0.03	0.56	0.62	0.58	50	26	54	14	0.81	0.99
StJoseph_MO	61,335	0.05	0.43	4172	0.05	0.49	0.62	0.58	30	25	51	15	0.83	0.99
StLouis_MO	665,880	0.08	0.36	7254	0.10	0.53	0.59	0.60	58	25	52	15	0.83	0.98
StPetersburg_FL	30,831	0.17	0.49	6194	0.06	0.25	0.64	0.51	26	24	48	18	0.67	0.98
Stamford_CT	36,991	0.03	0.43	11729	0.27	0.62	0.60	0.60	62	25	52	14	0.84	0.95
StatenIsland_NY	132,112	0.02	0.56	8327	0.25	0.67	0.64	0.59	56	27	57	17	0.84	0.97
Stockton_CA	34,605	0.01	0.46	5334	0.17	0.53	0.67	0.59	35	26	52	18	0.79	0.98
Syracuse_NY	173,151	0.01	0.49	10068	0.17	0.57	0.66	0.59	49	27	55	17	0.80	0.97
Tacoma_WA	70,786	0.01	0.63	3500	0.19	0.52	0.64	0.57	61	26	53	16	0.81	0.99
Tampa_FL	66,802	0.16	0.40	4046	0.16	0.16	0.58	0.62	25	24	47	13	0.79	0.96
TerreHaute_IN	52,646	0.05	0.49	4345	0.05	0.44	0.67	0.56	39	26	53	16	0.75	0.99
Toledo_OH	250,820	0.04	0.53	6688	0.12	0.62	0.63	0.59	49	26	55	14	0.80	0.98
Troy_NY	58,090	0.01	0.40	6558	0.14	0.53	0.65	0.61	83	26	53	15	0.82	0.98
Utica_NY	82,770	0.00	0.48	7994	0.21	0.48	0.66	0.60	43	26	52	14	0.79	0.94
Waltham_MA	31,475	0.00	0.42	7830	0.27	0.65	0.62	0.60	53	26	53	14	0.83	0.98
Warren_OH	29,274	0.05	0.57	6080	0.16	0.48	0.63	0.57	49	26	56	14	0.83	0.97
Watertown_MA	31,759	0.00	0.46	9267	0.28	0.67	0.61	0.59	50	27	55	17	0.83	0.98
Wheeling_WV	45,311	0.03	0.46	7169	0.08	0.50	0.58	0.57	36	25	52	16	0.81	0.98
Wichita_KS	62,996	0.03	0.48	4726	0.02	0.40	0.65	0.57	38	26	53	18	0.83	0.99
Winchester_MA	11,489	0.02	0.69	11351	0.19	0.76	0.67	0.54	80	25	50	20	0.84	0.98
WinstonSalem_NC	44,493	0.31	0.38	8166	0.01	0.22	0.53	0.67	25	24	48	13	0.84	0.94
Winthrop_MA	14,977	0.00	0.55	8466	0.21	0.76	0.67	0.55	78	28	58	23	0.84	0.99
Youngstown_OH	136,985	0.07	0.57	6055	0.20	0.46	0.65	0.56	47	26	55	14	0.78	0.96