The Surprising Insignificance of Race: A Spatial Analysis of Race and Class Effects on Supermarket-Access in Chicago, 1970-2000.[1]

ABSTRACT

Studies examining neighborhood effects on health have found that residence in neighborhoods with acess to full-service grocery stores that supply a range of fresh, affordable fruits, vegetables and dairy products is associated with lower rates of obesity, diabetes and CHD. My paper contributes to ongoing research on the health effects of "food deserts" by investigating the ultimate causes of neighborhood access to essential, health-promoting amenities. Using Chicago as a case, I examine the effects of neighborhood racial and poverty composition on neighborhood access to full-service grocery stores, and how these effects have changed over the 4-decade period from 1970 to 2000. I use spatially-weighted regression to test Wilson's (1987) and Massey's (1993) competing theories, which debate whether race and class, or class alone affect neighborhood quality. I find that when spatial spillovers between contiguous neighborhoods are taken into account, it is class, not race, which predicts grocery store access.

INTRODUCTION

In recent time, "food deserts", or areas with limited access to healthy foods, have emerged as a major policy concern. The issue captured national attention with the publication of reports from philanthropic organizations seeking to influence public policy discourses around city planning, public health and urban revitalization (Gallagher 2006).

[1] This paper is a work-in-progress. Please do not cite or circulate without permission.

In response, the Federal government placed food deserts squarely on the national policy platform through the 2008 Food, Conservation, and Energy Act (Baum and Ruhm 2007, Ver Ploeg, Breneman, et al 2009). Research on the prevalence of food deserts and their effects has since proliferated rapidly (see Walker, Keane, and Burke 2010 for a review). This literature defines food deserts as "areas with limited access to affordable, healthy food", a definition that is commonly operationalized as neighborhoods situated at or beyond one mile from the nearest grocery store (Ver Ploeg, Breneman, et al 2009).

The emerging literature on "food deserts" identifies supermarket access as an important mediator of individual health outcomes through its effects on the price, quality and range of healthy food that is available to neighborhood residents (Walker, Keane and Burke 2010, Morland et al. 2002). Public health researchers studying food deserts connect neighborhood inequalities in supermarket access to the disproportionate levels of diet-related sequelae observed among residents of disadvantaged neighborhoods. Cross sectional studies find that poor, minority neighborhoods experience elevated levels of exposure to fast food restaurants, convenience stores, and small groceries and that these neighborhoods have depressed levels of exposure to supermarkets (Morland et al. 2002, 2006). Other work find associations between the land use patterns characteristic of poor, minority urban neighborhoods and the elevated rates of obesity, diabetes and coronary heart disease found among neighborhoods residents (Mobley et al. 2006). In contrast, neighborhoods with access to chain supermarkets are significantly associated with lower (BMI), lower individual-level overweight status, and lower atherosclerosis risk (Morland, Diez Roux, and Wing 2006).

The nascent body of "food desert" research in public health naturally connects to sociological investigations of neighborhood effects on health, where interest in the role that the built environment and access to organizational amenities play in mediating individual health outcomes is only just emerging (Entwistle 2007, Browning et al. 2006). Although food desert research is largely the purview of public health researchers, the food desert problem also speaks to sociological research on inequality, especially those studies that investigate the role that neighborhoods play in concentrating and distributing disadvantage. The grocery store access problem and its relation to dietary disease is thus an instance of a broader set of questions arising from the literature on inequality that ask, "How do neighborhood characteristics influence the differential allocation of social goods to spatially dispersed social groups, and how does such differential allocation affect individual and group life chances?"

Over the last few decades, sociological efforts to answer this question crystallized around competing theories about whether race and class, or class alone are the primary determinants of neighborhood quality. These theories are articulated by Massey residential segregation model (Massey and Denton 1993) and by Wilson's (1978) thesis on the declining significance of race. Massey and Wilson's theories are explicitly spatial, and make distinct predictions about the patterns of distribution of desirable amenities relative to disadvantaged social groups. Wilson's argument in particular focused on the gains to neighborhood quality he argued that middle-class blacks attained in the decades following the post-civil rights period.

My paper asks whether a neighborhood's class composition alone, or whether both neighborhood race and class composition affect access to full-service supermarkets.

I ask this question longitudinally, using data on grocery store access for Chicago's neighborhoods at four time points: 1970, 1980, 1990 and 2000. I use cross-sectional regression analyses with spatial lags to arbitrate between Wilson and Massey's theories at each time point. My longitudinal design allows me to explore how the relationship between race, class and neighborhood quality has changed since the 1970s.

Only a few studies have examined the relationship between neighborhood composition, and access to health-promoting amenities (***). None of these have controlled for spatial dependence between neighborhoods, even though it is clear that the number and quality of amenities within a neighborhood is affected by the race and class composition of the neighborhoods that surround it. Further, failure to account for the spatial autocorrelation of predictors in such studies runs the risk of falsely rejecting null hypotheses. By taking the spatial structure of the data into account, my examination of the determinants of neighborhood grocery store access offers a more stringent test of the relationship between race, class and health-promoting neighborhood amenities.

LITERATURE REVIEW

SUPERMARKET ACCESS IN INNER-CITIES

Supermarkets are essential, regularly-utilized neighborhood amenities (Dixon and McLaughlin 1971, ICIC 1999). Since the 1970s, research on the economics of inner-city markets has found that depressed, inner-city areas have failed to attract and retain desirable retailers – including supermarkets – over the last four decades, despite evidence of substantial unmet demand (Porter 1995, HUD 1999). As such, inner-city communities

are often left without affordable sources of fresh, nutritious food products, such as fruit, vegetables and diary. This research suggests that residents of these communities tend to pay more for food that is of lesser quality than what the middle class enjoys (Caplovitz 1967, Cotterill and Franklin 1995, Ver Ploeg, Breneman and Farrigan et al. 2009). Inner-city neighborhoods' inability to attract and retail supermarkets does not only affect residents' health. Research on urban economics has shown that supermarkets anchor business districts. When reputable supermarkets are unwilling to locate in a neighborhood, business people write the community off as a place that cannot support large retail enterprises (ICIC 1998, 2002). Poor neighborhood access to supermarkets thus leads to poor neighborhood access to retail more generally, and concomitantly, poor access to the service sector jobs that retailers bring to a community.

THE DECLINING SIGNIFICANCE OF RACE DEBATE

Fundamental theories of urban inequality see the spatial segregation of neighborhood socio-demographic types as a key force in shaping individual life-chances. The most influential of these theories are undoubtedly Wilson's declining significance of race model and Massey and Denton's residential segregation thesis (Kasarda 1985; Massey and Denton 1993; Wilson 1978, 1987). These theories disagree over the relative importance of race and class in shaping urban racial inequality. Wilson's theory contends that by the late 1970s racial discrimination in the housing and labor markets had declined so precipitously that the life chances of African American's depended far more on their class position than on their racial status. In Wilson's view, the out-migration of the black middle class from "inner city ghettos" to higher quality residential areas simultaneously

improved the prospects of the black middle class and increased the concentration of poverty in their former neighborhoods. According to Wilson's model, race was no longer a significant determinant of African American prospects because the black middle class had attained parity with their white counterparts, and because the observed disadvantages in poor, black neighborhoods resulted not from racial discrimination, but from the concentration of poverty due to black middle-class out-migration.

Challenging Wilson (1978), Massey and Denton (1993) argued that since the 1970s, racially based residential segregation and high black poverty rates together concentrated poverty in black neighborhoods at much higher rates than in white neighborhoods. Massey and Denton also disputed Wilson's claim that the black middle class successfully escaped their lower-income counterparts. They argued that although residential segregation decreased, it persisted, and continued to constrain African American's housing options. Consequently, many middle-class blacks' residential options were constrained to neighborhoods bordering black working-class and poor neighborhoods. These residential patterns kept African Americans spatially distant from the relatively resource-rich neighborhood amenities enjoyed by the white middle class. Massey and Denton also argued that both race and class continued to determine neighborhood quality, especially for residents of the poorest neighborhoods. They argued that between 1970 and 1990, high rates of residential segregation in places like Chicago set the stage for a dramatic increase in concentrated poverty, requiring only modest increases in the rate of minority poverty to produce profound effects at the neighborhood level (Massey 1990). Massey and Denton's theory suggests that the black middle class could not participate equally in the neighborhood advantages that their white middle class

counterparts enjoyed, and that racially-based residential segregation confers neighborhood-level advantages on whites over blacks regardless of class background.

"NEIGHBORHOOD EFFECTS" ON HEALTH & ORGANIZATIONS AS INTERVENING MECHANISMS

Despite their disagreements, Wilson's "declining significance of race" thesis and Massey and Denton's "residential segregation" model share common ground in the central insight that, due to the severely spatially segregated nature of social groups and social goods across urban space in US cities, neighborhoods may independently affect individual life-chances through their ability to concentrate both privilege and disadvantage. This insight constitutes the theoretical core of the "neighborhood effects" research agenda. In recent time, the study of neighborhood effects has increased its substantive focus on diet-related health outcomes – in particular, obesity, diabetes, and coronary heart disease, and its theoretical interest in organizations as potential mediating mechanisms (Mayer & Jencks 1989, Entwistle 2007).

Illustrative of the growing recognition of the organizational gap in the neighborhood effects literature is Ludwig et al. (2011)'s recent paper, which used data from the Moving to Opportunity (MTO) social experiment to investigate the effect of neighborhood poverty on health outcomes. The authors found that the treatment effect of moving from a high-to low-poverty neighborhood reduced adults' rates of morbid obesity and diabetes by 20%. Since the MTO data did not include information on neighborhoods' retail landscapes, the authors could only speculate that these dramatic neighborhood effects on health were mediated by improved access to supermarkets and other healthy

food stores, and call for further research examining neighborhood organizations as mediators of individual health outcomes. It is at these points that neighborhood effects research intersects naturally with new public health research on "food deserts".

With their immediate focus on contemporary obesogenic environments, food desert researchers have forged few connections with fundamental research on urban processes. But as research in urban inequality makes clear, the food desert problem is an important instance of a broader set of questions about the effects of neighborhood race and class composition on amenity access, and consequently on the life-chances of spatially segregated individuals and groups.

DATA

Independent Variables

Census tract boundaries change frequently across census years. The incomparability of spatial units over time causes significant challenges for examining neighborhood-level processes that unfold across multiple decades. This analysis uses Urban Institute and Geolytics' Neighborhood Change Database (NCDB) as the source of census demographic data. The NCDB was specifically designed to combat the problem of spatial unit non-comparability across census years. It takes data from the tabulated United States Census long form for the 1970, 1980 and 1990 decennial censuses, and 'normalizes' the data from each decade to 2000 census tract boundaries using an essentially population-weighted model of geographic apportionment, thereby providing consistent spatial units over time (Tatian and Cornelius 2003).

The predictors of interest for the models are *Neighborhood Poverty Rate* and *Neighborhood Ethnic Composition*, represented by the *% of Non-Hispanic Blacks*, the

% of Hispanics.[2] The *% of Foreign Born* residents was included to control for the distinct effect of ethnic enclaves.[3] Controls used include *Residential Stability*, or the proportion of persons in the neighborhood over age five whose residence in that census year was the same as their residence 5 years ago, *Population Density (Logged),* and *Public Housing Project Presence,* a dichotomous variable, which was controlled for in order to distinguish its effect from that of neighborhood poverty.[4] Two other controls were used that took the spatial structure of the city into account: *Distance from the City Center* was used to account for the regular variation in the urban to suburban land use patterns as one moves from the city center to its edges; and *Distance from Major Streets,* since the distribution of stores in urban space is also influenced by the structure of transportation routes.

Outcome Variable: *Grocery Store Access*

1. A Historical Census of Supermarkets

A unique four-decade census of all supermarkets and grocery stores for the city of Chicago for the years 1970, 1980, 1990 and 2000 was constructed for the purposes of this study. The census was composed by combining grocery store and supermarket lists from

[2] The census only created fully mutually exclusive categories for Non-Hispanic Blacks, Non-Hispanic Whites and Hispanics in 1980, and fully mutually exclusive groups for Asians and non-Asians in 1980. This study followed Timberlake and Iceland (2007)'s procedures for estimating mutually exclusive racial groups for 1970 and 1980.

[3] The effects of % Non-Hispanic White were not estimated. Due to the high degree of racial residential segregation in Chicago, the % Non-Hispanic White exhibited high degrees of collinearity with the % Non-Hispanic Black across all four decades, which made regression results unstable.

[4] Address-specific data for multi-family unit public housing for the four decades was obtained from the Chicago Housing Authority (CHA) through the Freedom of Information Act.

the Yellow Pages with an exhaustive combination of lists from industry directories for the years in question.[5] This choice of sources had the advantage of providing address-specific locations for all stores, while maximizing the completeness of the census (Marsden et al. 1990; Bader et al. 2010).

2. Defining Supermarket Access

In urban areas, food deserts are defined as neighborhoods that are more than or equal to a mile from the nearest full service grocery store (Ver Ploeg et al. 2009). This definition emphasizes pedestrian access. The idea among public health scholars is that households without cars, without the funds to use public transportation frequently, or without the physical capacity to travel long distances should have access to a store providing healthy, affordable food within walking distance. In the four-decade historical census, full service supermarkets were distinguished from smaller establishments using historically appropriate industry classifications (FMI 1998). Stores were classified as full service groceries when they were: 1) members of a national or regional chain, 2) single-unit operators, members of a local chain, or members of cooperatives whose annual store sales placed them in the same industry category as regional or national chains.

Methodological Issues in Measuring Spatial Effects

1. Discrete v. Continuous Measures of Access

The paper uses continuous rather than discrete measures of access. In previous

[5] Data on store sales came from the above-mentioned industry sources as well as two other annually published industry directories: The Distribution Study of Grocery Store Sales, published by Supermarket News, and the Chain Store Guide's Supermarket Retail Share Analysis.

sociological research, access is defined discretely, either as simple count of a given social good, or as a dummy variable indicating the presence or absence of any such facility located within each spatial unit (Small and McDermott 2006). Discrete measures of access are problematic because they parcel space into distinct, unrelated containers, ignoring the effects of spatial externalities between neighboring units. For instance, since discrete measures ignore the actual location of each facility, they treats facilities located near areal unit boundaries as though they (1) have no effect on people residing in adjacent units and (2) as though they affect every square inch of their home units equally. This "container" treatment of space also makes implicit assumptions about the logic of facility supply namely, that social goods are only allocated to the residents of the spatial unit that contains them, and that the areal unit itself lacks an internal spatial structure (Downey 2003, 2006).

2. Choice of Spatial Units

In analyses of "access" the cases used are invariably some kind of geographic unit, whether zip-codes, census tracts, wards, counties or MSAs. From a sociological perspective, many of these units are problematic because they separate space arbitrarily, without regard to the social uses and meanings of place. Choosing ecologically appropriate spatial units is not simply an issue of ecological precision. The shape and relative locations of spatial units can profoundly affect the sign, significance and magnitude of regression results, an issue that geographers term "the modifiable areal unit problem" or MAUP (Openshaw 1984).

This paper addresses these methodological challenges through a unique approach to constructing the spatial outcome variable:

1) It takes advantage of the unique address-specific store data to create an *average minimum distance* measure of access, which improves upon the more commonly used *aggregate minimum distance* measure (Downey 2006).
2) It uses census blocks as the spatial sub-units of choice in computing the *average minimum distance measure.* My approach to variable construction improves on Downey's (2003, 2006) "rasterizing" approach, which measures space in terms of a simple geometric grid of arbitrary dimensions, with no socio-spatial meaning. In contrast, census block boundaries convey greater socio-spatial meaning because they typically follow roads, streets and other physical aspects of the built environment. Census blocks enjoy far greater ecological validity than do the units of Downey's simple grid, and are therefore less vulnerable to the MAUP (Openshaw 1984).

RESULTS

1. Chicago Neighborhood Characteristics – A Four Decade Portrait

Table 1A shows four decades of summary statistics for the Chicago census tracts under study. The average population density declined between 1970 and 2000 by roughly 20%, although the standard deviations indicate the presence of both densely populated and quite depopulated tracts. The racial and cosmopolitan make-up of the city changed dramatically over this period. In 1970, the average tract was 58% Non-Hispanic White,

31% Non-Hispanic Black, 9% Latino and 1% Asian. In 2000, it was 30% white, 43% African American, 23% Latino and 4% Asian and other races. In addition the percentage of foreign born residents increased by 4% between 1980 and 2000.

TABLES 1A-B, about here.

Chicago neighborhoods' changing economic fortunes are also reflected in the substantial increase in poverty. In 1970 the average tract had 15% (s.d. 13) poor residents, but in 2000, 23% (s.d. 16) were poor; an increase of 46%. Table 1A also shows that the variance in the percentage of residents by race, by foreign born, by income, and by poverty rate is quite high, with the standard deviation exceeding the mean in many cases. These patterns indicate the presence of heavily homogeneous tracts, especially by race and income. Table 1B shows that for majority black census tracts, the average tract population declined by 32.7% and the average tract population density declined by 49.2% between 1970 and 2000. The respective values for changes in average tract population and tract population density were declines of 12.5% and 4.9% for majority white neighborhoods. In contrast majority Hispanic neighborhoods experienced, on average, an increase in population size of 23.2% and a decrease in population density of 4.8%.[6] The singular decline in population and population density experienced by African American majority neighborhoods is notable, as declining consumer demand offers an alternative explanation for alleged neighborhood-level inequalities in retail access by race.

TABLES 2 & 3, about here.

[6] Census tracts in which Hispanics were the majority race experienced a simultaneous average increase in population and an average decline in population density because the number of majority Hispanic neighborhoods also increased over thes period. In 1970, 15 cesnsus tracts were majority Hispanic, while in 2000, there were 138 tracts with a majority of Hispanic residents.

Tables 2 and 3 illustrate the changing profiles of tract poverty, and of the relationship between tract poverty and race. Identifying the four-decade patterns for these features is an essential backdrop to this analysis. In the neighborhood effects literature, concentrated poverty is routinely defined as a poverty rate greater than 40% (Wilson 1987, Jargowsky 1997). A profile of extreme concentrated poverty (with poverty rate greater than 80%) is included in Table 2 for comparison. As Tables 2 makes evident, concentrated poverty tripled across all tracts between 1970 and 1980, and increased 12-fold between 1970 and 1990. Moreover, extreme tract-level poverty was non-existent in 1970, while its rate in 1990 was ten times the rates of extreme poverty in 1980 and 2000.

Table 3 shows that the increases in concentrated tract poverty were not shared equally among Chicago's three major racial groups. In 1970, only 2.3% of majority Non-Hispanic White tracts experienced concentrated poverty, while no majority White tracts did so in the remaining three decades. Concentrated poverty in majority Hispanic tracts also declined over the four-decade period, starting at 20% in 1970 and falling to almost one quarter this rate in 2000. In contrast, more than one third of majority African American tracts continued to experience concentrated poverty between 1970 and 2000, with a peak of 42% of majority African American tracts mired in concentrated poverty in 1990.

2. City-Wide Trends in Access

Tables 4 and 5 chart global trends in access to supermarkets between 1970 and 2000. Business historians argue that since the 1970s, large urban centers experienced

massive retail flight, as national and regional chains left the city for the expanding suburbs (Donohue 1997). Grocery industry analysts observed similar trends, noting that while supermarkets in inner city areas remained profitable, chain supermarkets chose to locate to suburban areas rather than refurbish and expand ageing inner-city stores (Pothukuchi 2005). Tables 4 and 5 support these observations. They show that supermarkets became a scarcer social good city-wide. The trend is consistent across all measures of access. Taking tract population into account, the average number of large groceries per 100,000 persons declined by one half between 1970 and 2000. Notably, this decline was not monotonic. The average number of large groceries per 100,000 persons declined steadily by 40% between 1970 and 1980 and by 35% between 1980 and 1990, but showed a rise of 24% between 1990 and 2000, suggesting that grocery store prevalence tracks the city's global economic fortunes.

Distance access measures show that the average minimum distance that tract residents had to travel to get to a supermarket doubled between 1970 and 2000, and that after 1990, the average tract was a food desert (i.e. situated more than 1 mile from the closest supermarket). For the distance and count measures displayed in Table 4, the standard variations are large compared to the mean, suggesting that there is substantial variation across tracts in supermarket access by all measures across all years. Table 5 charts changes in the variety of supermarkets available to Chicago's tracts over the four-decade period. Where 66.04% of tracts lacked a large grocery within their boundaries in 1970, 90% lacked one by 2000. In addition, while 12% of all tracts contained 2 or more supermarkets in 1970, less than 3% did so by 2000.

TABLES 4 & 5, about here.

3. The Importance of Controlling for Spatial Structure

As this paper has already emphasized, most sociological efforts to test Massey and Denton and Wilson's theories of spatial inequality fail to adequately account for the spatial structure internal to the data. They do so by: 1) using discrete measures of access, 2) using *aggregate distance* measures over *average distance measures,* and 3) choosing arbitrary spatial sub-units to compute *average minimum distance*. All of these practices invite complications related to the MAUP, which affect the signs and significance of coefficient estimates in regression equations. The fourth mistake that sociologists frequently make in analyzing explicitly spatial phenomena is that they fail to account for the *spatial spillover effects of predictors* in their statistical models.

This usually takes the form of a naïve use of regression techniques to assess relationships between the outcome variable and predictors of interest. Traditional OLS models assume independence between cases. This assumption is not tenable when analyzing the relationship between contiguous tracts within a metropolitan area. Substantively, it is obvious that for amenities like supermarkets, the characteristics of an area's surrounding neighborhoods affect location decisions. Uncontrolled spatial autocorrelation is also problematic from a statistical standpoint. When positive spatial autocorrelation is high, the real variance will be under-estimated, increasing the likelihood of falsely rejecting null hypotheses. The subsequent analyses demonstrate the perils of ignoring spatial autocorrelation when conducting hypothesis tests.

4. Assessing the Effects of Race and Poverty on Access to Supermarkets:

Comparing a Spatially Naïve Approach to Regressions with Spatially Lags.

This section compares results from a simple OLS model that controls for these variables with an OLS model that controls for spatial autocorrelation by including spatially-lagged predictors. The models were computed using both Geoda and Stata 9. Spatial statistics offers two ways of accounting for the effects of space in the model: through spatial lags and spatial errors. Spatial errors are used to control for omitted variables that may vary spatially. Lag terms are used to account for spatial interaction. Commonly, the effect of an aggregate lag term is computed. The term aggregates spatial effects of all predictors into one index. This aggregate index helpfully controls for spatial structure in the data, but it is less useful if one is interested in measuring the separate spatial effect that each individual predictor exerts. If one is interested in this question, lag variables must be computed for each predictor of interest. Given the theoretical questions at hand, and the fact that cases are drawn from a single metropolitan area, the lag method with individually assessed lag predictors is the appropriate choice (Anselin 2005). Consequently, spatial lag terms were generated for the variables of interest. These lagged variables were used to fit the spatial models.

Using GeoDa, tests for the significance and magnitude of the Moran's I were used to confirm whether the spatial weights chosen successfully controlled for spatial autocorrelation. The final spatial models shown in Tables 6 use second-order queen contiguity weights, as the first-order queen failed to eliminate the effects of spatial autocorrelation.

Chicago's tracts have historically shown a very high degree of residential

segregation, with tracts with similar characteristics clustering together in urban space, so multi-collinearity must be dealt with in this analysis. The problem inheres for spatial models, given the very nature of the distribution of social groups across urban space.

Thus, in fitting the spatial model, a basic model was fitted that measured the lag effects of the key variables of interest (poverty rate, % black) as well as controls for other factors likely to affect store location, such as (population density (logged), and residential instability). If introducing any particular lag variable resulted in a high degree of multi-collinearity, it was dropped from the model. The models presented in Tables 6 are those with the best fit that are free of multi-collinearity problems.

TABLES 6, about here.

As Tables 6 shows, the use of second order queen weights to create spatially lagged controls eliminates problems with spatial autocorrelation present in the simple OLS model. The global Moran's I is used to measure the extent of spatial autocorrelation. Moran's I takes values ranging from 0 to 1, with 1 representing the highest degree of spatial autocorrelation. Inspection of Tables 6 reveals that in general, the degree of spatial autocorrelation in the simple OLS models is substantial – ranging from 0.31 in 1970 to 0.50 in 2000, and is highly significant in every case ($p > 0.0001$). Once spatial lags are introduced, the Moran's I falls to well below 0.01, and is no longer statistically significant. Comparison of the R-squared values for the OLS and second-order queen lag models shows that the introduction of spatial lags also improves model fit.

Turning to the effects of predictors on supermarket access, we find that across all years, a tract's distance from the central city exerts the most consistent effect. The

effect is in the expected direction, with a one-mile increase in distance from the center city translating into a decline in access ranging from 0.023 miles in 1970 ($p<0.001$)to 0.086 miles ($p<0.001$) in 2000 in the lag models. Notably, the magnitude and the significance of the central city predictor increases in each case as we move from the simple OLS model to the model with spatial lag.

Population density also shows a consistent relationship with supermarket access, in the expected direction. In the lag models, a unit increase in the log of population density in both the main and lag variables is associated with an increase in access ranging from a minimum of 0.035 miles ($p<0.05$) in 2000 to a maximum of 0.211 miles ($p<0.01$) in 1980. Comparison of the simple OLS and spatial lag models for 1970 and 1980 show that the significance of population density remains at the $p<0.001$ level after including spatial lags, while the magnitude of its influence increases modestly across these models. These models also show that the population density of surrounding census tracts exerts effects that are at the same order of magnitude and in the same direction as the population density of the individual census tract.

The effects of residential stability show a more mixed picture. In the models containing lag variables, residential stability is negatively associated with access, although the magnitudes of the effects are modest. Maximally, a 1% increase in residential stability is associated with decline in access of 0.0055 miles ($p<0.01$) in 1980. Overall, the positive relationship between residential stability and distance to the nearest supermarket supports Logan and Molotch's argument that large retail developments like grocery stores are a nuisance and are resisted by tracts that are more stable and socially organized. The inclusion of a lag variable for residential stability reduces the magnitude

of its effect operating at the level of the individual census tract in 1980 and 1990, but substantially increases the magnitude of its effect when the main and lag variable are considered together, from 0.0023 to 0.0054 miles, and a change in significance from $p < 0.05$ to $p<0.01$ in 1980 and from 0.0036 ($p<0.05$) to 0.0055 miles ($p<0.05$) in 1990. In 1970, the effect of residential stability remained essentially the same across the simple and lag models, while in 2000, residential stability was no longer significant in the spatial model. The differences in parameter magnitude and significance between the simple and lag models illustrate how spatial correlation can affect regression results.

Surprisingly, the distance between a tract and the closest major street did not display any significant association with supermarket access. This may be because the city's map of major streets does not make a strong distinction between highways, major streets and arterial roads.

The influence of % Hispanic residents on grocery store access varied between 1970 and 2000. In 1970, % Hispanic did not exert a significant effect, and did not improve model fit. This may be due to the fact that the Hispanic population in Chicago in 1970 was small, with Hispanics comprising only 8% of the average tract population, and with many Hispanics spatially concentrated in only a few tracts. By 1980, the proportion of Hispanics in the population had doubled, with Hispanics constituting 16% of the average tract's population. In 1980, a 10% increase in the number of Hispanic residents resulted in an average increase in supermarket proximity of 0.018 miles ($p < 0.05$). However, by 1990 and 2000, the direction of the relationship was reversed, with a 10% increase in Hispanic population resulting in an average increase of 0.039 miles ($p< 0.000$), and 0.019 miles ($p<0.1$) distance to the closest supermarket associated with a 1%

increase in the Hispanic population. These results present a puzzle for Wilson's theory, as controlling for all other factors, access to grocery stores for Hispanics should improve between 1970 and 2000 as the significance of race in determining access to valuable resources declines.

The findings on Hispanics do not contradict Massey and Denton's theory, as by 1990 and 2000, Hispanic tracts do experience disadvantage in their spatial access to supermarkets. However, Denton and Massey's theory does not explain why in 1980, Hispanics enjoyed greater proximity to these stores. This discrepancy is probably due to the changing spatial demography of the Chicago's Hispanic population over the four decade period. Where in 1970 and 1980, majority Hispanic tracts were fewer, smaller and were on average bordered by predominantly white neighborhoods, by 1990 and 2000, the growth in size and spatial spread of the Hispanic population meant that Hispanic tracts came to be surrounded on average, by other majority Hispanic tracts in the subsequent decades.

The influence of % foreign born on supermarket access is also rather surprising. In 1970 and 1990, the % foreign born did not exert statistically significant, independent effects on store access. Where enclave theory would predict that increases in the % of foreign born residents raises the tract's saturation with local ethnic businesses, making them potentially less welcoming to chain stores, instead we find that in 1980 and 2000, distance to the nearest supermarket decreases, by 0.038 miles ($p<0.05$) and by 0.068 ($p<0.001$) with a 10 % increase in the foreign born population. If we consider that tracts with large proportions of foreign born residents may possess high internal social capital, but may be poorly integrated into the city's political structures, this finding may support

Logan and Molotch's view of large retail developments as a nuisance that less politically connected tracts cannot successfully resist.

The effect of the final control variable, public housing density, is also quite interesting. It was statistically insignificant for all years except 1980, in which the presence of high density public housing (recall, a dichotomous variable) increased distance to the nearest supermarket by 0.061 miles ($p<0.05$). According to Wilson's (1978, 1987, 1996) the late 1970s and early 1980s saw the accelerated flight of manufacturing jobs from the inner cities to the suburbs. This period also marked an escalation of crime in the inner city, especially in tracts containing high density housing projects, which were often the sites of violent battles over the spoils of the crack economy (Venkatesh 2002). The association between high density public housing and lower supermarket access may be explained by grocery retailers' hesitance to locate near high-crime tracts.[7] However, the crime wave in US cities peaked in 1993, so it is surprising that public housing density exerted no significant effect on grocery store access in 1990 (Levitt 2004, Brownstein 1996).

Finally, we turn to the effect of our variables of interest on supermarket access. The second-order queen contiguity models in Tables 6 suggest that while the poverty rate of a given tract did not play a significant role in influencing access in 1970 and 1980, the average poverty rate of surrounding tracts did. In 1970 and 1980, the tract poverty rate did not exert a significant effect on access. However, as the average poverty rate in the surrounding tracts increases by 10%, distance to the nearest grocery store also increases by 0.085 miles in 1970 ($p<0.001$) and by 0.13 miles in 1980

[7] The original aim was to obtain address-specific crime data for Chicago for each of the four decades. The Chicago Police Department could not provide this information.

($p<0.001$). In 1990 and 2000, tract poverty and the poverty rate of surrounding tracts together reduced access to supermarkets. A 10% increase in tract poverty also increased distance to the nearest store by 0.029 miles in 1990 ($p<0.05$) and by 0.033 miles in 2000 ($p<0.05$), while a 10% increase in the average poverty rate of surrounding tracts increased distance to the nearest store by 0.22 miles in 1990 ($p<0.001$) and by 0.25 miles in 2000 ($p<0.001$). These results are consistent with Small and McDermott's (2006:1708) findings that in 2000, high poverty tracts had lower access to supermarkets.

The relationship between tract poverty, the spatial spillover effects of the poverty rates of surrounding tracts and access to supermarkets is as predicted by both Wilson and Massey and Denton's spatial inequality theories. The relationship between the % of African American residents in a tract, and the average % of African Americans in the surrounding tracts on supermarket access is less clear. In 1970, the main effect of an increase in Black residents by 10% was to increase the distance to the nearest store by 0. 010 miles ($p<0.1$), while the lag effect of a 10 % increase in Black residents was to *decrease* the distance by 0.16 miles ($p<0.05$). In 1980 and 1990, the main effect of a 10% increase in Black residents was to increase access by 0.024 miles ($p<0.001$) and 0.026 ($p<0.01$) miles respectively. The lag effect of an increase of 10% in Black residents could not be estimated in those years due to the high degree of collinearity between % Black and its lag counterpart. In 2000, the main effect of a 10% increase in Black residents within the tract is a 0.025 mile ($p<0.5$) increase in store proximity, while the effect of a 10% increase in the % of Black residents living in surrounding tracts *reduced* store proximity by 0.022 miles ($p<0.1$). Overall, the results are contrary to Massey and

Denton's findings and support Wilson's claim that from 1970 onward, black tracts experienced improvements in access to social goods as racial discrimination in firm location decisions declined. The marked improvement came between 1970 and 1980, and has remained stable thereafter.

Overall, it is worth commenting on the remarkably small magnitudes of all predictors in the model. At maximum, a 10% in increase predictors (of % of a population characteristic) was typically associated with a change in access of magnitude of 1/1000th to 1/100th of a mile. While many of these effects were statistically significant, they were practically meaningless. Thus, while poverty, residential stability and distance from the city center were statistically significantly associated with supermarket access, their effects operated at a surprisingly small scale.

CONCLUSIONS

This study is the first to use spatial methods to test Wilson's (1987) and Massey and Denton's (1993) theories about the effects of race and class composition on neighborhood access to desirable organizational amenities. Although these theories are explicitly spatial, previous tests of these hypotheses have neglected spatial structure in their analyses; 1) in terms of how access is operationalized (by choosing discrete vs. continuous measures of access, and by paying little attention to the MAUP in the choice of spatial units of analysis) and 2) by failing to account for spatial auto-correlation and spatial spillover effects in their regression analyses. My case study of supermarket access in Chicago speaks to these gaps. Using an original dataset of address-specific grocery

store locations, I created a continuous measure of neighborhood access – the *average minimum distance* – that uses real features of the built environment to measure access with greater ecological validity, and that accounts for spatial relationships between contiguous units. By using spatially lagged predictors in my regression analysis and the Moran's I test, this study explicitly takes the spatial structure of the city into account, and eliminates the distorting effects of spatial autocorrelation on parameter estimates and significance tests.

Results from my spatial models support Wilson (1987)'s "declining significance of race" theory over Massey and Denton's (1993) hypothesis. They indicate that poverty within the tract and its surrounds reduces access, while % Black within the tract improves access, even as the spatial spillover effects of % Black remain uncertain across the four-decade period. This result is quite surprising. Previous studies have found race, and in particular % Black, to be significantly and negatively related to access to organizational amenities (Small and McDermott 2006; Downey 2003, 2006). My results, when contrasted with this previous work, underscore the essential but often overlooked fact that modeling and measuring space precisely, and choosing spatial units that maximize ecological accuracy are not simply technical problems. US cities are characterized by high degrees of residential segregation by race and class. In statistical terms, this means that predictors and dependent variables are positively spatially auto-correlated and that significance tests are likely to falsely reject null hypotheses.

My results suggest that the both the direction and the significance of the effect of % Black on neighborhood amenity access – and thereby the empirical support for Massey and Denton's (1993) "residential segregation" thesis – found in previous studies that treat

space naively may well be a statistical artifact. My results also show that the effects of a tract's poverty rate, its residential stability, its population density and its distance from the city center (a measure of its "suburban-ness") remain significant and operate in the expected direction across all four decades when spatial structure is accounted for. This study is also the first longitudinal spatial test of Wilson (1987) and Massey and Denton's (1993) theories with respect to access to desirable organizational amenities. I examined these relationships between 1970 and 2000, beginning at the very time period at which Wilson predicted that the significance of race would decline. My analyses across all years support Wilson's (1987) thesis.

DISCUSSION

Theory and Policy

While poor, majority African American neighborhoods in Chicago do experience reduced access to supermarkets, my analysis suggests that it is neighborhood class composition, not racial makeup, that explains the observed inequalities. In addition, my results show no support for the argument that race explains observed inequalities in access to supermarkets in Chicago's middle-class African American neighborhoods. My regression results support Wilson's (1987) thesis that it is class, not race, that matters in determining whether neighborhoods gain access to desirable social goods such as supermarkets. Although my results support Wilson (1987), they do *not* entirely discredit Massey and Denton's argument that racial segregation and high black poverty rates interact to affect amenity access in poor, majority-minority neighborhoods. The fact that my results simultaneously support Wilson (1987)'s thesis, without providing a full refutation of Massey and Denton's (1993) hypothesis might seem puzzling, but the

coexistence of support for both theories in my analysis becomes clear when we consider: 1) the inherent limitations of the data and 2) what these data limitations tell us about the mechanisms through which race is and is not working in affecting the distribution of desirable amenities across urban space.

The primary data limitation is on display in Table 2, which highlights the "empty cell problem". The "empty cell problem" refers to the fact that, due to the high degree of residential segregation in US urban space, many majority-minority (and especially African American) neighborhoods experience concentrated poverty, whereas there are few to no majority-White concentrated poverty tracts. This data limitation exists in many US cities. The absence of a counterfactual for whites at the most extreme values of concentrated disadvantage means that neighborhood effects are undefined for them at these poverty rates (Sampson 2008). [8] Consequently, it is difficult to disentangle the distinct role that race and concentrated poverty play in producing spatial, neighborhood-level inequalities across a broad range of outcomes, including supermarkets.

How then, does this analysis intervene in the Massey and Wilson debate? The arbitration my analysis provides does not declare a single victor, nor does it point to a simple explanation. Instead it clarifies the layered mechanisms through which racial inequality in retail access works. Specifically, it suggests that firms like supermarkets are purely profit-driven. They choose to locate in neighborhoods with the buying power to support them. Racial discrimination does not appear to inform supply-side retail location decisions. Instead, the observed racial inequalities in neighborhood access to

[8] I emphasize *concentrated poverty* here. The absence of a counterfactual only applies at the highest values of neighborhood poverty (≥ 40%). Majority-white neighborhoods with lower poverty rates do exist as counterfactuals.

supermarkets and other retail arises from the interaction between firms' race-neutral (but class-conditioned) location decisions and the already segregated nature of urban residential space.

One of the central mechanisms through which Massey and Denton (1993) propose that race matters is through the interaction between racial residential segregation and high black poverty rates, which together concentrate poverty in black neighborhoods at much higher rates than in white neighborhoods. This pattern is evident in Table 2. Chicago's high rates of racial segregation, combined with African American's higher poverty rate compared to whites, means that African American neighborhoods are unique in their experience of concentrated poverty. Since supermarket retail location decisions are class-sensitive, this means that majority African American neighborhoods (especially the poorest ones) will necessarily experience the most acute spatial inequalities in access to desirable neighborhood amenities compared with other groups. Massey and Denton's (1993) hypothesis provides a mechanism that explains how supply-side, race-neutral retail location decisions can nevertheless produce racially unequal results

These theoretical findings have clear implications for policy. They suggest that observed patterns of racial inequality in supermarket access does not arise from racial discrimination within firms, but are created well before a business makes its location decisions. The inequalities originate instead in the processes of residential sorting and neighborhood attainment that have durably reproduced remarkably racially segregated cities ever since the Great Migration brought large numbers of African Americans to the North. My findings therefore point to the persistence of residential segregation – primarily by race, but also by class – in the housing market as the primary mechanism

through which poor African Americans are disproportionately denied access to amenity-rich neighborhoods.

My findings support Wilson (1987) and refute Massey and Denton (1993), by demonstrating that race does not matter when firms like supermarkets make location decisions, but they also support Massey and Denton's (1993) claim that the interaction of racial residential segregation and high black poverty rates relegates poor minorities, especially African Americans, to neighborhoods of markedly poorer quality. They show that upstream, racially discriminatory processes of residential sorting and neighborhood attainment make racial inequalities endogenous to race-neutral retail location decisions. From a policy perspective, these findings first support the general insights of neighborhood effects research, that promote mixed-income neighborhoods as a key means of shielding poor households from the deprivations of living in neighborhoods where disadvantage is concentrated. Second, they call for policies that aggressively curtail racial discrimination in housing markets, which, by all indications remains persistent and robust (Pager and Shepherd 2008). Third, since these interventions may only be executable in the long run, my findings suggest that stop-gap measures like government subsidies that attract desirable, essential retail like supermarkets into high-poverty areas will provide disproportionate relief to poor, African American communities.

Data, Methods and Theory

A second limitation of the analysis is that it is valid for the case of supermarket access in Chicago between 1970 and 2000. Althoug most profit-maximing firms should work similarly, future work will have to assess the relationship between these variables in

other cities, and between these variables and access to other kinds of organizational amenities. The limited empirical generalizability of this finding underscores the current data challenges that researchers face to testing hypotheses about neighborhood-level urban inequalities in organizational amenities or in the built environment in spatially sophisticated ways. My study focused on one city and one amenity type because address-specific information on neighborhood amenities is time-consuming to collect and prohibitively expensive to purchase. The only study to investigate the relationship between race, class and access to multiple essential amenities at a national level was restricted to a spatially naïve use of count-data using zip-codes – spatial units of questionable ecological validity for answering this particular substantive question (Small and McDermott 2006).

My analysis suggests that findings from studies using data with limited spatial information may produce misleading results since it is difficult for them to take spatial structure into proper account. This study therefore highlights the need for large-scale datasets with address-specific information about important neighborhood features. Address-specific feature data allows researchers to operationalize space more flexibly and more precisely, and to define spatial units with greater ecological and theoretical validity. As this paper indicates, these are not merely technical issues of method and measurement, but also issues of potentially great substantive and policy significance.

TABLES[10]

TABLE 1-A: Descriptive Statistics for Variables in the Analysis

	1970		1980		1990		2000	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
% Persons in Poverty	15.3	(12.0)	22.2	(16.8)	25.0	(19.5)	22.5	(16.3)
% Non-Hispanic White	57.6	(40.4)	42.1	(37.5)	35.1	(34.9)	29.8	(31.8)
% Non-Hispanic Black	30.8	(42.3)	39. 2	(44.3)	42.0	(44.3)	43.0	(43.6)
% Hispanic	8.5	(14.2)	16.0	(22.8)	19. 4	(26.2)	22. 8	(28.5)
% Non-Hispanic Asian	1.2	(4.8)	2.8	(5.8)	3.2	(7.5)	4.2	(8.6)
Population	3980	(2610)	3580	(2490)	3320	(2390)	3430	(2580)
Area (sq.mile)	0.25	(0.37)	0.25	(0.37)	0.26	(0.42)	0.25	(0.27)
Population density (persons per sq. mile)	23,100	(16,300)	19,800	(13,300)	17,900	(11,900)	18,100	(11,800)
% Foreign Born	11.1	(9.2)	14.2	(13. 5)	14.9	(15.2)	17.6	(17.4)
Average HH Income ($)	9,546	(2,937)	17,450	(5,600)	31,039	(14,252)	49,879	(23,779)
Aggregate HH Income (millions $)	13.6	(12.4)	24.5	(25.1)	42.2	(51.6)	68.2	(77.0)
% Persons in the same house 5 years ago	52.7	(14.7)	57.6	(15.9)	55.1	(14.9)	54.4	(15.0)

[10] To aid reading and interpretation, all numbers in these tables are reported to three significant figures.

Table 1-B: Mean Population and Mean Population Density for Chicago Census Tracts, Classified by their Majority Race.

	Neighborhood Racial Majority							
	White		Hispanic		Black		Mixed Race	
	Population	Population Density	Population	Population Density	Population	Population Density	Population	Population Density
1970	3,960	19,200	3,300	30,400	4,170	28,900	2,670	21,300
1980	3,750	16,400	3,100	25,400	3,560	20,700	2,880	19,100
1990	3,580	15,700	3,100	23,200	2,960	16,200	3,220	18,500
2000	3,480	18,200	4,100	22,900	2,810	14,700	3,630	18,300
% change:								
1970-2000	-12.1%	-4.9%	23.2%	-24.7%	-32.7%	-49.2%	35.9%	-4.9%

Census tracts are considered "Majority Race" if ≥ 60% of residents belong to a single racial/ethnic group.

Table 2: Percentage of All Tracts Experiencing Concentrated and Extreme Poverty

	1970	1980	1990	2000
Concentrated Poverty (> 40% Poor)	5%	14%	20%	13%
Extreme Poverty (> 80% Poor)	0%	0.24%	2.30%	0.24%

Table 3: Percentage of Racial Majority Tracts Experiencing Concentrated Poverty

	Black	White	Hispanic
1970	34%	0.0080%	20%
1980	35%	0.0092%	11%
1990	42%	0%	10%
2000	29%	0%	6%

Census tracts are considered "Majority Race" if there ≥ 60% of residents belong to a single racial/ethnic group.

Table 4: Average Neighborhood Exposure to Supermarkets

	1970		1980		1990		2000	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
# of Supermarkets	0.5	(0.826)	0.218	(0.497)	0.11	(0.342)	0.121	(0.398)
# of supermarkets per 100,000 persons	15.47	(53.3)	9.26	(42.34)	5.98	(39.82)	7.40	(45.62)
Minimum Distance to a Supermarket (miles)	0.539	(0.305)	0.803	(0.437)	1.073	(0.612)	1.11	(0.654)

Table 5: Percentage of Neighborhoods with Access to Zero or More Supermarkets

	% of Tracts			
# of Supermarkets	1970	1980	1990	2000
0	66.04	81.53	89.98	90.40
1	22.49	15.61	9.07	7.23
2	8.28	2.38	0.95	2.25
3	2.13	0.48	0	0.12
4	0.95	0	0	0
5 or more	0.12	0	0	0
Total	100.00	100.00	100.00	100.00

Table 6: Simple OLS models and Spatial Models of Supermarket Access, assessing the effect of Race and Concentrated Poverty, for 1970 and 1980 (see next page for 1990 and 2000)

	1970		1980	
	OLS	Queen2	OLS	Queen2
Predictors				
Intercept	1.32***	1.46***	1.46***	0.40
% Poor	0.0034**	-0.000027	0.0056***	0.0012
% Black	0.00018	0.0010	0.00016	-0.0024***
Spatial Weights for Predictors				
% Poor-lagged		0.0085***		0.013***
% Black-lagged		-0.0016*		
Controls				
% Hispanic			-0.0016*	-0.0018*
% Foreign born				-0.0038*
Residential Stability	0.0029***	0.0028***	0.0023*	0.000081
Population Density (logged)	-0.11***	-0.089***	-0.107***	-0.12***
Distance from Central City	0.014**	0.023***	0.02**	0.039***
Public Housing				0.061*
Spatial Weights for Controls				
Residential Stability-lagged				0.0054**
Population Density (logged)-lagged		-0.046***		-0.091**
Morans I	0.31***	0.0015	0.39***	0.0032
Overall R-squared	0.1536	0.1708	0.1133	0.1664

*p< 0.05, ** p < 0.01, ***p<0.001

Table 6: Simple OLS models and Spatial Models of Supermarket Access, assessing the effect of Race and Concentrated Poverty, for 1990 and 2000

	1990		2000	
	OLS	Queen2	OLS	Queen2
Predictors				
Intercept	1.75***	1.06***	0.75**	0.20
% Poor	0.0074***	0.0029*	0.0090***	0.0033
% Black	0.0015*	-0.0026**	0.0032***	-0.0025*
Spatial Weights for Predictors				
% Poor-lagged		0.022***		0.025***
% Black-lagged				0.0022
Controls				
% Hispanic		-0.0032**	0.0039***	0.0019
% Foreign born			-0.055**	-0.0068**
Residential Stability	0.0036*	-0.00036	0.0036*	0.0029
Population Density (logged)	-0.15***	-0.13***	-0.054*	-0.035
Distance from Central City	0.044***	0.083***	0.056***	0.086***
Public Housing				
Spatial Weights for Controls				
Residential Stability-lagged		0.0055*		
Population Density (logged)-lagged				
Morans I	0.44***	0.0056	0.50***	0.00076
Overall R-squared	0.2058	0.2696	0.2729	0.3504

*p< 0.05, ** p < 0.01, ***p<0.001

Figure 1: Supermarket in 1970 and 2000, by % African American and by % Poor

Legend

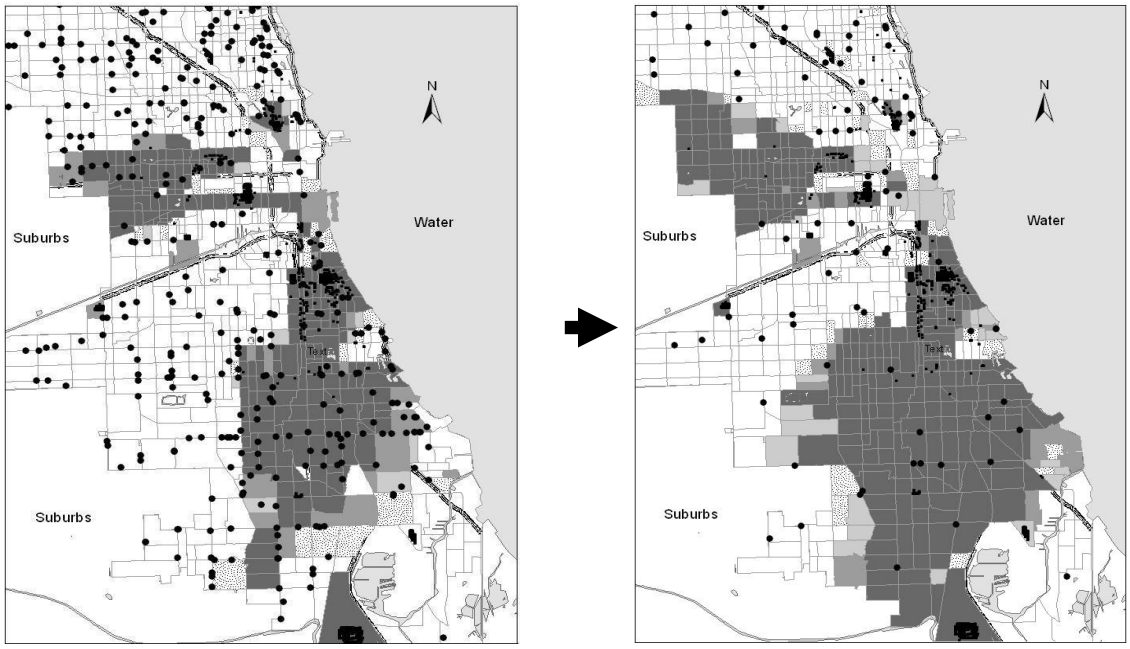
• Supermarket · Public Housing ═══ Highway

Color Spectrum for % African American and % Poor:

0 to ≤20% 20 to ≤ 40% 40 to ≤60% 60 to ≤ 80% 80 to ≤ 100%

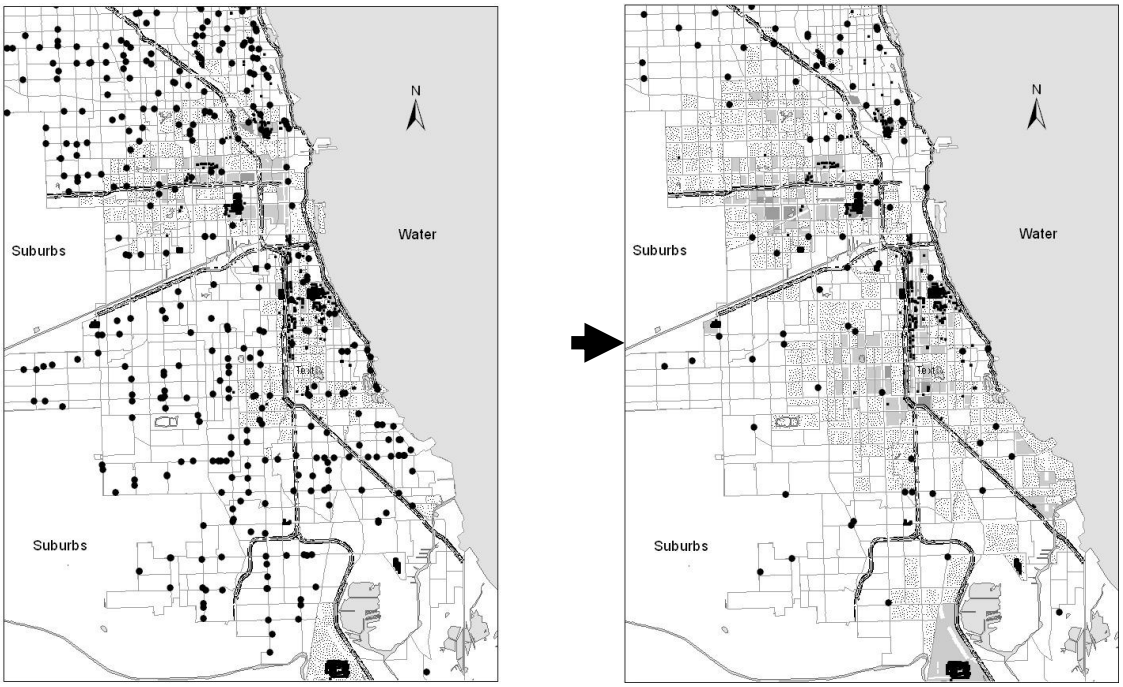
Supermarket Access & African American Population

1970 2000



Supermarket Access & Tract Poverty Rate

1970 2000



BIBLIOGRAPHY

Anselin, L (2005) *Exploring Spatial Data with Geoda: A Workbook*, Chapters 17, 23-25.

Bader, Michael D. M., Jennifer A. Ailshire, Jeffrey D. Morenoff, and James S. House. 2010. "Measurement of the Local Food Environment: A Comparison of Existing Data Sources." *American Journal of Epidemiology* 171:609-617.

Browning, CR, D Wallace, S Feinberg, and KA Cagney. 2006. "Neighborhood social processes and disaster-related mortality: The case of the 1995 Chicago heat wave." American Sociological Review 71:665-682.

Brownstein, Henry H. 1996 "The Rise and Fall of a Violent Crime Wave: Crack Cocaine and the Construction of a Social Crime Problem" Criminal Justice Press Project, Willow Tress Press Inc. Monsey, NY

Cotterill, Ronald W. and Andrew W. Franklin. 1995. "The Urban Grocery Store Gap." Food Marketing Policy Center, Dept. of Agricultural and Resource Economics, University of Connecticut, Storrs, CT.

Donohue, R.M 1997. "Abandonment and Revitalization of Central City Retailing: The Case of Grocery Stores." Unpublished doctoral dissertation. University of Michigan, Ann Arbor.

Downey, Liam. 2003. "Spatial Measurement, Geography, and Urban Racial Inequality." *Social Forces* 81:937-952.

Downey Liam. 2005 "The Unintended Significance of Race: Environmental Racial Inequality in Detroit" *Social Forces,* March 83(3):971–1008

Downey, Liam. 2006. "Using geographic information systems to reconceptualize spatial relationships and ecological context " *American Journal of Sociology* 112:567-612.
Entwisle, Barbara. 2007. "Putting People Into Place." *Demography* 44:687-703.

Entwisle, Barbara. 2007. "Putting People Into Place." Demography 44:687-703.

Food Marketing Institute (FMI). 1998. "Urban Supermarkets." Washington D.C.
Initiative for a Competitive Inner City ICIC & The Boston Consulting Group 1998 "The Business Case for Pursuing Retail Opportunities in the Inner City," ICIC/BCG

Initiative for a Competitive Inner City ICIC & The Garfield Foundation 2002 "The Changing Models of Inner City Grocery Retailing"

Kalleberg, Arne L., Peter V. Marsden, Howard E. Aldrich, and James W. Cassell. 1990. "Comparing Organizational Sampling Frames." *Administrative Science Quarterly* 35:658-688.

Kasarda, J. 1985. "Urban Change and Minority Opportunities." Pp. 33-67 in *The New Urban Reality*, edited by P. E. Peterson: Brookings Institution.

Levitt, Steven D. 2004. "Understanding why crime fell in the 1990s: Four factors that explain the decline and six that do not." Journal of Economic Perspectives 18.1:163-190

Ludwig, J, Sanbonmatsu L, Gennetian L et al. 2011 "Neighborhoods, Obesity and Diabetes: A Randomized Social Experiment" *New England Journal of Medicine*. 365:16. October.

McQuarrie and Marwell (2009) "The Missing Organizational Dimension in Urban Sociology" *City and Community* 8 (3): 247-268

Massey, D.S. and N. A. Denton. 1993. *American Apartheid: Segregation And The Making Of The Underclass*. Cambridge, Mass.: Harvard University Press.

Mayer, S.E. and C. Jencks. 1989. "Growing Up in Poor Neighborhoods: How Much Does It Matter?" *Science* 243:1441-45.

Mobley, Lee R., Elisabeth D. Root, Eric A. Finkelstein, Olga Khavjou, Rosanne P. Farris, and Julie C. Will. 2006. "Environment, Obesity, and Cardiovascular Disease Risk in Low-Income Women." *American Journal of Preventive Medicine* 30:327-327.

Morland, Kimberly, Ana V. Diez Roux, and Steve Wing. 2006. "Supermarkets, Other Food Stores, and Obesity: The Atherosclerosis Risk in Communities Study." *American Journal of Preventive Medicine* 30:333-339.

Openshaw, S. (1984). The Modifiable Areal Unit Problem. Norwich: Geo Books.
Porter, Michael E. 1995. "The Competitive Advantage of the Inner City." *Harvard Business Review* 73:55-71.

Pothukuchi, K. 2005 “Attracting Supermarkets to Inner-City Neighborhoods: Economic Development Outside the Box” *Economic Development Quarterly* 93: 232-244.

Small, Mario Luis and Laura Stark. 2005. "Are poor neighborhoods resource deprived? A case study of childcare centers in New York." *Social Science Quarterly* 86:1013-1036.

Small, Mario Luis and Monica McDermott. 2006. "The presence of organizational resources in poor urban neightborhoods: An analysis of average and contextual effects." *Social Forces* 84:1697-1724.

Timberlake, JM. and Iceland J. 2007. “Change in Racial and Ethnic Residential Inequality in American Cities, 1970-2000.” *City and Community* 6, 4: 335-365.

U.S. Department of Housing and Urban Development (HUD) 1999 “New Markets: The Untapped Retail Buying Power in America’s Inner Cities.” Washington, DC.

Ver Ploeg M, Breneman V, Farrigan T, et al. 2009. "Access to Affordable and Nutritious Food— Measuring and Understanding Food Deserts and Their Consequences: Report to Congress." United States Department of Agriculture. Administrative Publication No. (AP-036) 160 pp, June.

Venkatesh, SA. 2002l "American Project: the Rise and Fall of a Modern Ghetto" Harvard University Press.

Walker, Renee E., Christopher R. Keane, and Jessica G. Burke. 2010. "Disparities and access to healthy food in the United States: A review of food deserts literature." *Health & Place* 16:876-884.

Wilson, W.J. 1978. *The declining significance of race: Blacks and changing American institutions*. Chicago: University of Chicago Press.

Wilson, William Julius. 1987. *The Truly Disadvantaged: The Inner City, The Underclass, and Public Policy*. Chicago: University of Chicago Press.

Wilson, W.J. 1996. When Work Disappears: The World of the New Urban Poor. New York : Knopf