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ABSTRACT

Zoning has been cited as a discriminatory policy tool by critics, who argue that ordinances are used to deter the entry of minority residents into majority neighborhoods through density restrictions (exclusionary zoning) and locate manufacturing activity in minority neighborhoods (environmental racism). However, identifying discrimination in these regulations is complicated by the fact that land use and zoning have been co-evolving for nearly a century in most American cities, rendering residential sorting and inequitable treatment observationally equivalent. We employ a novel approach to overcome this challenge, studying the introduction of comprehensive zoning in Chicago. Using fine-scale spatial data on pre-existing land uses and the locations of minority neighborhoods, we find evidence of a pre-cursor to exclusionary zoning that was applied to black neighborhoods. We also find strong evidence of inequitable treatment of both southern black and immigrant neighborhoods with both appearing to have been targeted for increased levels of industrial use zoning.

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I. Introduction

Few local policies are as controversial or as frequently linked to discrimination as zoning. Critics argue that zoning is used as a tool to deter entry of poorer households into wealthier neighborhoods, often through the imposition of minimum lot sizes.[2] According to this view, low-income minority households become trapped in poor neighborhoods as a result of "exclusionary" zoning, contributing to racial segregation and disparities (Schlay and Rossi, 1981; Rothwell and Massey, 2009). Scholars and policy makers also argue that zoning is used to steer industrial activity towards minority neighborhoods, leading to disproportionate toxic exposure and depressed land values (Maantay, 2001; Wilson, Hutson, and Mujahid, 2008). "Environmental racism" associated with zoning could thus serve as a channel through which minorities remain disadvantaged and isolated.[3]

Research continues to demonstrate that minorities remain disproportionately isolated in poor neighborhoods and exposed to pollution (Sharkey, 2013; EPA Plan EJ 2014).[4] However, identifying the link between local land use regulations and these disparities is difficult because land use and zoning have been co-evolving for almost a century in most American cities. Existing scholarship has struggled to disentangle inequitable treatment in zoning ordinances and nuisance siting from residential mobility that is correlated with land use. For instance, the availability of affordable housing may cause low-income residents to cluster in areas with locally undesirable land uses (Been and Gupta, 1997). Nonetheless, understanding the link between zoning and disparities in access to public goods and exposure to pollution is critical for effective policymaking.

In this paper we employ a novel approach to studying how land use regulations affect minorities, focusing on the introduction of comprehensive zoning in the United States. The key innovation of our approach is that we observe detailed measures of existing land use at the city block level *prior* to the introduction of comprehensive zoning in Chicago. Our empirical strategy asks what impact pre-existing minority populations had on zoning outcomes, conditional on the extant land use and settlement patterns at the time of initial zoning adoption. The ability

[2] For reviews of the exclusionary zoning literature, see Ihlanfeldt (2004) and Pogodzinski (1991).
[3] The term "environmental racism" was coined by Reverend Benjamin Chavis during a press release regarding the influential report "Toxic Waste and Race in the United States: A National Report on the Racial and Socioeconomic Characteristics of Communities with Hazardous Waste Sites" (United Church of Christ, 1987).
[4] For the EPA see "Plan EJ 2014" see http://www.epa.gov/compliance/ej/plan-ej/.

to control for ex ante density allows us to distinguish between minority neighborhoods receiving higher density zoning and the tendency of minorities to settle in neighborhoods with denser development. Similarly, the ability to observe and control for ex ante minority proximity to undesirable land uses enables us to disentangle discrimination in land use regulation from the observationally equivalent mechanism of poor minorities sorting into less expensive neighborhoods near polluting sites.[5]

We focus on the initial comprehensive zoning ordinance adopted by Chicago in 1923, one of the first and most influential policies of its kind, and ask how the racial and ethnic composition of neighborhoods influenced local zoning outcomes. A second contribution of our study is the rich detail of the microdata assembled for the analysis. We observe place of birth and parents' place of birth for the universe of individuals living in Chicago in 1920, allowing us to precisely measure the size of both first- and second-generation immigrant populations. We are also able to distinguish northern-born black populations from enclaves of southern-born blacks who had migrated to Chicago, which enables us to ask whether these groups were treated differently in the zoning process.

We first study the density component of the zoning ordinance, finding evidence of an early form of "exclusionary" zoning that was applied to black neighborhoods.[6] On the margin between the two lowest levels of density zoning, where the greatest scope for unequal treatment in density restrictions would have existed, a one standard deviation increase in the black share of a neighborhood was associated with a 16 percentage point increase in the likelihood of the neighborhood being zoned primarily for higher density buildings. For European immigrants, the relationship is reversed. Thus, at the margin, the zoning board appears to have endeavored to increase the building density in neighborhoods with high numbers of black residents and decrease the density in neighborhoods with large numbers of European immigrants.

Turning to the use component of the zoning ordinance, we find that neighborhoods with a larger share of southern-born blacks or first-generation immigrants were more likely to be zoned

[5] Recent work by Depro, Timmins and O'Neil (2014) takes a different approach to this question, estimating a structural model of mobility by race in the presence of polluting sites. They show that race-pollution correlations can be in part explained by whites having a higher marginal willingness than Hispanics to pay to avoid pollution exposure.

[6] The extant literature on exclusionary zoning emphasizes differences in zoning ordinances across various incorporated municipalities, not within a single city (for instance, *The Homevoter Hypothesis*, Fischel, 2001). However, to the extent that cities faced pressure to concentrate minorities in particular neighborhoods, we may expect to see higher density zoning in black and immigrant neighborhoods in our context.

for industrial uses than comparable neighborhoods with white natives. Specifically, a standard deviation increase in southern black share is associated with a 8 percentage point increase in the likelihood of an enumeration district being zoned to include manufacturing uses, and a one standard deviation increase in the first-generation immigrant share is associated with a 5 percentage point increase in the likelihood of an enumeration district being zoned for manufacturing uses. These are quantitatively important effects given that only 26 percent of enumeration districts received any zoning for manufacturing uses.

Inequitable zoning had consequences in both the short and long run for blacks and immigrants. Minority communities receiving industrial use and higher density zoning were excluded from the economic benefit of low density, purely residential zoning in the 1923 ordinance.[7] Zoning thus served as a channel through which government action reduced the value of minority-owned homes relative to the properties owned by white native-born individuals. Discrimination in zoning ordinances translates directly into economic disparities since "… for the great majority of homeowners, the equity in their home is the most important savings they have." (Fischel, 2001, p. 4). We also show that conditional on pre-zoning land use, neighborhoods that received higher density zoning in 1923 had higher housing unit and population density by 1940. This finding buttresses the claim that zoning ordinances can be used to concentrate minorities in denser neighborhoods, contributing to segregation and environmental disparities (Rothwell, 2011). Furthermore, we demonstrate that this type of discriminatory policy had emerged as early as the 1920s.

Our results cast doubt on the de jure racial blindness of comprehensive zoning ordinances, of which all but one (New York) were passed after the Supreme Court ruled explicitly racial zoning unconstitutional in the 1917 *Buchanan v. Warley* case. Although our evidence is historical, the results demonstrate that racial discrimination can arise even with the most general and widely used forms of land use control. Furthermore, Shertzer, Twinam, and Walsh (2014) find that these ordinances have persistent effects on a city's economic geography today. Because minority enclaves also exhibit substantial persistence over time, the results of

[7] The price premium for strictly residential use zoning in the context of the Chicago ordinance is documented in McMillan and McDonald (2002). In order for blacks to be disadvantaged by the impact of the zoning ordinance on housing prices, it must be the case that some were homeowners and landlords. We cannot observe landlord status in the census, but nonetheless we see that 7 percent of blacks in our sample region were homeowners in 1920 and 10 percent in 1930.

these papers taken together indicate that observed inequities today could partially result from zoning decisions made many decades in the past.

II. Background on Zoning in Chicago

a. Brief History of Zoning in Chicago

The origins of comprehensive land use regulation in Chicago were rooted in public demand for "orderly" urban development, in particular the prevention of industrial and commercial encroachment on residential neighborhoods. Early twentieth century observers, including the influential Chicago Real Estate Board, expressed concern about the effect of unchecked expansion of commercial and industrial activity on property values (Schwieterman and Caspall, 2006). Others objected to the "canyon effect" created by unbroken rows of skyscrapers and the potential negative effects of the associated reduction in sunlight exposure and air flow on public health (Hall, 2002).

Chicago's city government had made previous attempts to control undesirable land uses, including an 1837 municipal code that prohibited any landowner or tenant from maintaining certain nuisances such as dead animals, dung, putrid meat, or fish entrails on their property. However, such piecemeal approaches proved insufficient for meeting public demand for controlled development, and in 1920 the newly created Chicago Zoning Commission began preparing a comprehensive zoning ordinance. The Commission, composed of eight aldermen and fourteen representatives from the Chicago community, spent eighteen months surveying existing land use in Chicago before issuing the initial statute.

Chicago's comprehensive zoning ordinance regulated land through both use districts and volume districts. Four distinct use districts were included: residential (single family housing), apartment, commercial, and manufacturing. These use districts were hierarchical, with apartment districts allowing residential uses, commercial districts allowing both apartments and single-family homes, and manufacturing districts allowing any use. Volume districts imposed restrictions on maximum lot coverage, aggregate volume, and height. The five volume districts in Chicago's ordinance were also hierarchical with district 5 allowing the tallest buildings.

Zoning statutes spread across the country in rapid order after Chicago's ordinance was passed, and by 1925 nearly 500 cities had adopted similar forms of comprehensive land use regulation (Mills, 1979). By this time, the question of whether zoning could explicitly address race and block black residents from certain neighborhoods had been settled: the U.S. Supreme Court had ruled a Louisville, Kentucky racial zoning ordinance unconstitutional in *Buchanan v. Warley* in 1917. This case squashed an effort by the Chicago Real Estate Board to convince the city to adopt a similar racial zoning ordinance. The realtors, led by agents from the Hyde Park, Kenwood, and Oakland neighborhoods, had argued that the dispersion of African-Americans throughout the city could lead to more than $250 million (in 1922 dollars) in property value depreciations (Chicago Commission on Race Relations, 1922).

When the move for a racial zoning ordinance failed, demand for segregation and protection from black "encroachment" led to the proliferation of private alternatives such as restrictive covenants (Brooks, 2011; Brooks and Rose, 2013). White residents were concerned by the arrival of blacks from the South, seeing them as "ignorant and rough-mannered, entirely unfamiliar with the standards of conduct in northern cities" (Chicago Commission on Race Relations, 1922). White immigrants were also concerned about competition for jobs from newly arrived African Americans and viewed the prospect of Negro neighbors as a "catastrophe equal to the loss of their homes" (Grossman, 1989, p. 175). Even longtime black residents of Chicago were hostile to the new arrivals, worrying that they would lose what social privileges they had as a result of the influx of poor and uneducated southern blacks into the city (Kennedy, 1968, p. 222).

For their part, African Americans were suspicious of the movement for comprehensive zoning, particularly so soon after the racial zoning debate. Nonetheless, the 1923 zoning ordinance passed without notable opposition from the black community in Chicago. Enthusiasm from black elites, many of whom optimistically welcomed the move for comprehensive zoning, may partly explain this outcome. For instance, a prominent African American developer on the zoning board, Charles S. Duke, championed land use regulation to the black community and is credited by historians for having shielded the wealthiest black neighborhoods from mixed-use zoning (NAACP, 1923). Secondary historical sources indicate that City Council in Chicago may have deliberating lowered zoning standards (e.g. permitted higher building density and mixed uses) in poorer black neighborhoods while maintaining strict zoning in white neighborhoods to

prevent "encroachment" of blacks (Flint, 1977). However, to our knowledge there is no empirical evidence regarding the presence of racial animus in either the 1923 ordinance or subsequent amendments over the 1930s and 1940s.

b. Related Empirical Work on Zoning in Chicago

Although to our knowledge we are the first scholars to empirically ask how the spatial distribution of minority populations shaped initial zoning ordinances, comprehensive land use regulation is the subject of a large literature, and the case of Chicago has attracted particular interest. Previous work on Chicago's 1923 zoning ordinance used a sample of city blocks to determine the extent to which the ordinance followed existing uses, finding that zoning patterns were highly predictable given existing land uses, proximity to transportation networks, and distance to waterways (McMillen and McDonald, 1999). The same authors also asked how the 1923 zoning ordinance impacted land values (McMillen and McDonald, 2002). Using propensity score matching on the same sample of city blocks, they find that strictly residential zoning increased land values relative to mixed-use zoning.

III. Data

The dataset used in this paper has three components: 1920 census data at the enumeration district level, the comprehensive 1922 Chicago land use survey, and a map of the city's 1923 zoning ordinance. Summary statistics for key predictors and outcomes are provided in Table 1.

a. Census Enumeration District Data

We obtained counts of the number of blacks and white ethnic group members at the census enumeration district level for a 100 percent sample of the population using a digitized version of the original 1920 Census taken from the genealogy website Ancestry.com. Enumeration districts were small administrative units used internally by the Census to divide cities into small areas that could be surveyed by one person.[8] The spatial microdata compiled for this paper represents a significant improvement over existing sources, most of which are

[8] The Census Bureau did not switch to a mail-based survey system until 1960.

tabulations of the population at the ward level produced by the Census Bureau.[9] The average enumeration district in Chicago had 1,182 individuals in 1920, less than two percent of the population of the average ward.

In order to investigate the relationship between the composition of the population and zoning outcomes, we digitized the 1920 enumeration district map of Chicago. We first used written descriptions of the enumeration districts available on microfilm from the National Archives. The information from these microfilms has been digitized and made available on the web due to the work of Stephen P. Morse.[10] Second, we took digital photographs of the physical map of the 1920 census enumeration districts of Chicago from the National Archives. Working primarily with a geocoded (GIS) historic base street map developed by the Early Indicators Project, we generated a GIS representation of the Chicago enumeration district map that is consistent with the historic street grid.[11]

In our empirical work we focus on four categories of racial and ethnic minorities. Given the emphasis in the historical record on the lack of cohesiveness between northern and southern blacks, we separate these two groups in much of our empirical work. We define as southern blacks those individuals who report their race as black or mulatto and their place of birth as in the South.[12] We also include in the southern black category "second-generation" blacks, that is, individuals born in the North but with southern-born fathers in order to group all blacks of southern origin together. Northern blacks are defined as black or mulatto individuals who were both born outside the South with fathers born outside the South.

First-generation immigrants include all foreign-born individuals plus second-generation individuals under the age of 18, the latter of whom are presumably children residing in the same household as their foreign-born parents. Second-generation immigrants are defined as individuals who were born in the U.S. and who are at least 18 years old with foreign-born fathers. Using these definitions, we avoid a standard problem in the segregation literature of immigrant populations being diluted by the presence of their native-born children (see Cutler, Glaeser, and Vigdor, 2008). Third-generation whites are defined as white individuals who were

[9] The IPUMS sample for 1920 (Ruggles et al, 2004) covers 1 percent of the population of Chicago and contain enumeration district identifiers; however, this small sample is insufficient for studying neighborhoods.
[10] Website: http://stevemorse.org/ed/ed.php.
[11] See "Historical health conditions in major US cities: The HUE dataset" (Villareal, Bettenhausen, Hanss, Hirsch) for details on the street file construction.
[12] We use an eleven state definition of the South, defining the region to include Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.

born in the U.S. and whose fathers were born in the U.S. As is shown in Table 1, the population of our study area is composed of 1.5 percent northern blacks, 2.9 percent southern blacks, 52.0 percent first-generation immigrants, and 17.9 percent second-generation immigrants in 1920. The remainder are white third-generation and beyond natives.

There are important compositional and economic differences between the first- and second-generation immigrant groups. Adult second-generation immigrants primarily traced their ancestry to Ireland and Germany and tended to be wealthier than recent arrivals. First-generation immigrants were more likely to have arrived from Poland, Italy, Russia, Bohemia (now the Czech Republic), and the other "new" sending countries of the late nineteenth and early twentieth century European immigration. The German and Irish communities also held political clout and most aldermanic seats; the larger new immigrant groups had mobilized politically but counted few aldermen among their number (Centennial List of Mayors, City Clerks, City Attorneys, City Treasurers, and Aldermen, 1937). We may thus expect first and second-generation immigrants to have been treated differently by the zoning process.

The spatial distribution of the minority groups we study is displayed in Figure 1.[13] Panel A shows the concentration of southern-born blacks in the "Black Belt" south of downtown with a secondary population to the west. Northern-born blacks appear to be concentrated in the Black Belt as well, but with larger numbers living to the north and south of the most densely African American areas. Figure 2 graphically illustrates the variation in where northern and southern blacks lived in finer detail, with a close up view of the black neighborhoods to the south and west of downtown. Focusing exclusively on enumeration districts that were at least 5 percent black, the figure shows the spatial distribution in the percentage of each neighborhoods' black population that we classify as being southern black. As is clear from the figure, the southern black composition of these neighborhoods ranges from a low near 20 percent to a high in excess of 80 percent. We thus find there is sufficient variation in where southern and northern blacks lived to examine their impact on zoning separately.

Turning to European immigrants, Panels C and D of Figure 1 show the distribution of first- and second-generation immigrants, respectively. Numerically much larger than the black population, first-generation immigrants were most concentrated in inland neighborhoods in the

[13] The two blank areas are the result of missing data. We had to omit 84 enumeration districts (out of 1884) from our sample: 36 were missing from Ancestry.com's database and 48 had illegible or missing land use maps, leaving us with 1800 observations.

periphery of the central business district. Second-generation immigrants occupy the next ring of enumeration districts further out from the downtown, particularly in the northwest.

b. The 1922 Chicago Land Use Survey

The comprehensive land use survey we draw upon was conducted by the Chicago Zoning Commission in 1922 for the purposes of informing the drafting process for the zoning ordinance. Four teams, each equipped with an automobile, recorded the use of every building and lot in the city (Zoning Chicago 1922 Pamphlet). From these survey maps we obtain the location of every commercial and manufacturing use in the city; we also obtain the location and number of stories for every building with four or more stories. We geocoded the largest sample to date of this pre-zoning survey for our study. While previous work by McMillen and McDonald used a sample of 1000 blocks, we digitized nearly two-thirds of the city by land mass.[14] Our sample covers 79.4 percent of the 1920 population along with 97.8 percent of blacks and 80.8 percent of first-generation immigrants. Figure 3 provides a graphical illustration of the land mass covered by our sample.

Figure 4 provides a map image of several blocks from the survey. The Tilden Public School in the center of the image is surrounded by noxious facilities, indicated by "++N" on the map. The building heights of all structures over four stories can also be seen (surveyors occasionally indicated three-story buildings although not consistently). The letters on buildings correspond to specific uses, which we classified as residential, commercial, or manufacturing (further distinguished by subclass) using the same system as the Chicago Zoning Commission in 1922. Of particular interest to our study are the various manufacturing classes: A and B include general manufacturing that does not cause a nuisance but may require yard storage, class S includes large-scale industrial facilities such as rail yards and granaries, class D covers storage of explosives and high pressure gases, and class C includes manufacturing facilities that emit noise, smoke, odors, or pose a fire risk. We consider the noxious facilities in classes C separately in much of our analysis (only one instance of Class D manufacturing exists in our sample). Commercial use is indicated using only one category and covers retail establishments, offices, and entertainment venues such as theaters.

c. Comprehensive Zoning Ordinance of 1923

[14] Our sample covers 64 percent of the 1920 area of Chicago and 56 percent of the current (2013) city area.

We digitized the initial zoning ordinance for the same broad sample of Chicago as the land use survey, recording both volume zoning and use zoning. The volume districts in the zoning ordinance are essentially rough concentric rings radiating out from the central business district. Figure 5.A shows the digitization of these districts with each enumeration district assigned to the volume district most common within its borders. Our empirical work focuses on the two outermost rings, which were volume districts 1 and 2. Under zoning for volume district 1, buildings were capped at 5 to 6 stories and could cover only 50 percent of an interior lot. In volume district 2, apartment buildings could reach 12 to 13 stories and cover 60 percent of the lot. However, the effective difference in height and density limitations between these two districts was actually much greater due to restrictions on overall building volume. The volume district 1 maximum building height was effectively 33 feet, corresponding to roughly three stories, while in district 2 the maximum height was effectively 8 to 10 stories. The inner three volume districts allowed buildings with effective heights of 11, 16, and 22 stories, respectively, and were found only in the central business district and surrounding areas (see Figure 5.A). There were no density "minimums," only restrictions only the maximum volume, height, and lot coverage.

Use zoning delineated the city into four distinct districts: residential (single-family homes), apartment, commercial, and manufacturing. These use districts were hierarchical, with apartment districts allowing residential uses, commercial districts allowing both apartments and single-family homes, and manufacturing districts allowing any use.[15] The residential category was rarely used in the initial zoning ordinance; only three percent of the enumeration districts in our sample have any zoning of this type. Figure 5.B shows a section of a use zoning map from an area west of the downtown along the Chicago River. Zones for apartments, commercial activity, and manufacturing can all be seen.

d. Empirical Approach

[15] There were additional gradations within the commercial and manufacturing districts, with certain objectionable commercial uses barred if they were within 125 feet of a residential or apartment district, while certain manufacturing uses were barred if they were within 100 to 2000 feet of a residential, apartment, or commercial district. Some commercial uses within 125 feet of residential or apartment districts also saw restrictions on the hours during which trucking activities could occur.

Our empirical approach relies on the ability to observe the same land use data employed by the Chicago Zoning Commission when they drafted the ordinance. We pose two questions in our empirical work. First, how were minorities sorted across the city and within neighborhoods with respect to existing land use and urban geography prior to the zoning ordinance? Second, accounting for geography and extant land use, what was the impact of various minority populations on zoning outcomes?

Crucial to the identification of the second question is that we sufficiently account for other causes of zoning that also influenced the demographic composition of enumeration districts. By conditioning on an extensive array of spatial, land use, and transportation variables, our empirical strategy attempts to block all "back-door" paths from our demographic variables to zoning outcomes (Pearl, 2009). In the language of Rosenbaum and Rubin (1983), we render the non-demographic causes of zoning "conditionally ignorable," and so the effect of demographic composition on zoning outcomes is identified. Recognizing the limits of our ability to block all alternate mechanisms via controls, we attempt to further verify our main results using a series of robustness checks in Section VI.

The models we estimate are all single index models, i.e., functions of a linear combination $x'\beta$ of our covariates. To permit nonlinearities in responses, we frequently allow covariates to enter through indicators as well as polynomials. Specifically, spatial variables such as distance to the central business district, distance to the nearest major street, distance to Lake Michigan, distance to the nearest river, distance to the nearest railroad, and distance to an ancillary railroad all enter as quartic polynomials, and we include indicators that equal one whenever an enumeration district is proximate to any of these features. We also include quartic polynomials for population density and the area of the enumeration districts. Indicators for overlapping a railroad or major street are included, as is a quartic polynomial for the distance to the nearest railroad.

To control for existing land use, we include variables measuring the density of commercial uses, warehouses, and each of the five different manufacturing use classes; these enter as both indicators and quadratic polynomials in the density of each type of use. To account for large industrial sites, we add an indicator equal to one if the enumeration district includes a contiguous area greater than 800,000 square feet (approximately four city blocks) populated by heavy industrial activity. We include separate indicators for enumeration districts that overlap

the Union Stockyards and those that are within 1,000 feet of the Stockyards. To capture the industrial character of the area surrounding an enumeration district, we also include counts of different manufacturing uses in 500 and 1,000-foot rings around each enumeration district. To account for the existing distribution of building heights, we include the densities of four, five, six, seven, eight, nine, and ten story buildings. We also include the density of eleven through twenty-five story buildings; disaggregating this category has little impact on the analysis due to the concentration of these buildings in the central business district.

To address the possibility that recent immigrants and black migrants located in cheaper areas of the city that were also suitable for manufacturing activity, we include as a control a measure of land values transcribed by Gabriel Ahlfeldt and Daniel McMillen from the 1913 edition of Olcott's Blue Books.[16] Specifically, this variable is the average land value per front foot based on 125 foot tracts (see McMillen, 2012). As a further control for wealth, we use the head of household variable in the census to develop an income measure based on live-in hired help. For each enumeration district, we count the number of household heads as well as the number of individuals who report being a maid, cook, servant, or laborer in relation to the head of house.[17] We then compute the ratio of live-in hired help to heads of household and include this value in our regressions. We also include ward fixed effects to account for differential political influence exerted by alderman. There are approximately 51 enumeration districts per ward in our sample. Finally, to measure home neighborhood motivations for the zoning board members, we added an indicator for whether a zoning board member lived in the enumeration district.[18] Appendix Table I provides a complete listing of our control variables by category.

We measure zoning outcomes using both continuous and discrete variables as appropriate. For example, we assess the probability that an enumeration district contains any

[16] Land prices may have influenced zoning directly; for example, the zoning board may have considered areas with cheaper land to be more suited for large-scale industrial uses. Land prices may also proxy for unobservable neighborhood characteristics. Since both racial and ethnic composition and unobservable neighborhood characteristics can be expected to have had a causal effect on land prices, conditioning on land prices may induce a correlation between these variables even if they are unconditionally independent. This "collider-stratification" could bias the estimation of our coefficients of interest (Greenland 2003, Pearl 2009). However, despite the fact that land prices are strongly correlated with both our explanatory and outcome variables, their inclusion has a negligible effect on our coefficient estimates.

[17] We do not observe occupation in the Ancestry.com data, relation to head of house is our only opportunity to measure household employment status.

[18] Only one enumeration district with a board member received any industrial zoning. We explored a variety of political representation indicators in our analysis, including whether a ward's alderman served on the zoning board. We found small and insignificant results on manufacturing zoning for all variables relating to local representation on the board.

manufacturing zoning as well as the percentage of the enumeration district that is zoned for manufacturing uses. When the outcome is a binary indicator, we typically report results from a probit model in terms of average marginal effects. We consider only discrete outcomes for density zoning because there are relatively few enumeration districts straddling the relevant density zone borders. Each enumeration district is assigned to the volume district in which most of its area falls. When considering continuous outcomes, we typically report results from a Tobit model, which assumes the existence of an underlying variable that equals the index $x'\beta$ plus a normally distributed error term. The observable value of the latent variable is equal to zero if the latent variable is below zero; similarly, it is equal to one if the latent variable exceeds one. This model accounts for the fact that EDs receiving boundary values may differ substantially in their suitability for different types of zoning. [19]

Our baseline specification is thus

$$\%\ or\ indicator\ for\ zoningtype_i = f(x_i'\beta + ward_i) + \epsilon_i \qquad (1)$$

where the zoning type is manufacturing or commercial and x_i includes the extensive list of spatial and land use controls described above as well as measures of the share of the enumeration district population composed of blacks, the share composed of first-generation immigrants, and the share composed of second-generation immigrants. We use robust standard errors throughout the analysis (White, 1980).[20] We also decompose the black share into southern- and northern-born blacks in much of the analysis.

IV. Existing Patterns of Minority Residential Location

We begin by documenting the distribution of minority location across the city and within neighborhoods with respect to measures of urban density, proximity to commercial and

[19] In the Tobit model, β is the marginal effect of x on the underlying latent variable; the marginal effect over the uncensored range is obtained by multiplying this β by a shrinkage factor, which explains why it is generally larger than the estimates we obtain from the OLS specifications (McDonald and Moffit, 1980). An alternative estimation procedure involves fitting a beta distribution whose parameters are a function of our covariates. However, this is inappropriate since we observe many values at the boundary, and these values are discarded when estimating the parameters of the beta distribution because there is no support on the boundary. Papke and Wooldridge (1996) recommend the fractional logit estimation procedure in this context. The fractional logit estimator is a generalized linear model where the conditional expectation of the outcome variable is equal to the logit function evaluated at the index $x_i'\beta$. This ensures that the output from the model is always bounded between zero and one. As a robustness check, we also estimated all of the continuous dependent variable models reported here using the fractional logit specification. These results were qualitatively similar to those reported in the paper. For parsimony, we only report the OLS and Tobit results.

[20] Using the method of Conley (1999) to construct standard errors robust to spatial autocorrelation consistently resulted in smaller standard errors, which we do not report here.

manufacturing activity, and proximity to other demographic groups. We employ two approaches to measure pre-existing sorting associated with land use. First, we report the exposure to various uses experienced by the average member of each demographic group we study. Second, we regress a variety of land use variables on demographic composition along with basic spatial controls to understand the relationship between demographics and pre-existing land uses.

Table 2 reports the average exposure results. The first two columns of Panel A report the average number of four story and four to ten story buildings per acre experienced by the average member of each demographic group we study. Southern-born blacks had the highest exposure to both categories of tall structures, followed by northern blacks and then first-generation immigrants. However, first-generation immigrants experienced the highest population density (column 3). The ordering is similar for commercial enterprises per acre, noxious facilities per acre (defined as the number of Manufacturing class C uses), and general manufacturing facilities per acre (defined as Manufacturing classes B, C, and S uses) with both black groups and first-generation immigrants having the highest exposure (columns 4-6). Although industrial facility exposure was essentially equal across groups, southern blacks and first-generation immigrants were exposed to more noxious industrial uses than other groups (.007 uses per acre compared with .006 for northern blacks and .0046 for second-generation immigrants).

Minority exposure to other demographic groups is shown in Panel B. As we would expect, both northern and southern blacks live in enumeration districts with larger shares of other blacks. However, the sum of share northern and share southern black faced by the average southern black is only .64. We interpret this result as evidence that blacks were not completely segregated by race; we also note that many black individuals served as live-in maids in white neighborhoods and would have been enumerated in their employers' houses. Immigrants and native whites had very low exposure to blacks (average share .02 and .03, respectively). Finally, we observe that southern blacks lived on the cheapest land relative to other groups, with first-generation immigrants just behind them. The difference in land values faced by the average black and average third-generation white is a striking $35 ($90.66 versus $125.67 in 1913 dollars) and underscores the importance of controlling for land values in our regressions.

As a second approach, we compare the sorting patterns of blacks and immigrants using a reverse regression analysis to identify the relationship between demographic groups and land uses while controlling for potentially confounding correlations with other demographic or spatial

variables. We regress land use variables on our slate of demographic variables and (in some cases) additional controls. Panel A of Table 3 includes no spatial or land use controls; the results can thus be thought of as the characteristics of areas in the cities where minority groups lived relative to third-generation whites (the omitted demographic group).[21] Panel B of Table 3 presents the results of the same specifications with the full set of spatial controls, including the area of the enumeration district, ward fixed effects, and distances to the central business district, major street, Lake Michigan, nearest river, and nearest railroad; these results can be thought of as the urban characteristics faced by minorities relative to third-generation whites conditional on the particular neighborhood of the city in which they lived.

The results from these regressions suggest relationships similar to those obtained from the average exposure exercise. Areas of the city with more second-generation immigrants and northern blacks had fewer tall structures compared with areas having more native whites. This finding is consistent with the pictorial evidence in Figure 1 showing that second-generation immigrants lived the furthest from the center city. Whether we look across the city (Panel A) or within neighborhoods (Panel B), first-generation immigrants lived in the densest, most commercial areas while southern blacks were exposed to more noxious and non-noxious manufacturing relative to third-generation whites (see columns 3 and 4 for first-generation immigrants and columns 5 and 6 for southern blacks). Furthermore, first-generation immigrants located in more industrial areas of the city (Panel A, columns 5 and 6).

These results underscore the need to control for existing sorting according to land use when asking how the spatial distribution of minorities shaped the zoning ordinance. We note, however, that the land use and demographic composition relationships identified in Panel B are in many instances at odds with the zoning findings we report in the next section, suggesting that our main results cannot driven solely by pre-existing relationships between land use and demography that later influenced the zoning ordinance.

V. The Impact of Minority Share on Zoning Outcomes

a. Density Zoning

We begin our analysis by exploring whether density zoning was used as a tool to concentrate blacks in higher density neighborhoods, a potential precursor to modern day

[21] We include only our proxy for income, maids per head of household, as a control.

arguments regarding exclusionary zoning.[22] Because the volume districts were essentially concentric rings radiating out from the central business district, the key tradeoff is between adjacent volume categories. We focus on the two outermost rings, which were volume districts 1 and 2 (see Figure 5.A). Under zoning for volume district 1, buildings were effectively capped at 3 stories In volume district 2, apartment buildings could reach as high as 8 to 10 stories. As a result, volume districts 1 and 2 effectively delineated the boundary between locations where 8 to 10 story tenements were allowed and locations where residential development was limited to structures of no more than 3 stories. This boundary represents the relevant margin for the proto-exclusionary zoning behavior we seek to analyze. We therefore focus our analysis on the border between volume districts 1 and 2.

To test for a potential exclusionary zoning motive in the location of these boundaries, in Table 4 we report the results from a probit analysis with the outcome variable equal to one if the enumeration district received a majority of zoning for volume district 2. To make the results readily comparable across groups, we report both coefficient estimates and standard errors in units of standard deviations for the relevant demographic variable (for instance, the coefficient on the variable "southern black" is reported in units of the standard deviation of southern black share). The standard deviations for each variable are reported in Table 1.

Columns 1-4 report the results with the sample consists of the entirety of volume districts 1 and 2. We begin with a simple specification omitting any controls (columns 1 and 2) and then add the full set of controls for geography, land use, political boundaries, and economic values (see Appendix Table 1 for list) in columns 3 and 4. In the no-controls specification, the presence of blacks appears positively correlated with higher density zoning (and second-generation immigrants negatively correlated). However, adding controls reduces the magnitude of the black effect and shows a precisely estimated *negative* first-generation immigrant effect on the likelihood of higher density zoning. The p-value of the difference between the effects of black share and first-generation immigrant share is .000 (column 3). These results are consistent with an exclusionary zoning strategy that, at the margin, sought to create low density neighborhoods for recent white immigrants while containing blacks in higher density areas where they had

[22] A second potential vehicle through which the zoning ordinance could have been used to advance exclusionary motives would have been through the location of residential vs. apartment use zoning. However, in practice, residential zoning was restricted to outlying portions of the city in neighborhoods that were not proximate to significant numbers of black residents. Thus, there is little scope for an empirical analysis of tradeoffs along this margin.

settled. We note that the main area of the "black belt" shown in Figure 2 contained none of the lowest density category.

We provide a further test of the exclusionary motive by examining black settlements that were located outside the main area of the "black belt" and nearer to areas that contained the lowest density category. In particular, we rerun the model limiting the sample to neighborhoods that were located along the boundary between volume districts 1 and 2 (within 1000 feet of both types and excluding neighborhoods that included any volume zoning other than districts 1 and 2). Our estimates suggest that either a one standard deviation increase in black share or a one standard deviation decrease in the first-generation immigrant share was associated with a 16 to 17 percentage point increase in the likelihood that an enumeration district received a majority of higher density zoning (column 5).[23]

We highlight that, in general, first-generation immigrants lived in *more* densely populated neighborhoods (see Tables 2 and 3) than did blacks prior to the zoning. This fact implies that these findings are unlikely to be driven by ex ante sorting and helps to explain why the inclusion of spatial controls makes such a difference for the estimated coefficients. In column 6, we divide the black population by origin, and our results suggest that the black effect is being driven by southern migrants (although these findings are not significant). We do, however, show that the difference in the black and first-generation immigrant effects (column 5) and southern black and first-generation immigrant effects (column 6) are statistically different at the one percent level, underscoring the differential treatment of the two groups.

In some ways, these findings are unexpected because our reading of the history indicates that the overarching concern of the zoning board relating to density was to keep skyscrapers in the downtown area. However, our results also suggest that a pre-cursor to modern-day exclusionary zoning may be found in the implementation of Chicago's initial zoning law. At the time, both European immigrants and black migrants faced housing shortages. At the margin, the Chicago Zoning Board appeared to adopt a strategy designed to keep blacks in place through high-density housing. The tendency towards lower-density zoning in European immigrant neighborhoods suggests an expectation that these immigrants would spread out across the city. Given the existence at the time of public animus towards both recent European immigrants and

[23] We note that some caution is warranted as these estimates leverage a much smaller number of black neighborhoods than was the case for the sample which included the entire coverage of volume districts one and two.

blacks, one possibility is that this differential treatment reflected the 1921 passage of federal immigration restrictions. With the border closing, the tide of European immigration was effectively stemmed, while the inflow of southern blacks was likely to continue unabated. Nonetheless, our findings suggest an early form of exclusionary zoning that was applied to blacks only and altered the trajectory of neighborhood density faced by minority groups.

b. Manufacturing Zoning

We next examine the relationship between the size of various minority groups and the likelihood of being zoned for manufacturing uses, again scaling coefficients by the standard deviation of the respective minority group. Turning first to the presence of any manufacturing zoning in the neighborhood, columns 1 through 3 of Table 5 report coefficient estimates from versions of equation (1) where the dependent variable is an indicator for the presence of any manufacturing zoning in the neighborhood. We begin with a simple probit model omitting all controls; this specification can be thought of as the standard environmental justice regression that does not control for sorting into areas suited for manufacturing. The results show a significant positive relationship between black and first-generation immigrant share and the likelihood of receiving at least some zoning for manufacturing uses. In column 2 we include the full vector of controls described in Section IV. Although the pseudo R-squared rises from .038 to .739 with the addition of controls, the black share effect increases in magnitude to .053. The first-generation immigrant effect is reduced by 40 percent but it still significant (.050).

In column 3 we replicate column 2 with northern and southern blacks included separately. It is immediately clear from these results that the entire positive relationship between black share and the presence of manufacturing zoning is being driven by the southern black share. The coefficient estimates presented in Columns 1 and 2 indicate that enumeration districts with more first-generation immigrants were also more likely to be zoned for manufacturing uses. The magnitudes of these estimates are economically significant. The results in column 3 imply that a one standard deviation increase (roughly 13 percentage points) in southern black share is associated with an 8 percentage point increase in the likelihood of an enumeration district being zoned to include manufacturing uses. A standard deviation increase in the first-generation immigrant share (roughly 22 percentage points) is associated with a 5 percentage point increase in the likelihood of an enumeration district being zoned for manufacturing uses. These estimates

are particularly large given that only 26 percent of enumeration districts in our sample received any manufacturing zoning. In Contrast, northern blacks were *less* likely to get manufacturing zoning in their neighborhoods. This finding is consistent with the anecdotal evidence regarding the status of northern blacks in the zoning process. Neighborhoods with larger populations of northern blacks were likely wealthier, more exclusive, and better represented by the Zoning Commission. In particular, contemporary reports suggest that Charles S. Duke, an African American on the Zoning Commission, actively worked to protecting northern black interests during the zoning process (Schwieterman and Caspall, 2006).

So far, we have argued that manufacturing use zoning was unambiguously "bad" in the sense that minority communities thus zoned would face disproportionate environmental hazards and decreased future home values. However, it is also possible that poor minority groups benefited economically from living in close proximity to their places of employment due to lower transportation costs. While we do not believe this is a driving force in our results, it is possible that within this context a positive value for the indicator may reflect advantageously located manufacturing zoning at the neighborhood fringe. One response to this concern is to focus instead on the share of a neighborhood that is zoned for manufacturing uses. The motivation here is that a positive relationship between minority share and the *percentage* of manufacturing zoning may be more consistent with the notion of encroachment of industry into black and immigrant neighborhoods and a finding that minorities were disadvantageously zoned.

Thus, we replicate our basic model using the continuous outcome measure, the percent of the enumeration district zoned for manufacturing. Tobit results are presented in columns 4 through 6 of Table 5. The dichotomy between the experience of northern and southern blacks is highlighted in these specifications. Overall, a one standard deviation increase in black share is associated with a roughly 4 percent increase in the area of an enumeration district being zoned for manufacturing uses. This effect is again driven by southern blacks, with a standard deviation increase in southern black share associated with an 11 percent increase in manufacturing zoning. Northern blacks were protected from manufacturing zoning along the intensive margin as well. In standard deviation terms, the southern black effect is nearly twice as large as the effect on first-generation immigrant share (.112 versus .068). Finally, we do not see any evidence that second-generation immigrant neighborhoods were disadvantageously zoned relative to third-generation white neighborhoods on either the extensive or intensive margin. Thus, our primary

finding on manufacturing zoning is that southern black and first-generation immigrant neighborhoods were more likely to be zoned for manufacturing uses and tended to receive a larger amount of such zoning.[24]

So far our identification strategy has relied on controlling for an extensive set of spatial and pre-existing land use variables in addition to land prices, political influence, and a wealth proxy. We may nonetheless be concerned that our findings are driven by unobserved sorting of blacks and immigrants into industrial areas in a manner that is correlated with the initial zoning but not fully captured by our specification. To investigate the robustness of our approach, we rerun the specifications from Table 5 on samples of the city that would provide fewer opportunities for poor minority groups to sort into areas with high potential for manufacturing. We begin by restricting our sample to enumeration districts with no existing large-scale or noxious manufacturing uses (manufacturing classes C and S). We then further restrict the sample to enumeration districts without heavy or noxious uses that are also at least 500 feet away from such uses. Finally, we restrict the sample to enumeration districts at least 1000 feet away from any heavy or noxious uses. The results from probit and Tobit analyses on these restricted samples are presented in Table 6. Columns 1 and 4 present results from the least restricted samples while columns 3 and 6 present results from the most restricted samples. Results from each of the 3 different sample restrictions are quantitatively similar to the baseline results presented in Table 5.

c. Commercial Zoning

We next turn our attention to commercial zoning. While zoning for this use was undesirable for the wealthiest of neighborhoods that were exclusively residential, poor black and immigrant populations would likely have viewed close proximity to food stores, shops and entertainment venues as a benefit and would have viewed proximity to commercial uses as

[24] One potential area of interest is the fact that the first-generation immigrant group is itself composed of immigrants from many countries. In Appendix Table 1 we present the results from the indicator and continuous measures of industrial zoning with the first-generation immigrants further divided by sending country; these results are also presented in standard deviation terms. We observe that no group was as disadvantageously zoned for industrial uses as were southern blacks; furthermore, the coefficients on the share of the enumeration district population composed of the main ethnic groups (Polish, Russian, Italian, Irish, and German) are all quantitatively similar. Thus, it does not appear that any particular immigrant group was singled out for industrial zoning in the same way as southern blacks.

preferable to manufacturing uses.[25] Table 7 reports Tobit estimates of the relationship between demographics and the percentage of the enumeration district zoned for commercial uses.[26]

We begin with the standard specification without controls in column 1 of Table 7 (continuing to list outcomes in terms of standard deviations). There is no effect of either black or first-generation immigrant share on commercial zoning while second-generation immigrant share is associated with less commercial zoning. However, adding controls addresses the pre-zoning sorting shown in Tables 2 and 3, and these results are shown in column 2 (black share entered separately) and column 3 (northern and southern black share entered separately). Column 3 shows that the small negative effect on total black share is driven by the presence of southern blacks with northern blacks receiving more commercial zoning. Similarly to the manufacturing results, we also find that first-generation immigrant neighborhoods also received less commercial zoning. We investigate the channels through which various groups received more manufacturing or commercial zoning in the next section.

d. Decomposing the Commercial Zoning vs. Manufacturing Zoning Tradeoff

To fully understand the mechanisms through which minority neighborhoods received more manufacturing and less commercial zoning, we split the sample by pre-existing levels of manufacturing and commercial activity and reproduce our baseline specifications in Table 8. Panel A presents results by quartile of pre-existing commercial use density, and Panel B by quartile of pre-existing manufacturing use density. For parsimony, we only present the coefficient estimates for the enumeration district's percent southern black and percent foreign born, again scaled so that the coefficients reflect the estimated effect of a one standard deviation increase in the given demographic group. The underlying regressions include the entire set of control and demographic variables that were incorporated in the baseline specification (listed in Appendix Table 1). To give a sense of scale and overall zoning patterns, we also present the average percentage of the neighborhoods in each quartile that were zoned for commercial or manufacturing uses. We also report by quartile the number of neighborhoods whose population

[25] An African American member of the Zoning Commission, Charles S. Duke, succeeded in removing two objectionable parts of the zoning ordinance covering the Black Belt, one of which would have extended a commercial district through Grand Boulevard where most of the "better colored homes" were situated (Schwieterman and Caspall, 2006, p. 29).

[26] Commercial zoning was much more prevalent than manufacturing zoning: 86 percent of enumeration districts received at least some commercial zoning, while only 26 percent received any manufacturing zoning. Thus, there is little reason to model commercial zoning outcomes using an indicator variable.

is at least 10 percent southern black populations and greater than 40 percent first-generation immigrant.[27]

Focusing first on the commercial density decomposition, we note that there is a systematic relationship between pre-existing commercial density and the zoning of land for manufacturing and commercial uses. Moving from the first quartile to the fourth quartile in commercial density (from low levels of pre-existing commercial activity to high levels of pre-existing commercial activity), the average percentage of a neighborhood that received manufacturing zoning decreases monotonically from 16 to 4 percent. Furthermore, the average percentage of a neighborhood receiving commercial zoning increases monotonically from 9 to 36 percent. This decomposition reinforces McMillan and McDonald's (1999) finding that Chicago's initial zoning ordinance was significantly influenced by pre-existing land uses.

The regression results in Panel A also shed light on our finding that neighborhoods containing larger numbers of southern blacks or first-generation immigrants received larger shares of manufacturing zoning and smaller shares of commercial zoning, controlling for pre-existing land uses and geography. The largest concentration of neighborhoods comprised of at least 10 percent southern blacks occurs in the third quartile of the commercial density distribution. On average, these neighborhoods received a high level of commercial zoning and relatively low levels of manufacturing zoning. However, our regression results for these neighborhoods indicate that a one standard deviation increase in southern black share is associated with an almost 10 percentage point decrease in commercial zoning and a 3 percentage point increase in manufacturing zoning (relative to baseline averages of 25 percent and 7 percent, respectively). Thus, the presence of southern blacks appears to be associated with a significant shift away from potentially more desirable commercial zoning and towards manufacturing zoning in these neighborhoods.

A second dimension of the manufacturing effect is evident in the first quartile neighborhoods, which on average received high levels of manufacturing zoning. While these neighborhoods contain fewer southern blacks than those in any other quartile, when southern blacks are present, they are associated with a significant increase in the level of manufacturing zoning. A one standard deviation increase in southern black share is associated with a 4.6

[27] We use a 10 percent cutoff for southern blacks and a 40 percent cutoff for foreign immigrants to characterize the presence of "enclaves" because of the difference in their relative size in the overall population.

percentage point increase, relative to a base of 16 percent. The first-generation immigrant results are generally similar to those for southern blacks with the exception that we do not see clear evidence of substitution between commercial and manufacturing in the third quartile of commercial density.

Panel B of Table 8 replicates the top panel with the sample decomposed based on pre-existing manufacturing density.[28] Very little manufacturing zoning was applied in these first quartile neighborhoods, all of which had no pre-existing manufacturing; on average, only 1.8 percent of these neighborhoods were zoned for manufacturing. The coefficient estimates from this quartile suggest that a large portion of the manufacturing zoning that did occur in these areas which had no extant manufacturing activity was concentrated in neighborhoods with large southern black and immigrant populations. The second quartile reveals a similar result for immigrants but not for southern blacks, although there were very few neighborhoods with a large number of southern blacks in this quartile.

Panel B also shows that higher levels of pre-existing manufacturing were generally associated with higher proportions of commercial zoning. The largest concentrations of southern blacks occurred in the third quartile of pre-existing manufacturing, while the largest concentrations of first-generation immigrants occurred in the fourth quartile. Both groups were associated with significantly lower levels of commercial zoning in these quartiles: a one standard deviation increase in southern black share in the third quartile led to 6.3 percentage points less commercial zoning, relative to an average of 23.4 percent, while a one standard deviation increase in first-generation immigrant share in the fourth quartile led to 5.6 percentage points less commercial zoning, relative to an average of 33.6 percent. We also note that for southern blacks, there is evidence that, in the third quartile, they are associated with substitution from commercial zoning to manufacturing zoning. This last result mimics the finding from Panel A: the presence of southern blacks led to an overall shift out of commercial zoning and into manufacturing zoning in neighborhoods that could have received either type based on existing uses.

e. **Impact of 1923 Zoning on 1940 Housing Density and Zoning Revisions**

[28] Here, there are 577 enumeration districts with no pre-existing manufacturing uses. As a result, the first and second quartiles differ in their number of observations.

In Table 9 we explore whether inequitable treatment in the initial zoning ordinance had persistent effects. We begin with the density component of the ordinance, linking the volume zoning outcome in 1923 to housing and population density from the 1940 census. We are also interested in the impact of the use zoning ordinance on the location of industrial and commercial activity over time; however, the limited availability of land use data in the early twentieth century makes it difficult to undertake a similar analysis for this part of the ordinance.[29] Instead, we digitized the first major revision to the Chicago zoning ordinance, which occurred in 1942, to examine the persistence of use zoning. We show in a companion paper (Shertzer, Twinam, and Walsh, 2014) that the 1923 zoning ordinance had robust effects on the location of commercial and industrial activity in 2005. Assessing the persistence in zoning over the 1923 to 1942 period thus sheds light on the channels through which the initial zoning ordinance affected minority exposure to industry and commerce over the ensuing decades.

For the density persistence analysis, we begin with the sample of 1920 census enumeration districts that were located 1000 feet from the border between the two most restrictive volume zoning categories from the 1923 ordinance and proceed in a similar manner to our exclusionary zoning analysis in part *a*. The population and housing unit density of these geographic units in 1940 is interpolated using the 1940 census tracts. Our specifications include the full set of controls for 1922 land use, building characteristics, population density, geography, and land values employed in the main analysis (see Appendix Table I for the full list), plus the 1923 zoning shares. Column 1 shows that moving to the lowest density category from the second lowest (from volume category 2 to 1) is associated with 1.6 fewer housing units per acre in 1940. The average housing unit density in this sample is 10.9, so this effect represents a 15 percent decrease with respect to the mean. These results suggest that zoning had a causal effect on the subsequent development of the housing stock. Taken together with our results from part *a.*, these findings suggest that black neighborhoods became more densely developed relative to immigrant neighborhoods within two decades of the zoning ordinance. The effect of lower density zoning on population density is negative and significant at the 10 percent level (column 2).

[29] For instance, the microdata for the census of manufacturers were not generally preserved in the same manner as the microdata for the census of the population in the early twentieth century.

Turning to use zoning, we find strong evidence of persistence. Column 3 indicates that a standard deviation increase in 1923 industrial zoning share is associated with an 18.6 percent increase in industrial zoning share in 1942 (.196*.952=.186) off a base of 9 percent. The effect is similarly large if we use an indicator for any industrial zoning (column 4), with the presence of industrial zoning in 1923 associated with a 65 percentage point increase in the likelihood of industrial zoning in 1942. Finally, we find that commercial zoning is persistent to a similar degree (column 5). Taken together with our main findings, these results suggest that the inequitable treatment of minorities in the use zoning ordinance had meaningful impacts and persisted for decades.

VI. Conclusion

This paper examines the introduction of zoning in Chicago and asks whether ostensibly race blind comprehensive zoning ordinances discriminated against minorities. We find evidence that neighborhoods with more black residents were more likely to be zoned for higher density buildings, suggesting that volume restrictions were used as an early form of exclusionary zoning. We also find robust and quantitatively important evidence that otherwise comparable neighborhoods with larger populations of blacks or immigrants were zoned disproportionately for manufacturing, suggesting environmental racism was present in the zoning process. Our results are robust to the inclusion of an extensive set of controls for geography, existing land use, land prices, and political factors; it is thus unlikely that sorting of minorities into neighborhoods suitable for industry can explain our results.

These findings suggest that zoning reshaped the urban landscape faced by black and immigrant residents of the city of Chicago. Immigrants had selected into more densely populated neighborhoods in the early twentieth century, but one result of the zoning ordinance was to reduce the density of immigrant neighborhoods in the future via constraints on building height. Meanwhile, black neighborhoods were zoned for higher building density along the same margin. Zoning for higher density and mixed uses meant that minorities were excluded from the economic benefit of low density, purely residential zoning in the 1923 ordinance in terms of increased property values. Moreover, greater exposure to industrial uses may have adversely affected the health of blacks and immigrants relative to native whites. The findings of this paper

indicate that zoning may have played a significant causal role in the adverse experience of minorities documented in the environmental justice and exclusionary zoning literature, and further research is needed to study the long-term impacts of land use regulation.

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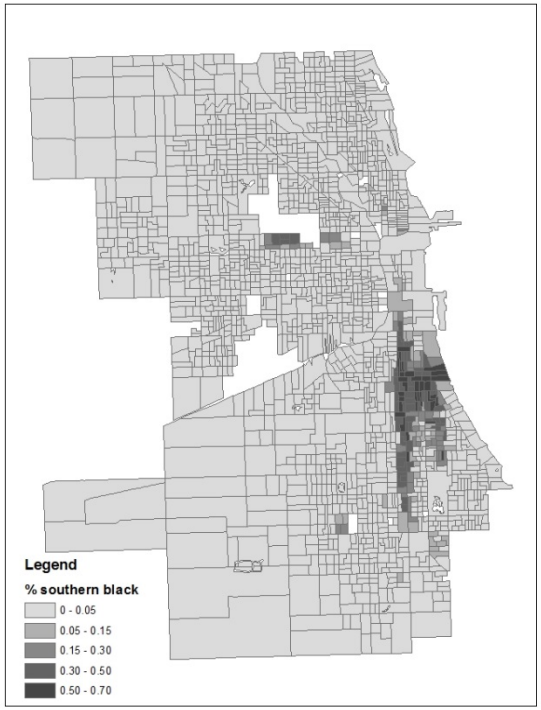
Figure 1. Distribution of Minorities across Chicago in 1920

Panel A. Distribution of Southern-Born Blacks



Panel B. Distribution of Northern-Born Blacks

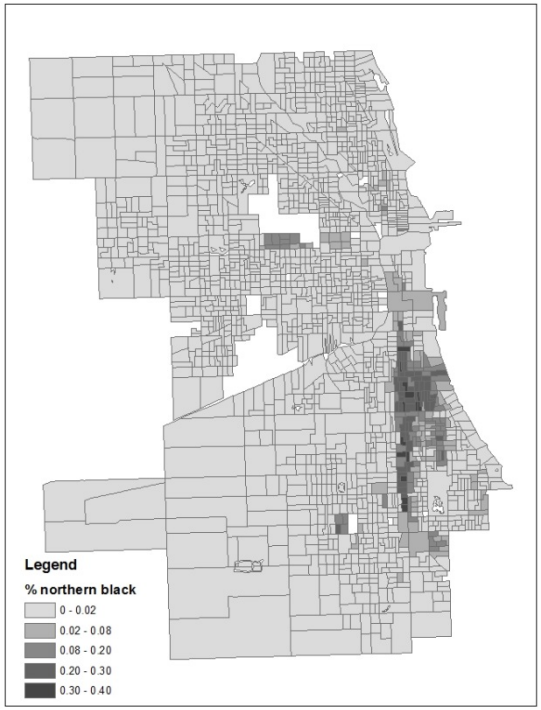
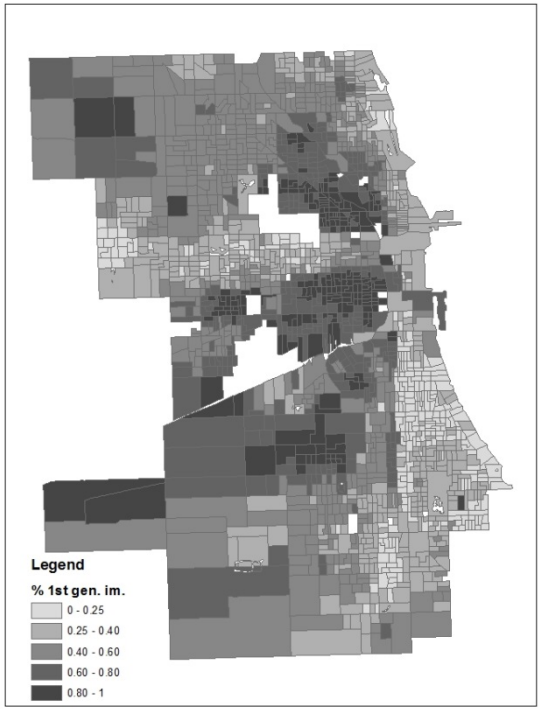
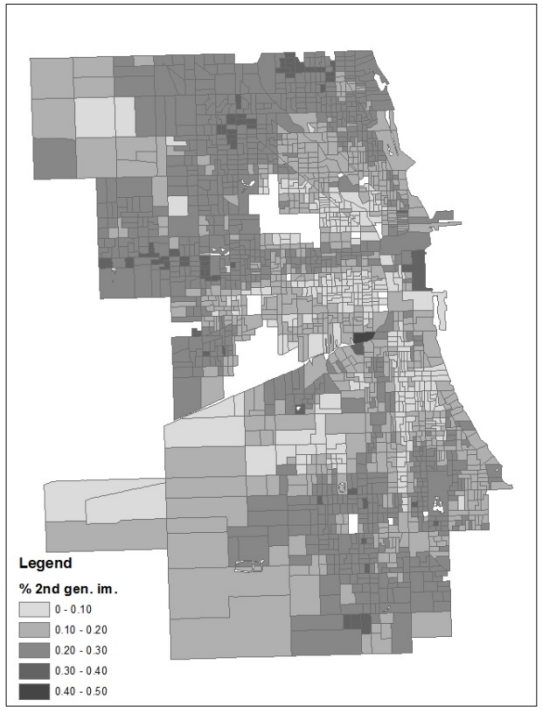


Figure 1. Distribution of Minorities across Chicago in 1920, continued

Panel C. Distribution of First-Generation Immigrants



Panel D. Distribution of Second-Generation Immigrants



Notes: The sample covers the 1800 enumeration districts for which we have digitized land use data and census data. Missing areas in the center of the city are due to either missing data from Ancestry.com or illegible land use maps (84 out of 1884 enumeration districts in the sample were omitted. Southern blacks are black individuals born in the South or black individuals born in the North whose fathers were born in the South. Northern blacks are black individuals born in the North whose fathers were also born in the North. First-generation immigrants are individuals born abroad or minor second-generation immigrants (aged 18 or younger). Second-generation immigrants are individuals aged 18 and above who were born in the United States but whose fathers were born abroad.

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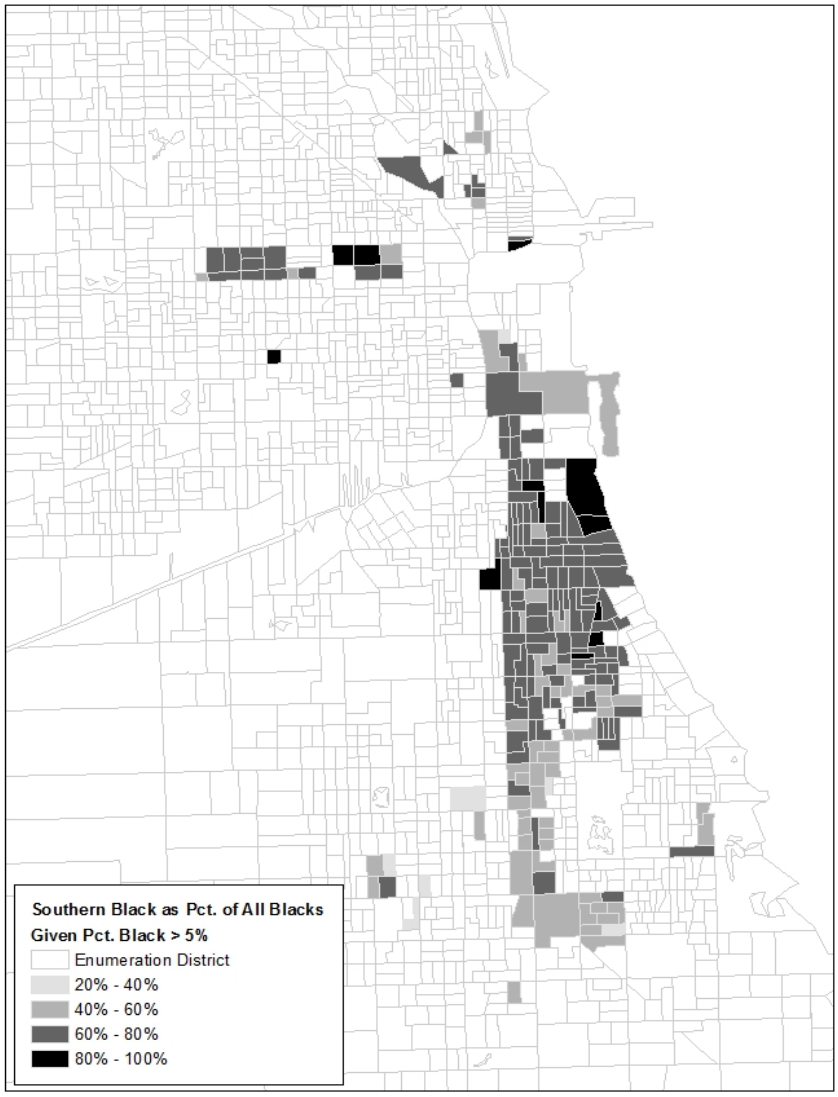
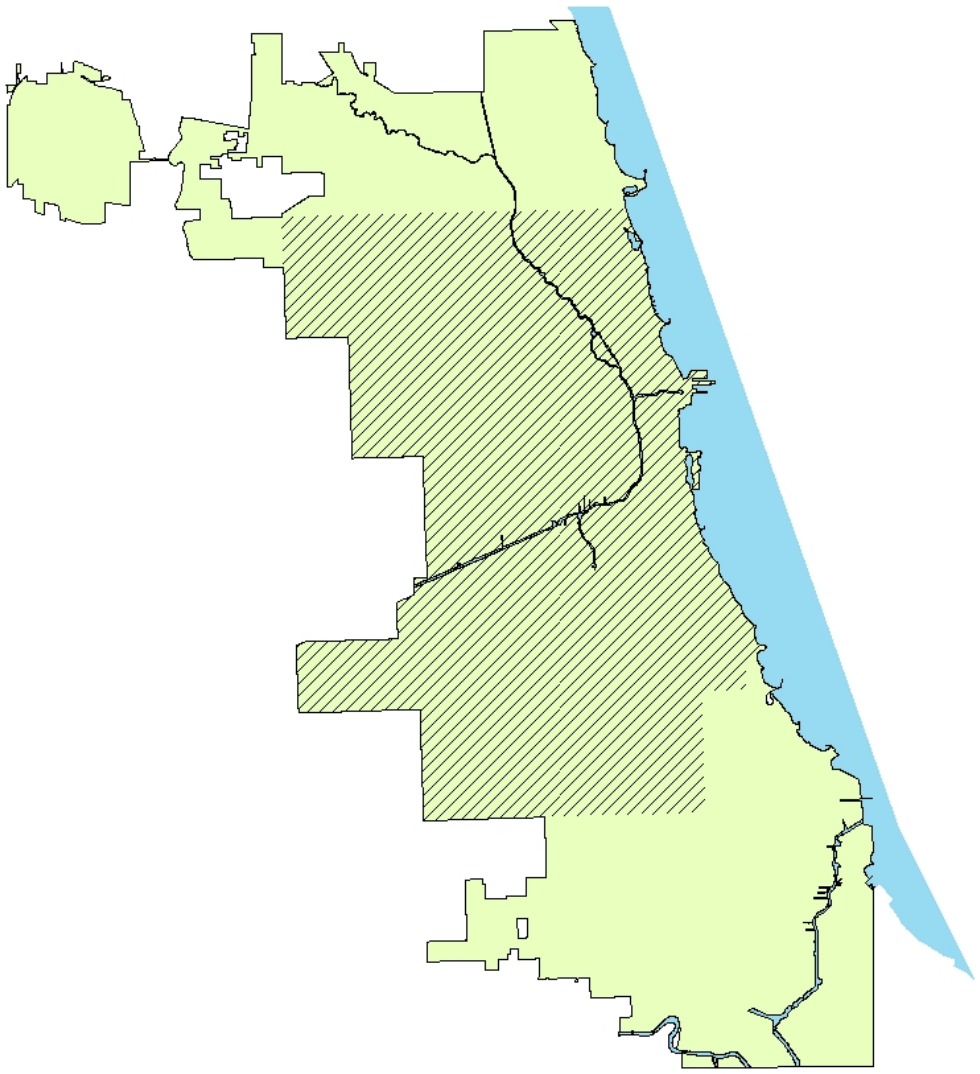
Figure 2. Distribution of Southern Blacks as Percentage of All Blacks



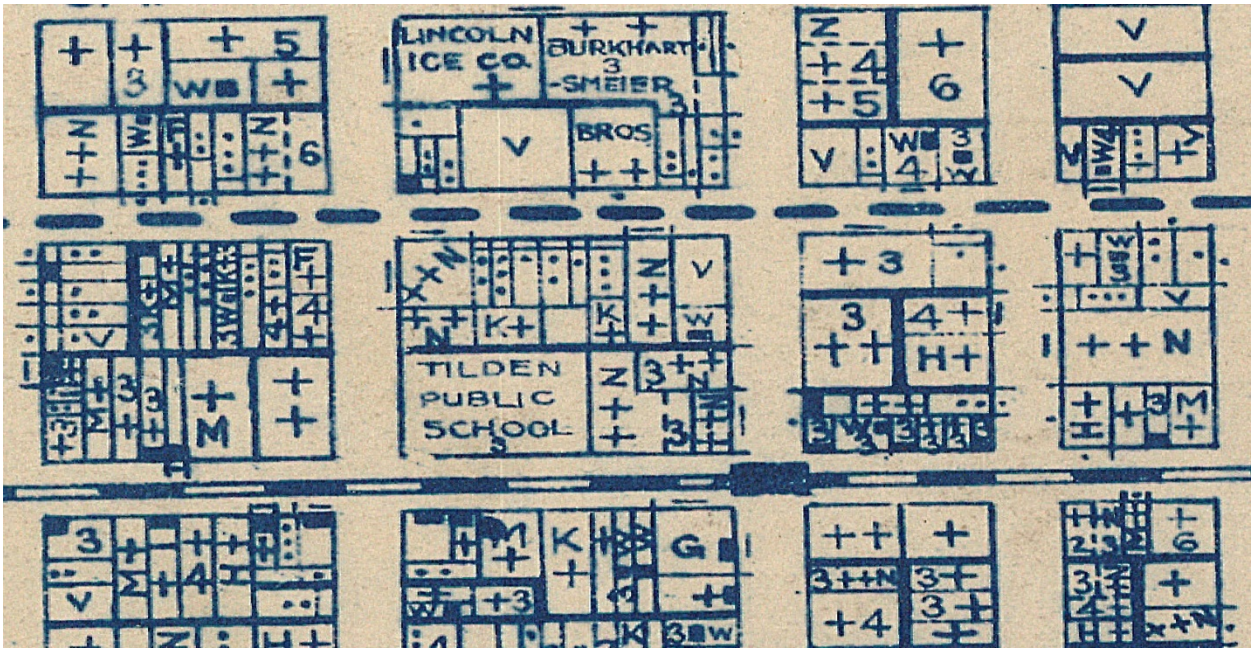
Notes: The figure shows the share of the percentage of each enumeration district's black population that we classify as being southern black among the sample of enumeration districts that are at least five percent black. Southern blacks are black individuals born in the South or black individuals born in the North whose fathers were born in the South.

Figure 3. Sample Coverage



Notes: The image shows the current (2013) borders of Chicago. The hatched area is the section covered by our sample. Our sample covers 64 percent of the 1920 area of Chicago and 56 percent of the current city area.

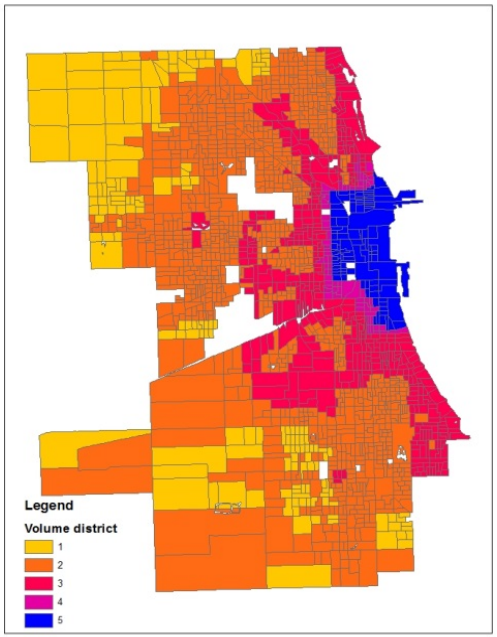
Figure 4. Land Use Map Sample



Notes: A portion of the 1922 land use survey map created by the Chicago Zoning Commission. These blocks are located just across the Chicago River to the west of the downtown.

Figure 5. Zoning Maps

Panel A: Digitized Volume Zone Map



Notes: This map shows volume districts in the Chicago zoning ordinance with enumeration districts assigned to the volume district in which the majority of its area fell. District 5 permitted the tallest buildings, up to 22 stories. District 1 was the most restrictive, allowing only buildings with three or fewer stories.

Panel B: Use Zoning Map Sample

Notes: This image shows the area of Chicago west of the downtown along the Chicago River. Unhatched areas are zoned for apartments, hatched areas are zoned for commercial uses, and cross-hatched areas are zoned for manufacturing.

Table 1. Descriptive Statistics

Percent manufacturing	0.097
	(0.196)
Percent manufacturing if greater than 5 percent	0.371
	(0.214)
Indicator for manufacturing zoning	0.262
	(0.440)
Percent commercial zoning	0.218
	(0.181)
Indicator for volume district 2 if within 500 feet of district 1 and 2	0.587
	(0.493)
Total blacks	0.057
	(0.181)
Southern blacks	0.039
	(0.126)
Northern blacks	0.018
	(0.057)
First-gen. immigrants	0.462
	(0.221)
Second-gen. immigrants	0.208
	(0.080)
1913 land values	103.368
	(386.982)

Notes: Descriptive statistics for primary outcome and explanatory variables at the enumeration district (ED) level. Means are given with standard deviations in parentheses. Statistics are computed on the full sample unless otherwise indicated. Percentages of zoning variables are the fraction of the area of each ED covered by the specified type of zoning. Indicators equal 1 if and only if the ED includes any of the specified zoning. Demographic variables are the fraction of the total ED population attributed to each group. See Figure 1 for demographic group definitions.

Table 2. Exposure to Urban Features and other Demographic Groups

Panel A Group	Number 4+ story buildings (1)	Number 4-10 story buildings (2)	Population density (3)	Commercial enterprises per acre (4)	Noxious facilities per acre (5)	Industrial facilities per acre (6)
Southern blacks	0.19	0.22	64.91	0.91	0.0072	0.02
Northern blacks	0.17	0.21	64.21	0.89	0.0060	0.02
First-gen. immigrants	0.12	0.15	70.09	1.01	0.0070	0.02
Second-gen. immigrants	0.08	0.11	58.01	0.72	0.0046	0.01
Third-gen. whites	0.10	0.14	55.00	0.64	0.0040	0.01
Sample Average	0.11	0.15	58.03	0.79	0.0071	0.02

Panel B Group	Share southern black (1)	Share northern black (2)	Share first gen. immigrant (3)	Share sec. gen. immigrant (4)	Share white 3rd gen. (5)	1913 avg. land prices (6)
Southern blacks	0.45	0.19	0.16	0.08	0.14	90.66
Northern blacks	0.42	0.19	0.17	0.09	0.15	96.69
First-gen. immigrants	0.01	0.01	0.60	0.19	0.20	93.11
Second-gen. immigrants	0.01	0.01	0.45	0.23	0.29	92.15
Third-gen. whites	0.02	0.01	0.38	0.23	0.36	125.67
Sample Average	0.04	0.02	0.46	0.21	0.27	103.37
Sample Std. Dev.	0.13	0.06	0.22	0.08	0.16	386.98

Notes: The numbers in panel A reflect the average value of the variable specified for the column experienced by the average member of the group specified for the row. For example, first two columns of Panel A report the average number of four story and four to ten story buildings per acre experienced by the average member of each demographic group we study. Panel B documents minority exposure to other demographic groups as well as the typical 1913 average land value experienced by the typical member of each group. The demographic data come from Ancestry.com and the land use counts were computed using the 1922 Land Use Survey created by the Chicago Zoning Commission. See Figure 1 for demographic group definitions.

Table 3. Pre-existing Sorting of Minority Groups across the City and Neighborhoods

Panel A (no controls)	Number 4+ story buildings (1)	Number 4-10 story buildings (2)	Population density (3)	Commercial enterprises per acre (4)	Noxious facilities per acre (5)	Industrial facilities per acre (6)
Southern black share	0.0167	-0.105	9.211	0.461	0.0553*	0.0750
	(0.125)	(0.162)	(18.55)	(0.393)	(0.0297)	(0.0464)
Northern black share	-0.718***	-0.849**	11.42	0.355	-0.115**	-0.130
	(0.255)	(0.372)	(37.47)	(0.804)	(0.0551)	(0.0886)
First-gen. immigrant share	-0.123***	-0.216***	38.85***	1.212***	0.0116***	0.0436***
	(0.0335)	(0.0466)	(5.800)	(0.106)	(0.00410)	(0.00865)
Second-gen. immigrant share	-1.239***	-1.655***	-75.03***	-1.965***	-0.0307***	-0.0575**
	(0.0971)	(0.136)	(16.22)	(0.304)	(0.0119)	(0.0272)
R-squared	0.128	0.104	0.112	0.243	0.030	0.058
Panel B (with controls)						
Southern black share	0.150	0.173	0.357	0.0187	0.0734**	0.0875*
	(0.121)	(0.133)	(16.17)	(0.366)	(0.0306)	(0.0471)
Northern black share	-0.307	-0.287	-13.74	0.886	-0.121**	-0.132*
	(0.225)	(0.298)	(32.05)	(0.733)	(0.0470)	(0.0769)
First-gen. immigrant share	-0.0592	-0.0446	24.39***	0.755***	0.00420	0.0106
	(0.0452)	(0.0606)	(7.188)	(0.141)	(0.00678)	(0.0135)
Second-gen. immigrant share	-0.303***	-0.188	-52.20***	-0.907***	0.0105	0.0104
	(0.0991)	(0.138)	(17.02)	(0.325)	(0.0158)	(0.0353)
R-squared	0.576	0.641	0.541	0.547	0.187	0.273

Notes: This table compares the sorting patterns of blacks and immigrants using a reverse regression analysis to identify the relationship between demographic groups and land uses while controlling for potentially confounding correlations with other demographic or spatial variables. Panel A includes no spatial or land use controls; the results can be thought of as the characteristics of areas in the cities where minority groups lived relative to third-generation whites. Panel B presents the results of the same specifications with the full set of geographic controls listed in Appendix Table 1; these results can be thought of as the urban characteristics faced by minorities relative to third-generation whites conditional on the particular neighborhood of the city in which they lived. See Figure 1 for demographic group definitions.

Table 4. Effect of Minority Share on Volume Zoning

	Indicator for Receiving a Majority Zoning for Higher Density					
	(1)	(2)	(3)	(4)	(5)	(6)
Total black percent share	0.130*		0.0340		0.163**	
	(0.0757)		(0.0278)		(0.0682)	
Southern black share		0.211		-0.00348		0.187
		(0.227)		(0.0619)		(0.138)
Northern black share		-0.0456		0.0303		-0.00489
		(0.135)		(0.0446)		(0.103)
First-gen. immigrant share	0.00782	0.00789	-0.0729***	-0.0731***	-0.177**	-0.176**
	(0.0168)	(0.0168)	(0.0249)	(0.0249)	(0.0743)	(0.0741)
Second-gen. immigrant share	-0.0456***	-0.0454***	-0.00331	-0.00334	0.0626	0.0620
	(0.0175)	(0.0175)	(0.0179)	(0.0179)	(0.0473)	(0.0474)
1913 land values			2.520***	2.527***	6.091***	6.088***
			(0.488)	(0.490)	(1.347)	(1.351)
Diff. between black and first-gen. effect (p-value)	0.083		0.000		0.000	
Diff. between south. black and first-gen. effect (p-value)		0.368		0.273		0.012
Pseudo-R^2	0.037	0.037	0.675	0.676	0.529	0.529
Sample	Vol 1 & 2	Vol 1 & 2	Vol 1 & 2	Vol 1 & 2	Within 1000 ft of 1 & 2	
Controls	N	N	Y	Y	Y	Y
Observations	1,228	1,228	1,164	1,164	380	380

Notes: Columns (1)-(4) are restricted to areas that were zoned for volume districts 1 and 2 (the two lowest density areas). For columns (5)-(6), the sample is restricted to EDs within 1000ft of the border between volume districts 1 and 2 and excluding EDs containing any other type of volume zoning. The outcome indicator is equal to one if the enumeration district received a majority of volume district 2 zoning, the higher density type. The specifications in columns (3)-(6) include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions.

Table 5. Effect of Minority Share on Manufacturing Zoning

	Indicator for Any Industrial Zoning in ED			Percent of ED Zoned Industrial		
	Probit			Tobit		
	(1)	(2)	(3)	(4)	(5)	(6)
Total black share	0.0428***	0.0536***		0.0626***	0.0420***	
	(0.0164)	(0.0122)		(0.0238)	(0.0158)	
Southern blacks share			0.0770***			0.112***
			(0.0147)			(0.0208)
Northern black share			-0.0232**			-0.0655***
			(0.0118)			(0.0174)
First-gen. immigrant share	0.0806***	0.0496***	0.0496***	0.135***	0.0669***	0.0682***
	(0.0150)	(0.0154)	(0.0153)	(0.0228)	(0.0198)	(0.0196)
Second-gen. immigrant share	-0.0210	0.0323**	0.0316**	-0.0448*	-0.0175	-0.0179
	(0.0161)	(0.0127)	(0.0127)	(0.0245)	(0.0162)	(0.0160)
1913 land values		0.0371**	0.0408**		0.000608	0.00557
		(0.0180)	(0.0177)		(0.00995)	(0.0108)
Controls	N	Y	Y	N	Y	Y
Pseudo-R^2	0.038	0.739	0.742	0.056	0.916	0.923
Observations	1,800	1,789	1,789	1,800	1,800	1,800

Notes: All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions.

Table 6. Effect of Minority Share on Manufacturing Zoning Robustness

	Indicator for Any Industrial Zoning in ED Probit			Percent of ED Zoned Industrial Tobit		
	No C or S	No C or S and 500 feet away	No C or S and 1000 feet away	No C or S	No C or S and 500 feet away	No C or S and 1000 feet away
	(1)	(2)	(3)	(4)	(5)	(6)
Southern black share	0.0924***	0.0621***	0.0797***	0.145***	0.136***	0.158***
	(0.0161)	(0.0165)	(0.0280)	(0.0277)	(0.0288)	(0.0371)
Northern black share	-0.0319**	-0.0260**	-0.0490**	-0.0651***	-0.0443**	-0.0485**
	(0.0124)	(0.0127)	(0.0235)	(0.0213)	(0.0217)	(0.0242)
First-gen. immigrant share	0.0498***	0.0398**	0.0353	0.0996***	0.110***	0.127***
	(0.0178)	(0.0195)	(0.0223)	(0.0244)	(0.0280)	(0.0357)
Second-gen. immigrant share	0.0367**	0.0282*	0.0176	0.0212	0.0378	0.0488
	(0.0144)	(0.0164)	(0.0191)	(0.0208)	(0.0246)	(0.0299)
Observations	1,481	1,147	765	1,504	1,199	838

Notes: All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions. Columns (1) and (4) include only enumeration districts with no Class C or S manufacturing. Columns (2) and (5) include only enumeration districts with no Class C or S manufacturing that are at least 500 feet away from such uses. Columns (3) and (6) include only enumeration districts with no Class C or S manufacturing that are at least 1,000 feet away from such uses.

Table 7. Effect of Minority Share on Commercial Zoning

	Percent of ED Zoned Commercial		
		Tobit	
	(1)	(2)	(3)
Total black percent share	0.0108	-0.0161*	
	(0.00856)	(0.00828)	
Southern black share			-0.0514***
			(0.0163)
Northern black share			0.0351**
			(0.0137)
First-gen. immigrant share	-0.00726	-0.0420***	-0.0412***
	(0.00741)	(0.00848)	(0.00848)
Second-gen. immigrant share	-0.0470***	-0.0168**	-0.0155**
	(0.00739)	(0.00713)	(0.00713)
1913 land values		-0.0104**	-0.0113**
		(0.00517)	(0.00520)
Controls			
Observations	1,800	1,800	1,800

Notes: All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions.

Table 8. Main Result by Commercial and Manufacturing Activity Quartiles

Panel A: Commercial Density	1st Quart.	2nd Quart.	3rd Quart.	4th Quart.
Pct. Zoned Manufacturing				
Avg. pct. zoned manufacturing	15.97%	12.16%	6.78%	4.05%
Percent southern black share	0.0467***	0.0131	0.0315*	0.0236
	(0.0158)	(0.0193)	(0.0187)	(0.0182)
Percent foreign born share	0.0563***	0.00398	0.0184	-0.00531
	(0.0187)	(0.0150)	(0.0146)	(0.00997)
Pct. Zoned Commercial				
Avg. pct. zoned commercial	9.25%	16.52%	25.23%	36.11%
Percent southern black share	0.00618	-0.000764	-0.0966***	-0.0406
	(0.0393)	(0.0269)	(0.0321)	(0.0260)
Percent foreign born share	0.00604	-0.0243	-0.0465**	-0.0712***
	(0.0110)	(0.0177)	(0.0197)	(0.0203)
# of observations	450	450	450	450
# of observations w/ s. black > 10%	22	40	54	45
# of observations w/ for. born > 40%	164	233	256	325

Panel B: Manufacturing Density	1st Quart.	2nd Quart.	3rd Quart.	4th Quart.
Pct. Zoned Manufacturing				
Avg. pct. zoned manufacturing	1.76%	12.15%	12.97%	15.00%
Percent southern black share	0.0188*	0.00256	0.0328*	0.0117
	(0.0109)	(0.0525)	(0.0188)	(0.0187)
Percent foreign born share	0.0134**	0.0613***	-0.00725	-0.0107
	(0.00645)	(0.0215)	(0.0155)	(0.0174)
Pct. Zoned Commercial				
Avg. pct. zoned commercial	13.88%	17.21%	23.37%	33.59%
Percent southern black share	0.0237	-0.161**	-0.0625**	-0.0283
	(0.0258)	(0.0628)	(0.0290)	(0.0272)
Percent foreign born share	-0.0116	-0.000510	-0.0172	-0.0561**
	(0.0124)	(0.0201)	(0.0177)	(0.0239)
# of observations	577	323	450	450
# of observations w/ s. black > 10%	38	11	61	51
# of observations w/ for. born > 40%	233	206	239	300

Notes: Outcome variables in panel A are the percent of the enumeration district zoned industrial and commercial (as indicated), with regressions run on subsamples defined by quartile of commercial density. Outcome variables in panel B are the percent of the enumeration district zoned industrial or commercial, respectively, with regressions run on subsamples defined by the quartile of manufacturing (A, B, C, D and S) density. All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions. All models are estimated using OLS.

Table 9. Impact of 1923 Zoning Ordinance on 1940 Outcomes

	Housing Unit Density	Population Density	Percent Zoned Industrial	Indicator for Industrial Zoning	Percent Zoned Commercial
	(1)	(2)	(3)	(4)	(5)
Percent 1923 lowest density zoning	-1.484***	-3.638*	0.0521	-0.0205	0.0195
	(0.548)	(1.909)	(0.0941)	(0.116)	(0.0446)
Percent 1923 industrial zoning	-4.747**	-13.82*	0.952***	0.648***	0.0643**
	(2.285)	(8.146)	(0.0421)	(0.0554)	(0.0269)
Percent 1923 commercial zoning	0.167	1.093	0.225***	0.143***	0.668***
	(2.171)	(7.453)	(0.0551)	(0.0464)	(0.0289)
Model	OLS	OLS	Tobit	Probit	Tobit
Observations	347	347	1,800	1,687	1,800

Notes: The sample in columns (1) and (2) is restricted to EDs within 1000ft of the border between density districts 1 and 2. The housing density is defined as the number of housing units per acre in the 1940 census. Population density is defined as individuals per acre from the 1940 census. The zoning outcomes in columns (3)-(5) are from the revision to the Chicago zoning ordinance issued in 1942. The unit of observation for all specifications is the 1920 enumeration district. Zoning and density measures from the 1940 decade are assigned to these geographic areas using areal interpolation. All specifications include the full vector of controls listed in Appendix Table 1.

Appendix Table I. Full Results with Manufacturing Zoning as Outcome

	Percent of ED Zoned Industrial (1)	Ind. for Industrial Zoning in ED (2)
Southern black share	0.0338***	0.0767***
	(0.00947)	(0.0233)
Northern black share	-0.0235***	-0.0224
	(0.00815)	(0.0219)
First-generation immigrant share	0.0142**	0.0671***
	(0.00711)	(0.0201)
Second-generation immigrant share	-0.00550	0.0164
	(0.00631)	(0.0163)
Geographic controls		
ED area (acres)	-0.000142	0.000311
	(0.000258)	(0.000556)
ED area^2 (acres)	-1.53e-07	-7.60e-07
	(5.18e-07)	(1.29e-06)
ED area^3 (acres)	2.98e-10	6.94e-10
	(3.72e-10)	(9.10e-10)
ED area^4 (acres)	0.0000	0.0000
	0.0000	0.0000
CBD indicator	-0.0461*	-0.0575
	(0.0240)	(0.0556)
Distance to the CBD	-0.0678**	-0.0202
	(0.0313)	(0.0707)
Distance to the CBD^2	-0.0160	0.0138
	(0.0156)	(0.0390)
Distance to the CBD^3	-0.0233***	-0.0516***
	(0.00777)	(0.0194)
Distance to the CBD^4	0.0101**	0.0162
	(0.00394)	(0.0101)
Major street indicator	0.0121	-0.0222
	(0.0200)	(0.0666)
Distance to nearest major street	0.00468	-0.0101
	(0.0106)	(0.0330)
Distance to nearest major street^2	-0.00138	0.000285
	(0.00118)	(0.00374)
Population Density	-0.00551***	-0.00560**
	(0.00109)	(0.00218)
Population Density^2	4.98e-05***	3.32e-05
	(1.34e-05)	(2.80e-05)

Population Density^3	-1.83e-07***	-4.69e-08
	(6.13e-08)	(1.35e-07)
Population Density^4	2.22e-10***	0.0000
	(8.54e-11)	(1.94e-10)
Coast indicator	-0.0716***	0.0460
	(0.0221)	(0.0561)
Distance to Lake Michigan	-0.0361	-0.147***
	(0.0267)	(0.0537)
Distance to Lake Michigan^2	-0.00909	-0.000609
	(0.0126)	(0.0342)
Distance to Lake Michigan^3	0.0428***	0.121***
	(0.00805)	(0.0195)
Distance to Lake Michigan^4	-0.0125***	-0.0373***
	(0.00278)	(0.00735)
Distance to the nearest river	0.0383**	0.166***
	(0.0177)	(0.0423)
Distance to the nearest river^2	-0.00268	-0.103***
	(0.0115)	(0.0311)
Distance to the nearest river^3	-0.00669	-0.0385*
	(0.00944)	(0.0212)
Distance to the nearest river^4	0.00293	0.0226**
	(0.00366)	(0.00936)
Railroad indicator	0.0640***	0.0423
	(0.0156)	(0.0425)
Distance to nearest railroad	-0.00806	-0.0438**
	(0.00616)	(0.0206)
Distance to nearest railroad^2	0.0456***	0.176***
	(0.00652)	(0.0213)
Distance to nearest railroad^3	-0.0196***	-0.0893***
	(0.00522)	(0.0180)
Distance to nearest railroad^4	0.00204**	0.0126***
	(0.000976)	(0.00395)
Ancillary railroad indicator	0.123***	0.295***
	(0.0227)	(0.0497)
Distance to ancillary railroad	0.0271*	0.114***
	(0.0163)	(0.0440)
Distance to ancillary railroad^2	0.0256**	0.0687**
	(0.0105)	(0.0284)
Distance to ancillary railroad^3	-0.0187**	-0.0558**
	(0.00905)	(0.0245)
Distance to ancillary railroad^4	0.00351	0.00723
	(0.00251)	(0.00738)
Pre-existing land use controls		

Commercial land use indicator	0.0377***	0.0545
	(0.0141)	(0.0338)
Mfg. A land use indicator	0.00491	0.0591***
	(0.00701)	(0.0197)
Mfg. B land use indicator	0.0679***	0.229***
	(0.0199)	(0.0430)
Mfg. C land use indicator	0.0313	0.116**
	(0.0283)	(0.0563)
Mfg. S land use indicator	0.0972**	0.0713
	(0.0425)	(0.0846)
Indicator for large parcel with mfg. C or S use	0.130***	0.0619
	(0.0232)	(0.0435)
Indicator for overlap with Union Stockyards	0.323***	0.472***
	(0.0540)	(0.0932)
Indicator for proximity to Union Stockyards	0.0369	0.0644
	(0.0355)	(0.0643)
Density of commercial uses	-0.0519***	-0.0992***
	(0.0155)	(0.0342)
Number of warehouses	-0.00146	0.00198
	(0.00133)	(0.00318)
Density of mfg. A uses	-0.0287	0.0129
	(0.0432)	(0.115)
Density of mfg. B uses	0.00600	-0.444
	(0.355)	(0.732)
Density of mfg. C uses	-0.466	-0.454
	(0.554)	(1.138)
Density of mfg. S uses	-1.154	-1.103
	(1.585)	(2.926)
Density of commercial uses^2	0.00925*	0.0170
	(0.00539)	(0.0107)
Density of mfg. A uses^2	-0.0287	-0.0730
	(0.0331)	(0.0851)
Density of mfg. B uses^2	0.104	0.803
	(1.100)	(2.100)
Density of mfg. C uses^2	2.135	0.370
	(2.178)	(4.334)
Density of mfg. S uses^2	5.291	4.648
	(6.689)	(13.86)
Density of 4 story buildings	-0.0316*	-0.00681
	(0.0183)	(0.0502)
Density of 5 story buildings	0.0186	0.0571
	(0.0638)	(0.186)
Density of 6 story buildings	0.0240	-0.0183

	(0.0721)	(0.224)
Density of 7 story buildings	-0.115	-0.888***
	(0.132)	(0.317)
Density of 8 story buildings	0.0846	-0.175
	(0.154)	(0.442)
Density of 9 story buildings	0.284	0.416
	(0.461)	(1.201)
Density of 10 story buildings	-0.339	-0.372
	(0.280)	(0.810)
Density of 11-25 story buildings	0.108	-0.288
	(0.0930)	(0.229)
Number of mfg. B uses within 500ft of ED	0.00714**	0.0199***
	(0.00283)	(0.00652)
Number of mfg. C uses within 500ft of ED	-0.00375	-0.00464
	(0.00428)	(0.0100)
Number of mfg. S uses within 500ft of ED	0.0115*	0.00229
	(0.00600)	(0.0140)
Number of mfg. B uses within 1000ft of ED	0.00447**	0.00468
	(0.00201)	(0.00402)
Number of mfg. C uses within 1000ft of ED	-0.00201	-0.00624
	(0.00327)	(0.00702)
Number of mfg. S uses within 1000ft of ED	0.00208	0.00676
	(0.00757)	(0.0180)
<u>Economic and political controls</u>		
Maids per heads of households	-0.101	-0.287**
	(0.149)	(0.128)
Average land value in 1913 dollars	-0.0124***	0.0107
	(0.00392)	(0.0104)
Alderman on Board	-0.0124	-0.0395
	-0.0172	-0.0542
Constant	0.204***	0.462***
	(0.0536)	(0.129)
Ward FE	Y	Y
Observations	1,800	1,800
R-squared	0.739	0.635

Notes: Full set of coefficients (excluding coefficients on ward fixed effects) from OLS regressions with industrial zoning outcomes (continuous and indicator). All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions.

Appendix Table II. Immigrant Breakdown for Manufacturing Zoning

	Ind. for Industrial Zoning in ED	Percent of ED Zoned Industrial
	Tobit	Probit
	(2)	(4)
Southern black	0.113***	0.0755***
	(0.0209)	(0.0150)
Northern black	-0.0620***	-0.0235**
	(0.0175)	(0.0120)
Polish	0.0470***	0.0200*
	(0.0145)	(0.0119)
Russian	0.0203*	0.0263***
	(0.0115)	(0.00922)
Italy	0.0239*	0.0263**
	(0.0130)	(0.0112)
Irish	0.0403***	0.0231**
	(0.0134)	(0.0106)
German	0.0328***	0.0148**
	(0.00921)	(0.00660)
Other immigrant	0.0395***	0.0229**
	(0.0140)	(0.0114)
Second generation	-0.0318*	0.0192
	(0.0162)	(0.0136)
1913 land values	0.00853	0.0412**
	(0.0110)	(0.0181)
Observations	1,800	1,789

Notes: All specifications include the full set of controls listed in Appendix Table 1. See Figure 1 for demographic group definitions.