THE DYNAMICS AND IMPACTS OF RETAIL SUPERMARKET DECENTRALIZATION IN DETROIT, MICHIGAN

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ABSTRACT

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This dissertation integrates a social ecological framework with GIS, historical records, survey data and multivariate statistics to examine the transformation of the tri-County Detroit, Michigan food environment from 1970 to 2010. It documents how patterns of retail supermarket decentralization combined with a racially selective residential suburbanization process to create an uneven food environment characterized by a city-suburb dichotomy in which the predominately African American city of Detroit was devoid of national and regional supermarkets and the predominately-White suburbs were awash in stores. It shows how these disparities were further exacerbated by a massive economic restructuring among the major national and regional supermarkets operating within the tri-County, Detroit region. Last, it examines how disadvantaged residents responded to these changing conditions and how limited food environments shape public health outcomes as measured by dietary-intake levels. In so doing, this dissertation challenges several assumptions and fills in some missing gaps within the existing "food desert" literature.

First, it tests the prevalent assumption within the "food desert" discourse that socially and economically marginalized residents living in a limited food environment disproportionately rely on the convenience, corner grocery and liquor stores nearest to them for their food provisions. This dissertation finds that socially and economically marginalized residents—regardless of economical and physical mobility constraints—overwhelming shop outside their immediate food environment at independent, discount and national and regional full-service supermarkets in the

city of Detroit and its suburbs. Consequently, this research shows that direct effects of the immediate food environment in explaining differentials in dietary-intake levels is assuaged by such shopping patterns. Sociodemographic factors play a greater role in explaining differentials in dietary-intake levels while the local food environment plays an indirect role by imposing additional travel burdens upon an already marginalized population.

Second, this dissertation elucidates how rates of retail supermarket accessibility have changed in relation to levels of neighborhood economic deprivation and neighborhood racial composition. It shows that there were initially very few differences with respect to store composition and accessibility levels across the tri-County Detroit region in 1970. However, by 1980 racial and economic disparities in store composition and accessibility levels emerged. Low-income White census tracts began to have more national and regional supermarkets than comparable low-income African American tracts. Moreover, racial composition became a major force in explaining the presence of a national and regional supermarket across tri-County Detroit by 1990. The emergence of race also reflected a polarized landscape in which impoverished African American census tracts had fewer national and regional supermarkets and a greater number of corner grocery and liquor stores than affluent White census tracts.

Last, it tests the methodological assumption that neighborhood processes related to the food environment can be captured accurately by arbitrary administrative boundaries such as a census tract. Utilizing spatial clustering algorithms to generate new neighborhood configurations across the study area, this dissertation shows that the spatial inequities in the tri-County Detroit food environment and the processes of racial and economic stratification driving them are not an artifact of census geography. Extreme disparities between low-income African American neighborhoods and wealthy White neighborhoods persist.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

Figure 1-1: Farmer Jack Store Closing (©Detroit News) For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this dissertation.

In July of 2007, the last two Farmer Jack supermarkets in the city of Detroit closed their doors (Figure 1-1). Farmer Jack's closure not only brought an end to a historic retail legacy that dated back to the early 1920s, but it also left three quarters of a million residents without a major national supermarket chain. While the economic impact of the closing was severe, the abandonment of national and regional supermarkets from the city had been on-going for decades, leaving many to wonder if the city's rising obesity and food insecurity rates were somehow inexplicitly linked to the national supermarket chains' disinvestment from the city. Such concerns were not germane to Detroit. Inner city residents from Philadelphia to Oakland have raised similar concerns over the past two decades. More recently, concerns about the links between access to affordable, nutritious food sources and public health outcomes garnered national attention when echoed by first lady Michelle Obama during the launch of the Let's

Move! (America's Move to Raise A Healthier Generation of Kids) campaign in 2010. These growing public health concerns have corresponded with a rising academic interest in the socioeconomic and spatial inequities within food environments.

With the resurgence of social ecological theory, spatial inequalities in access to affordable, nutritious food sources has become a major research topic in the United States (U.S.), Canada, Australia, New Zealand and the United Kingdom. In particular, much attention has focused on the phenomenon commonly referred to as "food deserts" in which predominately low-income and minority rural and urban communities have limited or no access to affordable, healthful and culturally appropriate food sources (Wrigley, 2002). The concern underlying this research is that restricted access to affordable nutritious food sources, such as large-scale national and regional supermarkets, makes individuals more dependent on convenience and corner grocery stores, which often have higher food prices and a larger selection of unhealthful foods (Bell and Burlin, 1993; Alwitt and Donley, 1997; Chung and Myers, 1999). Over time, insufficient access to quality nutritious foods adversely affects the dietary-intake of socially and economically disadvantaged communities, thereby contributing to already high incidence rates of food insecurity, obesity and chronic diet-related diseases such as diabetes and heart disease (Baker et al., 2006; Jetter and Cassady, 2006; Larson et al., 2009).

To date, there has been much research that has demonstrated various associations between the neighborhood food environment, dietary behavior and obesity (Cheadle et al., 1991; Morland et al., 2002a; Laraia et al., 2004; Zenk et al., 2005a, 2009; Inagami et al., 2006; Morland et al., 2006; Jago et al., 2007; Liu et al., 2007; Gittelsohn et al., 2007; Powell et al., 2007a; Wang et al., 2007a; Brown et al., 2008; Bodor et al., 2008; Galvez et al., 2009; Rose et al., 2009a; Rundle et al., 2009; Laska et al., 2010; Michimi and Wimberly, 2010; Izumi et al.,

2011). Despite these efforts to document the health impacts arising from spatial inequalities in access to nourishing food sources, little is known about the long-term health, economic and social impacts of "food deserts" (Cummins and Macintyre, 2002, 2006). Moreover, scholars have made little effort to discern the processes underlying their formation.

It commonly is accepted that the emergence of urban "food deserts" is linked to residential and retail suburbanization, racial, ethnic and economic segregation and the restructuring of the supermarket industry (Eisenhauer, 2001; Smoyer-Tomic et al., 2006; Larsen and Gilliland, 2008). Yet, few empirical studies have systematically attempted to examine how these broader processes transform existing food environments into "food deserts" within a major metropolitan region. Most studies examine only one point in time. The failure to scrutinize the historical formations and transformations of urban food environments, and in turn how people respond to these changes, has led to the overlooking of several crucial assumptions and issues within the "food desert" literature.

First, it commonly is assumed that residents of socially and economically disadvantaged neighborhoods shop either at stores located in their neighborhood food environment or at the stores nearest to them. Consequently, it is implicit that food purchasing overwhelmingly occurs in these neighborhood stores. Therefore, neighborhood food environments are considered influential due to the purchase and consumption of foods available within the local neighborhood.

Such assumptions not only oversimplify the problem by reducing consumption and purchasing habits into a gravity model framework (Glanz et al., 2005), but also tend to contradict findings from the disadvantaged consumer literature and earlier research on low-income households' supermarket shopping behavior. Past studies have found that disadvantaged

consumers shop outside of their neighborhood food environment (Alexis and Simon, 1967; Alexis et al., 1969; Berry and Solomon, 1971; Petrof, 1971; Goldman, 1976; Piacentini et al., 2001; Clifton, 2004; Gittelsohn et al., 2007; Drewnowski et al., 2010). Given that marginalized households actively seek stores in which they can maximize their food dollars and given that many residents shop outside of their existing food environments even when full-service supermarkets are present, attention needs to be placed on documenting the complex interplay between broader structural realignments in the supermarket industry, neighborhood effects, travel behavior and the psychological, economical and social determinants of food shopping behavior.

By not scrutinizing these dynamics, many "food desert" studies might be making inferences that simply are not valid. The role of a resident's neighborhood food environment on his/her dietary health outcomes hinges on an untested assumption that residents purchase and consume food in their immediate environment. In addition, these assumptions risk overlooking the food environments that socially and economically disadvantaged neighborhood residents utilize or are forced to utilize due to broader socio-spatial dynamics in the community (Kumar et al., 2011).

Second, past research has struggled to conceptualize and operationalize neighborhoods. Many studies simply equate a neighborhood to an arbitrary administrative boundary such as a census tract or ward. It is assumed that these boundaries accurately capture and represent the phenomena and processes under inquiry. Yet, social and economic processes along with people's perceptions do not neatly align with such administrative boundaries (Coulton et al., 2001, Burton et al., 2007; Flowerdew et al., 2008). Ignoring the congruence between neighborhood processes and outcomes with arbitrary units and aggregations could introduce

error and misleadingly predicate results based on how neighborhood delineation occurs (Openshaw, 1984) rather than on the socio-spatial processes thought to be of importance.

Failure to scrutinize these assumptions could lead to false outcomes and the overlooking of crucial processes in the making and unmaking of uneven food environments. At a more prescriptive level, it might lead policymakers and health officials to prescribe solutions that may not alleviate the underlying public health concerns, fail to address the regional processes and structural conditions that are uprooting the social fabric of neighborhoods and in some cases might divert resources away from more effective programs (Allen, 2004; Osypuk and Acevedo-Garcia, 2010). Since the formation of urban "food deserts" over space and time depends on the interaction of complex scalar processes and discursive historical practices, it is crucial for research to identify how they evolve overtime and it is crucial for policy makers to understand these dynamics in order craft viable policy solutions.

This dissertation fills the gap by studying the historical transformation of tri-County Detroit, Michigan food environment from 1970 to 2010. In particular, it seeks to analyze how rates of retail supermarket accessibility have changed in relation to levels of neighborhood economic deprivation, neighborhood racial composition and the broader decentralization and restructuring of the supermarket industry in order to gain a better understanding of how limited food accessibility to nutritious food sources might shape public health outcomes. In addition, it examines how disadvantaged residents respond to these changing conditions and how scholars' conceptions of neighborhood might influence the outcomes of their studies. By so doing, I seek to explicitly examine the past overlooked assumptions and historical processes responsible for the creation of uneven food environments.

In so doing, I raise several research questions:

1. Do people who live in neighborhoods with poor accessibility to national and regional supermarkets shop in their immediate food environment?

2. Does living in a limited food environment adversely affect public health outcomes as measured by dietary-intake levels?

3. How has the decentralization of retail supermarkets led to the creation of spatial inequalities in the food environment of tri-County Detroit, Michigan?

4. Are spatial inequities in the tri-County Detroit food environment mainly differentiated by neighborhood racial composition or neighborhood economic conditions? Are these perceived spatial inequities an artifact of how a neighborhood is delineated?

The first two questions examine the untested assumption that residents living in a limited food environment are confined to shop and consume at the stores closest to them. By examining this assumption, I am directly testing whether unhealthful food environments adversely impact public health outcomes. The third question seeks to illuminate the major players and processes responsible for transforming the food environment and the last question seeks to scrutinize whether administrative boundaries accurately capture neighborhoods and the processes that have differentiated the food environment. In essence, it examines whether or not past results in the literature are an artifact of how scholars conceptualize and operationalize neighborhoods.

I explore the changing retail food landscape of tri-County Detroit through the lens of social ecological theory. Social ecological theory attempts to explore how the spatial distribution and intensity of neighborhood economic deprivation and racial residential segregation impact the life outcomes of individuals and communities (Wilson, 1987; Massey and Denton, 1993; Jargowsky, 1997; Sampson and Morenoff, 1997; Williams and Collins, 2001). This approach allows for an analysis of the social, political and economical processes that have shaped the spatial manifestation and the reconfiguration of the urban food environment over time and space.

The working premise of my research is that the agency of residents living in limited food environments has been underrated and that residents no matter their economic and physical constraints predominately shop outside their neighborhood food environment rather than at small neighborhood convenience, liquor and corner grocery stores (Q1). It also is postulated that such agency assuages potential negative neighborhood effects on the dietary-intake of individuals living in limited food environments (Q2). Consequently, it is hypothesized that sociodemographics will play a greater role explaining dietary-intake levels than neighborhood conditions. Neighborhood food environments are believed to influence indirectly dietary-intake levels through the imposition of greater travel and food costs upon households thereby reducing the amount of resources available to purchase nutritious food sources.

The premise with regard to the historical formation of the tri-County Detroit food environment is that retail supermarket suburbanization and economic restructuring occurred over a racially polarized landscape to create an uneven food environment between the predominately African American city and the predominately-White suburbs (Q3). Therefore, it is contended that spatial inequalities have been unevenly distributed across the region and vary predominately by levels of neighborhood racial composition rather than levels of neighborhood economic

deprivation (Q4). That is, it is expected that African American sections of tri-County Detroit, including the more affluent African American neighborhoods, will have the greatest spatial inequities in access to national and regional supermarkets in comparison to low-income, middle class and affluent White neighborhoods. Moreover, it also is expected that African American neighborhoods will be overburdened disproportionately by unhealthful food stores, such as corner grocery, party and liquor stores. This is in direct contrast to scholars who have argued that the role of racial residential segregation and stratification in shaping neighborhood impacts on individual life outcomes has waned over the past 50 years (Wilson, 1980, 1987, 1996; Jargowsky, 1997). Conversely, it is believed that these outcomes are not a methodological byproduct of census tract geography or how one delineates a neighborhood but rather the broader racial stratification processes that have transformed the region.

This research occurs within an 892 square mile study area that represents all census tracts that have their centroid within a 23-mile buffer derived from the Campus Martius Park, the point of origin for Detroit's street network. This study area captures the heart of the tri-County Detroit region, which consists of Oakland, Macomb and Wayne counties and the city of Detroit (Figure 1-2 to 1-4). In 2010, the sprawling region consisting of 2,006 square miles was home to roughly 3.9 million people (67% White, 25% African American and 8% other) (US Census, 2012). Like many older industrial and manufacturing metropolitan areas, the region has struggled to adapt its labor force, economy and social capital to deal with the large-scale reorganization of the American economy that has hollowed out and withered away the foundations of the city (Vojnovic, 2009). This has resulted in a socio-spatial structure that is heavily polarized along racial and class lines (Darden et al., 1987; Thomas, 1997; Farley et al., 2000; Sugrue, 2005; Galster, 2012; Darden and Thomas, 2013).

At its pinnacle in 1950, the city of Detroit stood at 1.8 million people (83.6% White, 16.2% African-American and .2% Other) (US Census, 1952). Yet by 2010, the White population in the city of Detroit dropped roughly from 1.5 million to 75,000, while the African American population grew roughly from 300,000 to 750,000 in 2000 before dropping down to roughly 600,000 in 2010. In stark contrast, the White population increased from roughly 370,000 to roughly 900,000 in Oakland County and roughly from 200,000 to 700,000 in Macomb County between 1950 and 2010 (US Census, 2001, 2012).

Across the tri-County region, 14% of the population and 1 in 5 children live in poverty. This poverty is heavily concentrated in the city of Detroit, in which 36.2% of the residents live below the poverty line while roughly 50.4% of the children under the age of 18 live in poverty (US Census, 2011). Many of these households also are at risk of hunger, under-nutrition and food insecurity. One in four households with children cannot consistently afford food to sustain their family members. Each week, over 100,000 people in tri-County Detroit receive emergency food assistance (Mabli et al., 2010). In Wayne County, one of every 25 residents reports an income of only food stamps (Deparle and Gebeloff, 2010). These brutal conditions are sharply contrasted by conditions in the two predominate-White suburbs of Oakland and Macomb County. The 2011 median household income in Oakland ($66,456) and Macomb County ($54,087) dwarf the median household income found in the city of Detroit ($27,862) (U.S. Census, 2011).

While these conditions make it possible to explore my research, it also raises important questions about positionality in this research. The burdens faced by the residents living in the city of Detroit are severe, especially in context of the concentrated wealth in the Detroit suburbs. The bitter racial legacy and violence associated with the history of the region are worn on the

faces of neighborhood residents attempting to make ends meet. The severe economic disinvestment in the region can be seen in every facet of the built-environment. Being a White male researcher from a Northeast working class family, it is important to recognize that the analysis, insights and knowledge contained in this dissertation were not produced in a vacuum but were influenced by my life history, which in turn shaped my interpretations and interactions with the cultural, social, political and historical conditions encountered in the region. Moreover, while much of the analysis to follow is quantitative by design, the numbers and results should not be mistaken for any privileged epistemological space. The results and analysis contained herein are my attempts to navigate and make sense of a complex divided landscape in effort to broaden the academic literature and inform public policy.

This dissertation is divided into five additional chapters. Chapter 2 grounds the dissertation into the relevant social ecology, "food desert" and retail decentralization literature. It highlights the broader debates that this research engages in as well as several of the short comings within the literature that it seeks to address. Chapter 3 explores potential health impacts that arise from residents living in a sparse food environment and how conceptualization of neighborhood complicates past assumptions in the literature. In particular, it assess where people living in a limited food environment shop for food. Chapter 4 examines how retail decentralization and realignments within the supermarket industry reconfigured the tri-County Detroit food environment. It sets the backdrop for Chapter 5, which examines how potential neighborhood food inequities are differentiated and whether or not they are a byproduct of how one conceptualizes and delineates a neighborhood. Chapter 6 offers brief summary remarks about the major findings of the dissertation.

Figure 1-2: Study Area

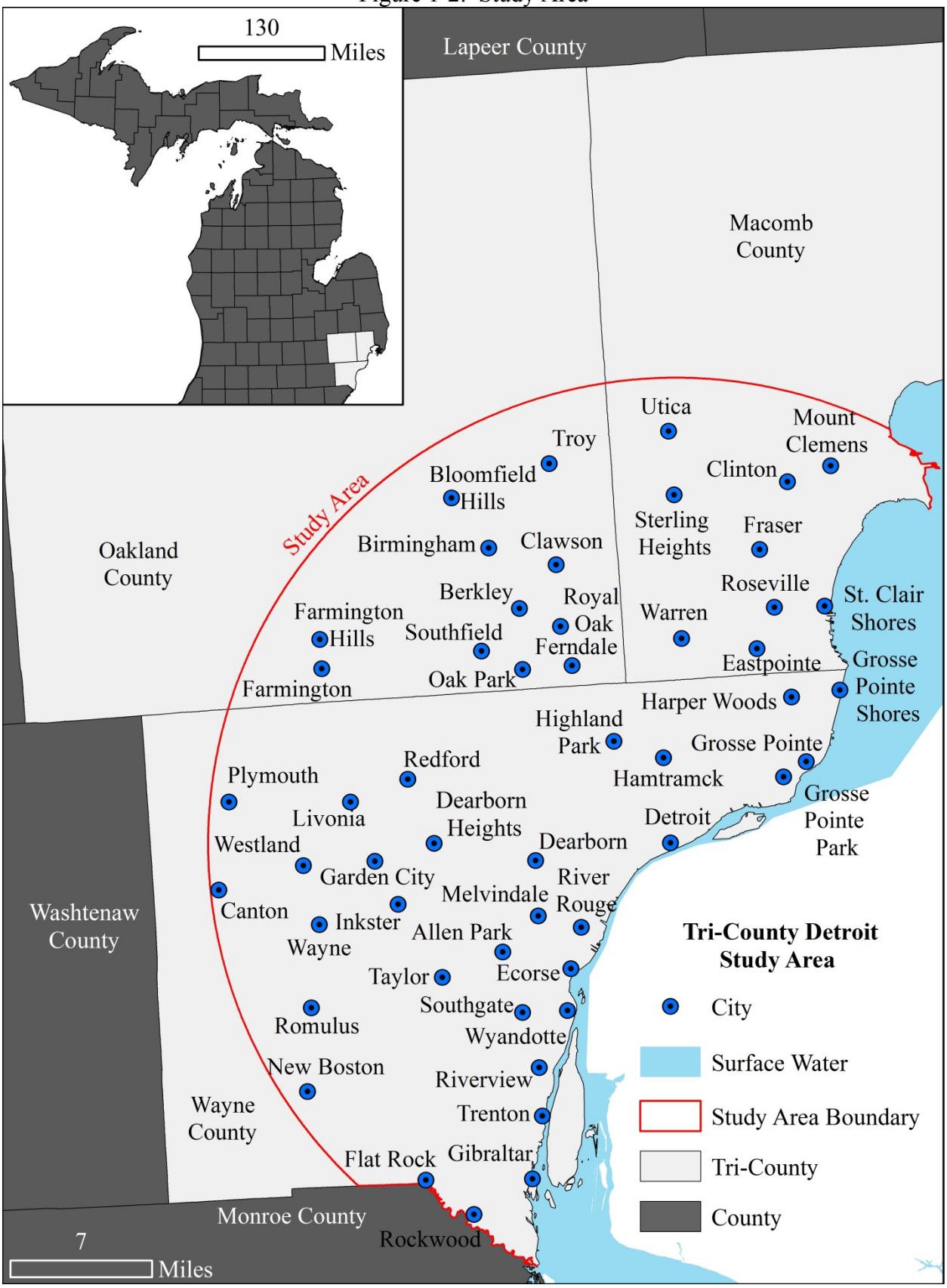


Figure 1-3: Tri-County Detroit City Municipalities

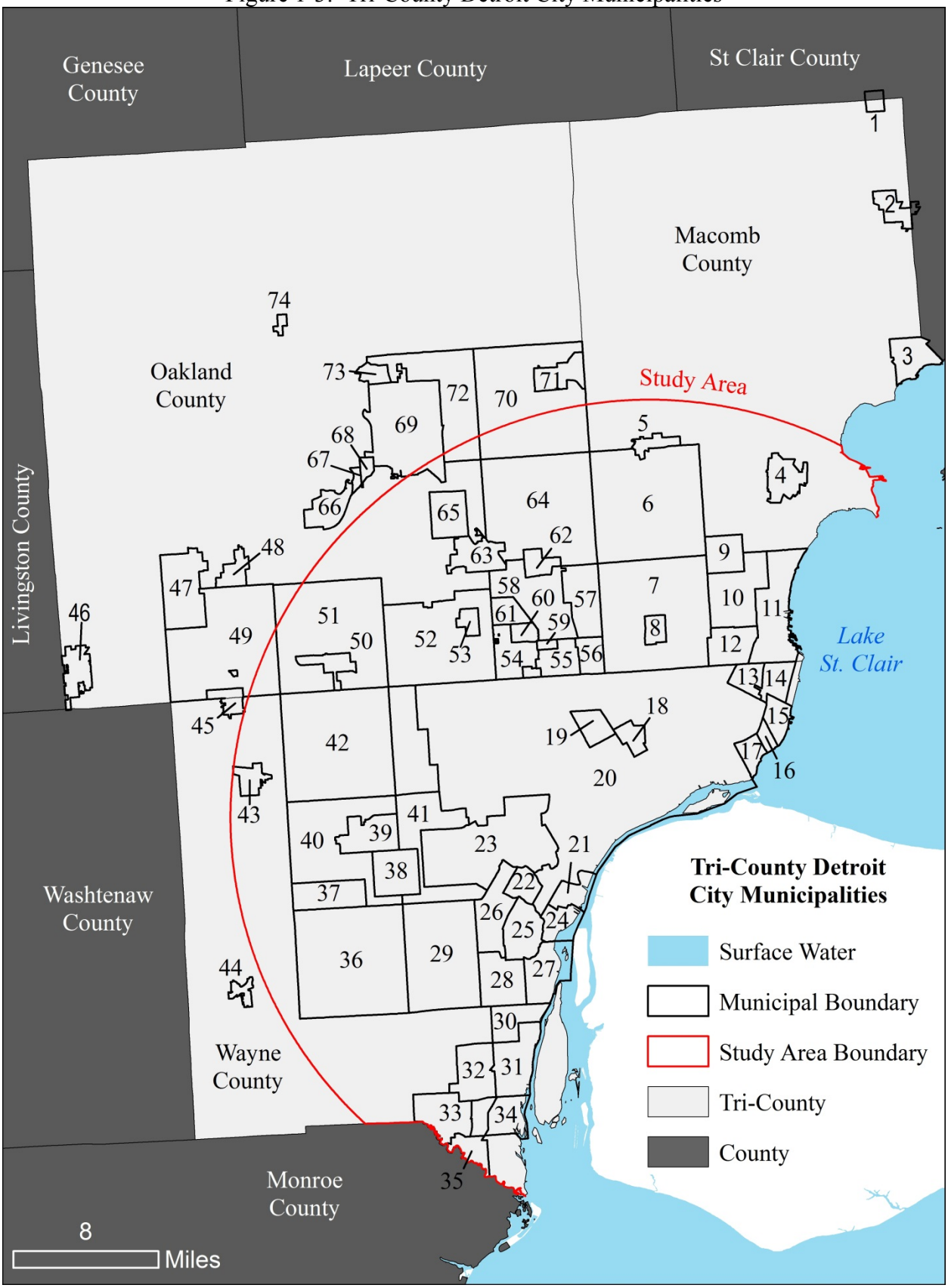
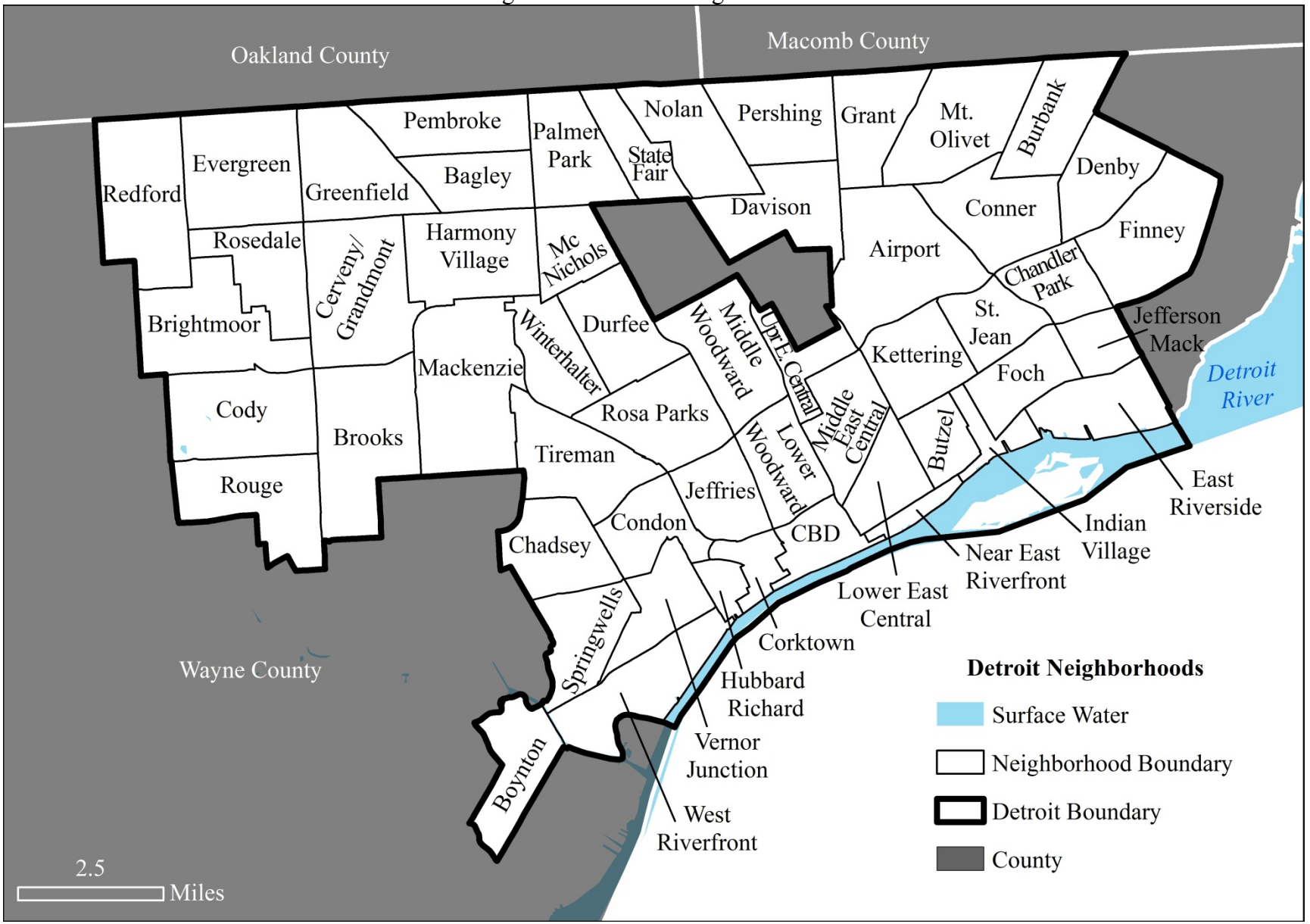


Figure 1-3 (Cont'd)

Municipalities					
1	Memphis	26	Allen Park	51	Farmington Hills
2	Richmond	27	Wyandotte	52	Southfield
3	New Baltimore	28	Southgate	53	Lathrup Village
4	Mt. Clemens	29	Taylor	54	Oak Park
5	Utica	30	Riverview	55	Ferndale
6	Sterling Heights	31	Trenton	56	Hazel Park
7	Warren	32	Woodhaven	57	Madison Heights
8	Center Line	33	Flat Rock	58	Royal Oak
9	Fraser	34	Gibraltar	59	Pleasant Ridge
10	Roseville	35	Rockwood	60	Huntington Woods
11	St. Clair Shores	36	Romulus	61	Berkley
12	Eastpointe	37	Wayne	62	Clawson
13	Harper Woods	38	Inkster	63	Birmingham
14	Grosse Pointe Woods	39	Garden City	64	Troy
15	Grosse Pointe Farms	40	Westland	65	Bloomfield Hills
16	Grosse Pointe	41	Dearborn Heights	66	Orchard Lake
17	Grosse Pointe Park	42	Livonia	67	Keego Harbor
18	Hamtramck	43	Plymouth	68	Sylvan Lake
19	Highland Park	44	Belleville	69	Pontiac
20	Detroit	45	Northville	70	Rochester Hills
21	River Rouge	46	South Lyon	71	Rochester
22	Melvindale	47	Wixom	72	Auburn Hills
23	Dearborn	48	Walled Lake	73	Lake Angelus
24	Ecorse	49	Novi	74	Clarkston
25	Lincoln Park	50	Farmington		

Figure 1-4: Detroit Neighborhoods



CHAPTER 2 LITERATURE REVIEW

"Those who cannot remember the past are condemned to repeat it." -George Santayana

This chapter reviews the key findings and disagreements that have emerged from the urban "food deserts" literature in the United States. It highlights how the divergent findings point to a series of questions and assumptions that remain unanswered and underexplored in the literature. At a broader level, this chapter contextualizes the research questions and grounds them within a social ecological framework. It also highlights the pertinent retail decentralization and supermarket restructuring literature to help set the background on which subsequent chapters will be based.

Social Ecology

Social ecological theory attempts to explore how the spatial distribution and intensity of neighborhood economic deprivation and racial residential segregation impact the life outcomes of individuals, households and communities (Wilson, 1987, 1996; Massey and Denton, 1993; Jargowsky, 1997; Sampson and Morenoff, 1997; Williams and Collins, 2001). It examines the interactions of humans with their built-environment and the socio-spatial relationships embedded and constructed within such built-environments (Park, 1916; Park et al., 1925). At its most fundamental level, social ecological theory explores how socioeconomic and cultural forces beyond individual level characteristics shape the lives of people and their environment.

Early social ecological research focused on exploring variations in collective social behaviors across neighborhoods and how the social fabric of neighborhoods were altered by the changing structural conditions associated with urbanization (Sampson and Morenoff, 1997). Within this framework, disadvantaged neighborhoods structured the life opportunities that various immigrant groups were exposed to as they tried to translate their socioeconomic status

into spatial assimilation and mobility. While such analysis was common in urban geography prior to the 1960s, a new paradigm that focused on exploring how family characteristics influenced individual's behaviors and outcomes took center stage within urban academic circles during the 1970s and 1980s (Clampet-Lundquist and Massey, 2008). However, with Wilson's seminal work, The Truly Disadvantaged, the neighborhood effects discourse reemerged.

Wilson (1987) argued that the spatial concentration of poverty yielded neighborhoods devoid of resources, services and opportunities, which resulted in a negative effect on a wide range of individual, household and neighborhood level outcomes. For Wilson, increasing social dislocation and the pathologies associated with it within inner-city ghetto neighborhoods was a product of a broader economic restructuring, middle-class migration and structural inequality. It was an attempt to link the social and economic experiences of people living in the inner-city to widening and deepening economic class divisions.

Subsequent research challenged Wilson's emphasis on class and postulated that racial segregation and entrenched institutional racism were the driving factors behind measured neighborhood effects (Massey and Denton, 1993; Sugrue, 2005). It was argued that the spatial isolation caused by unabated residential segregation and racial discrimination could not be entirely explained by class driven economic arguments. Instead, widespread racial discrimination in the housing market combined with entrenched institutional racism and prejudice within society concentrated poverty among inner-city minority neighborhoods at greater rates than White neighborhoods resulting in widespread economic and social dislocation within minority neighborhoods (Massey et al., 1991). Moreover, such discrimination has made it difficult for middle and upper class minorities to spatially distance themselves from their low-income counterparts and it has prevented them from integrating into equivalent White

neighborhoods. Despite the debates about which mechanism is most salient, researchers continue to explore the role of neighborhood effects on disadvantaged populations.

In the past two decades, a plethora of social ecological research has explored social disparities by race, socioeconomic status and neighborhood characteristics in everything from health outcomes and childhood development to housing and employment opportunities (Brooks-Gunn et al., 1993; Guest et al., 1998; Acevedo-Garcia et al., 2004; Glaeser et al., 2004). Underlying this research is the notion that all neighborhoods are not created equal. Neighborhood conditions independent of individual socioeconomic characteristics play a significant role in explaining socioeconomic and racial disparities in life opportunities and outcomes. Neighborhood conditions may negatively impact individual outcomes through mechanisms such as the lack of availability, quality and accessibility of stores and services, physical isolation of residents from resources and economic opportunities, negative collective socialization and peer effects, weakened social networks and capital and increased stress due to exposure to crime and violence (Mayer and Jencks, 1989ab; Ellen and Turner, 1997; Pickett and Pearl, 2001; Sampson et al., 2002).

The emerging body of research within this framework has shown that minorities and low-income households tend to live disproportionately in poor, low quality neighborhoods (Massey et al., 1987; Wilson, 1996; Jargowsky, 1997; Bayer and McMillan, 2005). Consequently, minorities and low-income households are placed at a disadvantaged by living in neighborhoods that have limited availability of resources, services and amenities. Moreover, upper income minority neighborhoods across the United States also lack the quality of life and life opportunities of comparable White neighborhoods (Massey and Denton, 1993; Wilson 1996).

Overall, a social ecology framework seeks to understand how racial and economic stratification processes create unequal neighborhoods that structure and shape the life opportunities of low-income and minority neighborhoods. Such concerns underline the emerging 'food desert' paradigm in the social sciences as it seeks to better understand how the spatial mismatch or unequal access to neighborhood food resources impact life opportunities and health outcomes.

Food Deserts

Over the past 40 years, food retailing has undergone a profound spatial restructuring. Technological advances, organizational restructuring, and consolidation in the supermarket industry combined with commercial blight in the central business district, residential suburbanization, increased personal mobility and racial and economic segregation led to the formation of decentralized superstores and the concentration of national and regional supermarket chains on the urban fringes where land prices, insurance premiums and utility costs were lower and customer purchasing power was higher than in the urban centers (Dawson, 1974; Muller, 1981; Wrigley, 1988; Bromley & Thomas, 1993ab; Teaford, 2006). This suburbanization of large-scale retail food outlets combined with the rapid decline in neighborhood supermarkets and other urban amenities in older inner-city neighborhoods has led to severely restricted food options in the central city where large concentrations of minorities and the poor are segregated (Vojnovic, 2000ab; 2006; Vojnovic et al., 2006). In its wake, cities across the United States have experienced a net loss in urban retail supermarkets (Curtis and McClellan, 1995; Eisenhauer, 2001). In addition, the new globalized supermarket business model based on economies of scale and razor-thin profit margins has made it difficult to reestablish large-scale supermarkets in city centers, where land ownership is fragmented and

zoning barriers and higher operating costs exist (Alwitt and Donley, 1997). The absence of retail supermarkets from urban centers has implications for food access and nutrition.

The uneven spatial distribution of retail chain supermarkets and other sources of affordable, nutritious and culturally appropriate food sources have long thought to impact individual, household and neighborhood well-being. The lack of these neighborhood resources independent of individual socioeconomic characteristics may play a significant role in widespread socioeconomic and racial public health disparities (Cummins and Macintyre, 2006). Similar to the concerns of past social ecological theory, "food desert" scholars, activists and policy-makers have thought to explore how uneven neighborhood food environments impact the accessibility, availability, quality and cost of foods; thereby structuring, limiting and enabling certain patterns of individual, household and neighborhood dietary practices.

In the United States, "food desert" scholars have found that socially disadvantaged and predominantly racial/ethnic minority inner-city neighborhoods have limited types of food stores. These neighborhoods tend to have fewer supermarkets and more convenience stores than predominantly-White and more affluent suburban neighborhoods (Cotterill and Franklin, 1995; Morland et al., 2002a; Moore and Diez Roux, 2006; Powell et al., 2007b; Lisabeth et al., 2010; Gordon et al., 2011). As a result, spatial access to healthful food sources such as retail supermarkets is low or nonexistent (Sallis et al., 1986; Curtis and McClellan, 1995; Cotterill and Franklin, 1995; Alwitt and Donley, 1997; Chung and Myers, 1999; Helling and Sawicki, 2003; Baker et al., 2006; Algert et al., 2006; Howard and Fulfrost, 2007; Galvez et al., 2007; Powell et al., 2007b; Berg and Murdoch, 2008). This restricted access makes individuals more dependent on smaller convenience, liquor, party and corner grocery stores, which have higher prices (Chung and Myers, 1999; Hendrickson et al., 2006; Jetter and Cassady, 2006; Lisabeth et al.,

2010; Sheldon et al., 2010; Smith et al., 2010; Vojnovic et al., 2013), a sparse selection of nutritious food staples (Hall, 1983; Sloane et al., 2003; Horowitz et al., 2004; Block and Kouba, 2006; Hosler et al., 2006; Jetter and Cassady, 2006; Gittelsohn et al., 2007; Morland and Filomena, 2007; Franco et al., 2008; Andreyeva et al., 2008; Bovell-Benjamin et al., 2009; Azuma et al., 2010; Grisgsby-Toussaint et al., 2010; Krukowski et al., 2010) and a large selection of liquor, soda and unhealthful energy dense foods laden with fats and sugar (Alwitt and Donley, 1997; Morland et al., 2002a; Zenk et al., 2006; Moore and Diez Roux, 2006; Block and Kouba, 2006; Gittelsohn et al., 2007; Powell et al., 2007b; Azuma et al., 2010; Thomas, 2010; Lisabeth et al., 2010). Even when affordable nourishing food sources are present, they have been found to be of poorer quality than those found in wealthy, predominantly White neighborhoods (Hall 1983; Sloane et al., 2003; Topolski et al., 2003; Zenk et al., 2005b, 2006; Hendrickson et al., 2006; Munoz-Plaza et al., 2007; Glanz et al., 2007; Pothukuchi et al., 2008).

Overall, these studies illuminate how physical and economic constraints play vital roles in accessibility differentials. In terms of physical accessibility constraints, one can be disadvantaged by their own physical limitations or by the built-environment around them and the socio-spatial practices and structure embedded within it (Imrie, 2000a; Goldsmith, 2000; Bromley et al., 2007). The street network, uneven pavement, the lack of sidewalks, steep steps and the types of road crossings combined with lack of public transportation or overall poor public transit and the socio-spatial dynamics of a residential or commercial neighborhood such as crime or racial hostility can hinder the mobility of an individual through the built-environment (Southworth and Owens, 1993; Thomas and Bromley, 1996; Lang, 2007).

Economic constraints manifest themselves as transportation and food costs as well as monetary and time constraints imposed on an individual to purchase and prepare food (Travers,

1996). Nutritious food staples such as fruits and vegetables and lean meats cost more than high-energy dense foods laden with fat and sugar (Drewnowski and Darmon, 2005). Moreover, households on a fixed budget often cannot afford the increased costs of increasing fruit and vegetable consumption levels recommended by nutritional dietary guidelines (Cassady et al., 2007). Transportations costs often are associated with car ownership and other costs associated with traveling to a store. Subsequently, having less access to a car limits spatial mobility forcing individuals to shop at small neighborhood stores (Caraher et al., 1998; Dunkley et al., 2004). Conversely, even socially and economically deprived households living in a "food desert" with reliable transportation are able to shop at large retail shopping centers in the suburbs (Burns and Inglis, 2007; Coveney and O'Dwyer, 2009).

Many of these studies found that unequal access to healthful foods based on economic and physical barriers are not experienced uniformly across all households and segments of society. Physical mobility constraints fall disproportionately on individuals with physical and psychological disabilities, the elderly, women traveling with children or carts and individuals lacking access to reliable and affordable automobile (Massey, 1994; Smith, 1991; Imrie, 2000b; Hine and Mitchell, 2001; Audirac, 2008; Morland and Filomena, 2008). Economic constraints disproportionately affect disadvantaged consumers, younger single female-headed households with children and the elderly and households who either lacked access to personal or public transportation (Travers, 1996; Whelan et al., 2002; Clarke et al., 2004). In the end, these studies highlight the major role that economical and physical constraints play in shaping the food consumption patterns of households.

Structural inequalities in the urban retail food environment and in food accessibility may influence diet-related public health outcomes thereby contributing to already high incidence rates

of food insecurity, obesity and chronic diet-related diseases such as diabetes and heart disease (Baker et al., 2006; Jetter and Cassady, 2006; Larson et al., 2009). Research has found that the fruit and vegetable dietary-intake of African Americans significantly increased with the presence of a retail chain supermarket even after individual sociodemographic factors were controlled (Morland et al., 2002b; Laraia et al., 2004). Similar research found that the dietary-intake of fruits and vegetables among Whites, Latinos and African Americans increased with the presence of large-scale chain supermarkets (Zenk et al., 2009; Adu-Nyako and Okafor, 2011) and that women who shop at large-scale chain supermarkets on average consume more fruits and vegetables than women shopping at independent neighborhood stores (Zenk et al., 2005a). The presence or relative close proximity of nutritious food sources increased not only the likelihood of increased dietary-intake of fruits and vegetables (Bodor et al., 2008; Michimi and Wimberly, 2010; Izumi et al., 2011) but it also improved overall diet and lowered the risk for childhood obesity (Cheadle et al., 1991; Liu et al., 2007) and low birth weight births among pregnant women regardless of one's income level (Lane et al., 2008).

Conversely, food environments dominated by neighborhood convenience stores lacking healthful foods have been associated with insalubrious dietary patterns (Gittelsohn et al., 2007; Wang et al., 2008). Increased residential distance from small neighborhood food stores was associated with increased vegetable consumption (Jago et al., 2007; Laska et al., 2010), while the presence of neighborhood convenience stores was associated with a decreased dietary-intake of fruits and vegetables (Zenk et al., 2009). Overall, residents inhabiting poor neighborhood food environments tend to have lower quality diets and consume less fruits and vegetables and more processed foods low in nutritional value but high in fat and sugar than those living in ample food environments (Moore et al., 2009; Franco et al., 2009).

Research also has shown that access to nutritious food sources plays an important role in explaining variations in individual body mass index (BMI) even after controlling for personal, behavioral and neighborhood factors (Morland et al., 2006; Powell et al., 2007a; Wang et al., 2007a; Brown et al., 2008; Galvez et al., 2009; Rose et al., 2009b; Rundle et al., 2009; Morland and Evenson, 2009; Zick et al., 2009; Michimi and Wimberly, 2010; Laska et al., 2010). In particular, it has been shown that socially disadvantaged consumers who frequent poor quality local food environments had significantly higher BMIs than disadvantaged consumers who shopped in higher quality food environments outside their neighborhood (Inagami et al., 2006) as well as women who lived in neighborhoods with a high density of neighborhood convenience stores (Wang et al., 2007a). Moreover, scholars have found that the presence of a retail chain supermarket was associated with the prevalence of lower obesity rates while the presence of a convenience store and increased shelf space dedicated to high energy dense foods was associated with higher obesity rates even after adjusting for individual level and behavioral factors (Morland et al., 2006; Powell et al., 2007a; Rose et al., 2009a; Rundle et al., 2009; Laska et al., 2010).

Another crucial component of the urban food environment thought to impact public health outcomes is the presence and availability of fast food restaurants. Research has shown that residents in the United States have been increasingly consuming meals outside of the home (Guthrie et al., 2002; Nielson et al., 2002; Kant and Graubard, 2004). Complementary to studies showing that low-income and predominantly minority urban neighborhoods are composed disproportionately of convenience stores, have been studies that show an overconcentration of fast food establishments in these same neighborhoods (Block et al., 2004; Lewis et al., 2005; Powell et al., 2007c). Associations also have been found between increased intake of fast food

and increased weight gain, BMI levels, and incidences of dietary related diseases such as hypertension (Jeffery et al., 1998; Binkley et al., 2000; French et al., 2000; Bowman and Vinyard, 2004; Maddock, 2004; Mehta and Chang, 2008; Moore et al., 2009).

These findings have not been without their critics. U.S. research critical of past findings have shown that availability and accessibility does not vary between socially disadvantaged or predominantly racial/ethnic minority neighborhoods and affluent, predominantly-White neighborhoods (Wechsler et al., 1995; Andrews et al., 2001; Short et al., 2007; Raja et al., 2008; Sparks et al., 2009; Ard et al., 2010). Instead, these studies have noted that low-income communities tend to have better overall accessibility to supermarkets than more affluent and suburban neighborhoods. Many of these studies also found no difference in the price, availability, and variety of fresh fruits and vegetables, and in some cases they found nutritious foods at cheaper prices. In addition, some of these studies found that small independent and ethnic grocers played a vital role in providing affordable nutritious food staples to the community (Short et al., 2007; Raja et al., 2008). Finally, research has shown that the dietary habits of residents living in a poor food environment did not change with the opening of a neighborhood full-service supermarket (Wang et al., 2007b) and increased supermarket availability was mostly unrelated to dietary-intake (Boone-Heinonen et al., 2011; Lee, 2012; An and Sturm, 2012) and obesity prevalence (Ford and Dzewaltowski, 2010).

These mixed findings within the "food desert" paradigm echo a much larger debate on whether or not neighborhood effects contribute to individual and collective disparities in access to resources, opportunities and services (Clampet-Lundquist and Massey, 2008; Ludwig et al., 2008; Sampson, 2008; Wilson, 2009; Zuberi, 2010). There is no doubt that the diverging results from the various strands of 'food deserts' research not only reflect this larger debate within

social ecological theory but also stem from differences in methodological standards and socio-spatial conditions across cities and regions. However, it also is a broader reflection of the failure to scrutinize several crucial assumptions within the literature.

Explicit in the past research reviewed above is the assumption that residents with economically or physically restricted mobility overwhelmingly shop in their neighborhood food environment or at stores nearest them to them. Consequently, it is implicit that food purchasing and consumption overwhelmingly occurs in these neighborhood stores. Unfortunately, such assumptions not only oversimplify the problem by reducing consumption and purchasing habits into a gravity model framework (Glanz et al., 2005), but also contradict findings from the disadvantaged consumer literature.

Disadvantaged Consumers

The shopping and travel patterns of disadvantaged consumers are multifaceted and complex (Bromley and Thomas, 1993a). Many disadvantaged consumers tend to exhibit shopping behaviors similar to non-disadvantaged consumers in that they shop at retail supermarkets located outside of their local neighborhood, but rely on neighborhood convenience stores to supplement their food budgets (Alexis and Simon, 1967; Alexis et al., 1969; Berry and Solomon, 1971; Petrof, 1971; Goldman, 1978; Piacentini et al., 2001; Clifton, 2004; Gittelsohn et al., 2007). Early on, Goodman (1968) noted that the majority of low-income residents shopped at large-scale chain supermarkets outside of their immediate neighborhood food environment. Likewise, studies noted that low-income consumers not only shop at stores far removed from their residences even when closer stores were present, but also that they preferred to shop at these distant supermarkets (Alexis and Simon, 1967; Alexis et al., 1969; Berry and Solomon, 1971; Petrof, 1971; Goldman, 1978).

These early findings question the commonly held assumption that low-income residents shop in the local food environment due to restricted mobility, cultural preference or personal choice (Haines et al., 1972; Goldman, 1978). In many cases, low-income and minority neighborhood residents often viewed the stores in their local food environment as suspect and many did not view shopping outside of their neighborhood as an inconvenience (Petrof, 1971). The best price for the highest quality food was found in some cases to be the decisive factor in store choice (Berry and Solomon, 1971; Timmermans, 1980).

More recent research in the United States has shown that low-income households receiving government food supports, such as Supplemental Nutrition Assistance Program (SNAP) benefits, overwhelmingly redeem their benefits at retail chain supermarkets (Cole and Lee, 2005; Castner and Henke, 2011). Similar research also demonstrates that SNAP participants travel nearly five miles to their preferred retail supermarket despite living an average of 1.8 miles from the nearest store (Cole, 1997), and Supplemental Nutrition Program for Women, Infants and Children (WIC) participants rarely shop at the closest supermarket for both non-WIC and WIC shopping (Hillier et al., 2011).

What emerges from these studies is the notion that the most disadvantaged of the disadvantaged—those lacking access to transportation, younger single female-headed households with children, the elderly, the disabled and the long-term unemployed—are much more reliant on the local food environment for their household food staples (Bromley and Thomas, 1993b, 1995). Yet, these subgroups are by no means homogeneous in their shopping experiences (Williams and Hubbard, 2001; Woodliffe, 2004, 2007; Bromley and Matthews, 2007). It is the complex interplay between structural conditions, social disadvantage, personal mobility and personal preferences and perceptions that often determine the shopping behavior of

disadvantaged consumers. Ultimately, economical, physical, and structural constraints play a major role in shaping the food consumption patterns of households, and these constraints interact with complex socio-spatial relationships that play out unevenly among neighborhoods and social groups.

These studies highlight the need not to lose sight of where people travel to shop and how those movements might affect public health outcomes. For if residents in "food deserts" can access stores with affordable nutritious food staples outside of their neighborhood, then is the neighborhood food environment the underlying problem; or are the real issues the financial and temporal pressures placed on the household by broader structural inequalities? Accordingly, can one assume that a neighborhood full-service supermarket would increase consumption of nutritious foods in households already accessing stores with such foods outside of the neighborhood? Consequently, public health studies (Morland et al., 2002b; Laraia et al., 2004; Morland et al., 2006; Jago et al., 2007; Powell et al., 2007a; Galvez et al., 2009; Michimi and Wimberly, 2010) that simply correlate the neighborhood food environment with longitudinal health data but fail to account for the travel and shopping patterns of residents risk making inaccurate associations and conclusions about actual shopping behavior and potential health outcomes. Such associations should be viewed carefully, as they are potential victims of misestimating neighborhood effects.

It is these untested assumptions and contradictions that give rise to two of the research questions examined in this dissertation. First, do people who live in neighborhoods with poor accessibility to national and regional supermarkets shop in their immediate food environment? Second, does living in a limited food environment adversely affect public health outcomes as measured by dietary-intake levels? It is hypothesized that residents shop and consume outside of

their immediate food environment, therefore the impact of residents' surrounding food environment will play a smaller role in comparison to socioeconomic conditions. It will be argued that this oversight in the literature is directly tied to the downplaying of disadvantaged consumers agency. While it is believed that the agency of disadvantaged residents has been downplayed in the "food desert" literature, it also is believed that these untested assumptions arise from the failure to examine how studies define and interpret the saliency of neighborhoods.

Neighborhoods

One of the biggest conceptual and methodological quandaries has been how 'food desert" studies construct neighborhoods (Cummins, 2007; Matthews et al., 2009; Odoms-Young et al., 2009). Many studies conceptualize and operationalize a neighborhood as a static arbitrary administrative boundary such as a census tract (Morland et al., 2002a; Powell et al., 2007b). The utilization of administrative boundaries in past "food desert" studies and other urban geography research has largely been out of convenience and in an often misguided belief that it accurately corresponds to the phenomena that scholars are interest in understanding (Coulton et al., 2001; Matthews, 2008). Such administrative boundaries fail to capture the lived experiences, cultural practices and social interactions that shape human behavior (Burton et al., 1997; Kwan and Weber, 2008).

People's perceptions of neighborhood do not neatly align with arbitrary administrative boundaries. Neighborhoods are rooted in dynamic and fluid cultural and social practices that operate at multiple scales. As a result, neighborhoods are heterogeneous lived spaces composed of complex social meanings, which are maintained and transformed through power relationships and socio-spatial processes (Downs, 1981; Guest and Lee, 1984; Haeberle, 1988; Massey, 2005). Moreover, given that how people observe, interpret, internalize and interact with their built-

environment varies by sociodemographics and life experiences there is often little agreement between residents as to the conceptualization and spatial boundaries of neighborhoods in their everyday lives (Gans, 1962; Gould and White, 1974; Haney and Knowles, 1978; Ellen and Turner, 1997; Lee and Campbell, 1997; Coulton et al., 2001).

The imposition of administrative boundaries as an appropriate unit to capture neighborhood effects often obscure the characteristics and processes associated with the phenomena scholars seek to understand while opening the door for error and the conflation of dynamic process to a fixed bounded space (Chaskin, 1997; Boyle and Willms, 1999; Mitchell, 2001; Oakes, 2004; Cockings and Martin, 2005; Flowerdew et al., 2008; Gale et al., 2011). Within the "food desert" scholarship it has provided a false sense of stability by overlooking the variability and heterogeneity in size and social demographics of the boundaries, limited the understanding of the scale and dynamic spatial manifestation of food environments and failed to challenge critically assumptions about where people shop and how far they are willing to travel by assuming that everyone within the boundary share equally the environment and interact at similar levels within and outside their environment (Ball et al., 2006).

At a broader level, it raises questions about whether the role of economic and racial stratification processes and their role in past outcomes are artifacts of naive boundaries. This issue is further complicated by past research that has shown spatial data to be influenced by the size and partitioning of the boundaries used to analyze it (Tatalovich et al., 2006; Kwan and Weber, 2008). This modifiable areal unit problem (MAUP) has been well documented in the geographic literature (Openshaw, 1977; Openshaw and Taylor, 1979; Fotheringham and Wong, 1993; Openshaw, 1984; Fotheringham et al, 1995; Amrhein, 1995).

Understanding the MAUP is particularly important for any "food desert" analysis rooted in accessibility and land use-travel interactions. It is out of this methodological concern that this dissertation examines how the delineation of neighborhood boundaries influences potential disparities, associations and causalities in the analysis. It is hypothesized that potential spatial disparities in the urban food environment are not a byproduct of census tract geographies but rather racial and economic stratification processes that are invariant to such boundary manipulations.

Social Ecology, Food Deserts and Metropolitan Detroit

Perhaps no metropolitan area is a better candidate to examine how economic and racial disparities create unequal neighborhoods that limit access to resources and shape life and health outcomes than Detroit. Metropolitan Detroit has become the most racially and class segregated metropolitan in the nation (US Census, 2010; Logan and Stults, 2011). It is characterized by extreme socioeconomic divides that have not only produced one of the most spatially divided regions, where low-income African Americans are concentrated in the city of Detroit while affluent Whites are scattered across the suburbs, but also a landscape characterized by unequal life opportunities and unequal access to resources (Darden et al., 1987; Farley et al., 2000; Darden and Thomas, 2013).

The vociferous racial and economic divide has created uneven neighborhoods in which Whites have better access to resources and opportunities such as quality schools (Welch et al., 2001; Wu & Batterman, 2006), employment (Kain, 1968; Turner, 1997; Mouw, 2000; Stoll, 2007), housing (Pearce, 1979; Darden et al., 2007), non-polluted neighborhoods (Bryant and Mohai, 1992; Downey, 2006; Lee and Mohai, 2011) and health care facilities (Allard et al., 2003; Dai, 2010) than African Americans. Moreover, given the levels of residential segregation,

low-income Whites often have been shown to have better access to resources than middle and upper income African Americans (Darden and Kamel, 2000).

While the strong relationship between race, class and access to resources as well as how the patterns of race and class residential segregation were created and maintained in metropolitan Detroit has been well documented (see Darden et al., 1987; Thomas, 1997; Farley et al., 2000; Sugrue, 2005; Darden et al., 2007; Darden, 2009; Vojnovic, 2009; Galster, 2012; Darden and Thomas, 2013), it opens the door to whether or not such relationships exist with regards to access to national and regional supermarkets. Moreover, it provides an opportunity to examine how economic or racial stratifications processes drive potential disparities in food accessibility over time and across space and whether or not these might be artifacts of how a neighborhood is conceptualized.

Past research on the spatial inequities in access to affordable nutritious food in the tri-County Detroit region have found mixed results. Zenk et al. (2005b, 2006) found little disparities in food accessibility between well off White and African American neighborhoods but found that impoverished African American neighborhoods had to travel greater distances than impoverished White neighborhoods to reach retail supermarkets. They also found that low-income African American neighborhoods were disproportionately composed of liquor and party stores than affluent White neighborhoods.

In terms of dietary-intake, Zenk et al. (2005a) found that African American women who shopped at national and regional supermarkets consumed higher levels of produce than women who did not shop at such stores. Moreover, they found that the presence of national and regional supermarkets had a positive effect on fruit and vegetable intake (Zenk et al., 2009). The importance of availability was highlighted by Izuma et al. (2011) who found that vegetable

consumption of Detroit residents living near stores carrying dark-green and orange vegetables were higher than residents living near stores devoid of such vegetables.

These studies capture many of the tensions and untested assumptions noted in the larger "food desert" discourse. Both Zenk et al. (2009) and Izumi et al (2011) assume that residents shop and consume within their food environment. Surprisingly, Zenk et al., (2005b) found only partial support for socioeconomic disparities in food accessibility in the most economically and racially polarized region in the nation. Moreover, they do not examine to see if their results are a byproduct of relying on census geography to define their neighborhoods. Last, all of these studies are silent on how the tri-County Detroit food environment has been transformed.

This dissertation builds upon this work by examining how economic neighborhood deprivation and racial stratification shape neighborhood inequalities in food accessibility over a larger spatial extent and broader timeframe. It specifically seeks to determine if spatial inequalities in access are driven by economic or racial stratification processes. It will be hypothesized that spatial inequities in the tri-County Detroit food environment will be driven by race. That is, based on the racialized landscape in the region, African American communities will experience the largest disparities in access to national and regional supermarkets. Last, it seeks to develop the first narrative about how the tri-County Detroit food environment has evolved.

Retail Decentralization

While much has been written at a broader level about how advances in transportation, increasing wealth, new technologies, changing cultural norms, new urban planning paradigms and tax subsidies aided the suburbanization of retail in the United States (see Vance, 1962; Dawson, 1974; Muller, 1981; Hanchett, 1996; Teaford, 2006, 2008; Vojnovic, 2009), there has

been very little scrutiny on how retail supermarket decentralization occurred in the U.S. Most accounts simply lump supermarket decentralization into the broader suburbanization process. This is predicated on the assumption that retail suburbanization occurred as a homogenous experience across all retail sectors. Yet, many retail suburbanization accounts have been derived from the experience of department stores. Such accounts fail to acknowledge that supermarkets were already residing in the suburbs before department store decentralization occurred (Conzen and Conzen, 1979; Harris and Lewis, 2001). They also fail to account for the different market mechanisms and economic conditions influencing the location of supermarkets. Such assumptions are embedded in the retail suburbanization narrative of Detroit.

Many accounts on the urban form of tri-County Detroit point to the J.L. Hudson Company, the largest department store in the region, decision to open the Northland shopping center in 1953 as the beginning of the retail decentralization process (Darden et al., 1987; Thomas, 1997; Farley et al., 2000). During the 1950s, the region saw the creation of 18 suburban shopping centers, which often were anchored by a major department shopping store. Such accounts reflect a suburbanization narrative that focuses on the acceleration and intensification of the process during the 1960s as evident by the emergence of regional shopping centers and malls (Muller, 1981).

In the case of Detroit, by the mid-1970s the city only accounted for 1 of the 20 major shopping centers in the tri-County Detroit (Darden et al., 1987). It is within this narrative that supermarket decentralization of tri-County Detroit is grouped. Therefore, a general account of supermarket decentralization in the region has been established in which the decentralization of retail supermarket chains left inner-city residents with fewer store choices for affordable

nutritious food. Consequently little is known about how the major national and regional supermarket chains transformed the tri-County Detroit food environment.

It is in within this void that this dissertation analyzes how supermarket decentralization within the tri-County Detroit region evolved overtime. In particular, it seeks to show how broader trends of retail decentralization where further exacerbated by the economic restructuring of the retail food industry during the second half of the 20th century.

Economic Restructuring in the Supermarket Industry

The abandonment of retail chain supermarkets from the urban core corresponded with several structural changes within the industry during the post Second War era. During the 1950s, a wave of market consolidation within the retail food industry began. This wave was driven by middle tier national and regional companies looking to expand their market share through acquisition (Appel, 1972). This frenzy of market consolidation resulted in the closing of older smaller stores in the central cities and continued into the early 1960s.

By the late 1960s, regional and national supermarket chains had captured 70% of the retail food market (Eisenhauer, 2001). However, faced with rising wage costs and declining profit margins, supermarkets turned to mechanization, organizational restructuring and increased market consolidation to increase their revenues. Eventually, supermarket chains began to integrate their wholesale and retail operations, reduce inventory and labor costs, increase the size of their operations and improve their customer service (Walsh, 1993). Central to increasing the size of their operations was the introduction of new food products and a significant increase in the amount of non-food products with high profit margins offered in their stores. Consequently, the increase in the amounts of products offered required larger store sizes, which ushered in the

modern supermarket and superstore/hypermarket formats familiar to today's shoppers (Ellickson, 2011).

Attempts to achieve market consolidation led to a series of mergers, leveraged buyouts and price wars during the 1970s and early 1980s. These price wars and the wave of economic consolidation sent many independent supermarkets out of business (Guy, 1996; Wrigley, 1999). The remaining supermarket chains began to achieve economies of scale through a series of capital investments to consolidate operations and create larger superstores on the urban fringes where land prices, insurance premiums and utility and distribution costs were lower and customer purchasing power was higher than in the urban centers.

The movement towards larger stores in order to achieve an economy of scale made the potential for the redevelopment or development of retail supermarket stores in the central city problematic. These economies of scale were extremely difficult to achieve in the older city centers where land prices and taxes were high and the acquisition of continuous tracts of land to house a new store were often difficult to achieve. In addition, insurances and utility costs were higher in the central city. When combined with advances in site selection algorithms, central cities were put at an increasing disadvantage leading to significant disinvestment (Alwitt and Donley, 1997).

During the late 1980s, the supermarket industry underwent an additional merger and privatization phase, which left the remaining large companies with huge debts. Therefore, many of the major retail supermarket chains began to close down less profitable stores, which tended to be in declining urban areas than in the growing suburbs (Curtis and McClellan, 1995).
The entry of Wal-Mart into the supermarket industry in mid 1990s and its prominent rise to the largest supermarket firm based on total sales brought about another wave of market

consolidation in the late 1990s and early 2000s. However, unlike earlier waves, this wave saw mega mergers occur among longtime rival national and regional supermarket chains. Consequently, concentration within the supermarket industry reached an all-time high with 8 companies controlling roughly 50% of the national market.

Overall, the spatial restructuring of the retail food industry decimated food options in the central city where large concentrations of the urban poor and minority populations have been segregated. Cities across the United States have experienced a net loss in urban retail supermarkets (Curtis and McClellan, 1995; Eisenhauer, 2001). In addition, the new business model based on economies of scale within the retail food industry has made it difficult to implement in the city centers, where land ownership is fragmented and zoning barriers and higher operating costs exists (Alwitt and Donley, 1997).

Despite the important implications tied to this restructuring, little has been written about how it played out in one of the most competitive markets in the nation, tri-County Detroit. The last goal of this dissertation is to bring to light the major supermarket chains within the region and how the economic restructuring described above helped to transform the tri-County Detroit food environment and led to the creation of uneven food environment marked by racial disparities.

Conclusion

This chapter has grounded the "food desert" literature within a larger social ecological framework that informs the working hypothesis of this dissertation. Fundamental concerns about how neighborhoods structure the life opportunities and outcomes of residents are central to social ecological and "food desert" research. Within this vein, this chapter has highlighted the major findings, contradictions and overlooked assumptions within the literature that this dissertation

attempts to examine. In particular, it has shown how overlooked assumptions about the travel behavior of disadvantaged consumers and how one delineates a neighborhood could produce potentially misleading results. This chapter also has highlighted major contributions from the retail decentralization and supermarket restructuring literature to show how the widespread decentralization of retail supermarket chains has created a spatial mismatch in which inner-city residents must commute to suburban stores thereby exerting additional travel costs to shop at quality affordable retail supermarkets. Last, it has highlighted how the unique economic and racial polarization of the tri-County Detroit region makes it an excellent backdrop in which to examine the major research questions and hypotheses.

CHAPTER 3
URBAN SUPERMARKETS, PUBLIC HEALTH OUTCOMES AND TRAVEL PATTERNS

This chapter examines where people who live in neighborhoods[1] with poor accessibility to national and regional supermarkets shop and whether or not a deprived food environment impacts public health outcomes. It is hypothesized that individuals living in sparse food environments predominately utilize full-service supermarkets outside their immediate neighborhood rather than rely on nearby corner grocery, party and liquor stores for their food provisions. This premise is in contrast to past U.S. "food desert" studies that assume individuals are constrained to shop at stores with unhealthful foods located in their immediate neighborhood food environment.

In line with this reasoning, this chapter also scrutinizes how spatial and socioeconomic inequalities in access to affordable nutritious food sources impacts public health outcomes as measured by dietary-intake. In particular, it is expected that sociodemographics play a greater role in explaining differentials in dietary-intake levels among individuals than the immediate neighborhood food environment. This relationship is expected given that low-income households are expected to travel outside their immediate food environment thereby incurring greater travel costs for food shopping. Such cost will reduce further their already limited food income and decrease a household's ability to purchase nutritious food staples, which often cost more than cheaper processed food items.

[1] The word "neighborhood" is used throughout this document in reference to the various administrative configurations that attempt to capture the socio-spatial processes and perceptions shared by groups of people. It should not be assumed that such boundaries are in agreement with the perceptions of individuals or the processes one seeks to examine. Such tensions are explored throughout the remaining text.

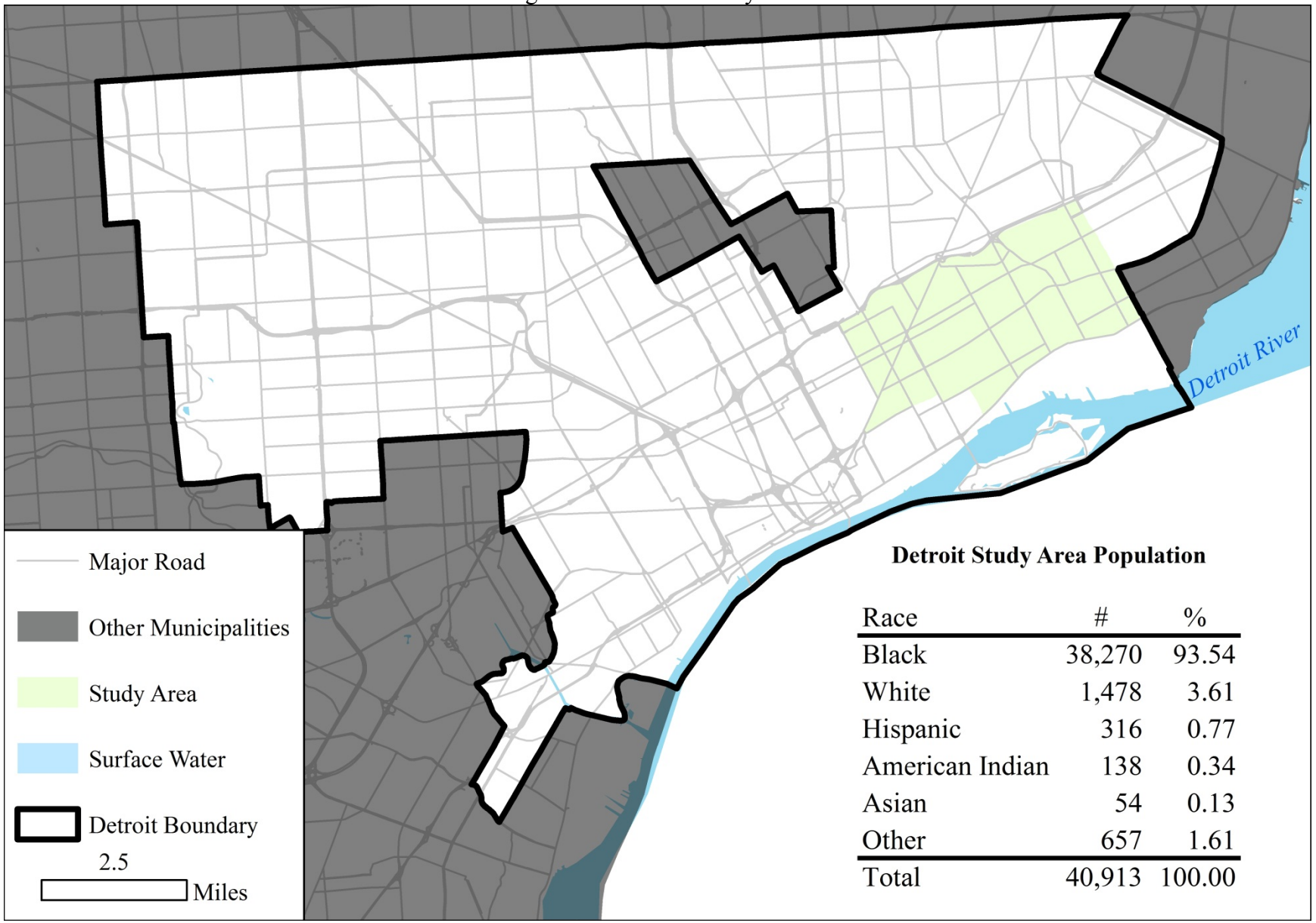
Given that some of the greatest levels of neighborhood inequity and retail disinvestment occur in the city of Detroit, these hypotheses are tested with a survey dataset collected from the lower eastside neighborhoods of Detroit, Michigan. The remaining chapter is broken into 6 additional sections. The first and second sections describe the study area and survey dataset. The third section tests the hypothesis that individuals living in a sparse food environment do not shop in their immediate food environment. The fourth section examines the relationship between the food environment, sociodemographics and dietary-intake. In particular, it tests the hypothesis that the role of the food environment is minimized in comparison to sociodemographic factors in explaining differentials in dietary-intake levels. The fifth section provides a detail discussion of the results from section 3 and 4 while the final section offers concluding remarks.

Detroit Study Area

The study area covers approximately 10.5 square miles and contains 24 census tracts consisting of roughly 41,000 people (Figure 3-1). It encompasses the predominately African American neighborhoods of Butzel, Chandler Park, Indian Village, Foch, Jefferson/Mack, Kettering, Lower East Central, Middle East Central and St. Jean. Overall, African-Americans make up roughly 94% of the study area population. In terms of the built-environment, the neighborhoods are characterized by medium-density, high connectivity and mixed land uses (integrated commercial, civic and residential land uses).

Over the past 50 years, these neighborhoods have experienced a large-scale disinvestment that has slowly eroded the foundations of their communities (Vojnovic, et al., forthcoming). Moreover, these neighborhoods exemplify the national and regional supermarket disinvestment

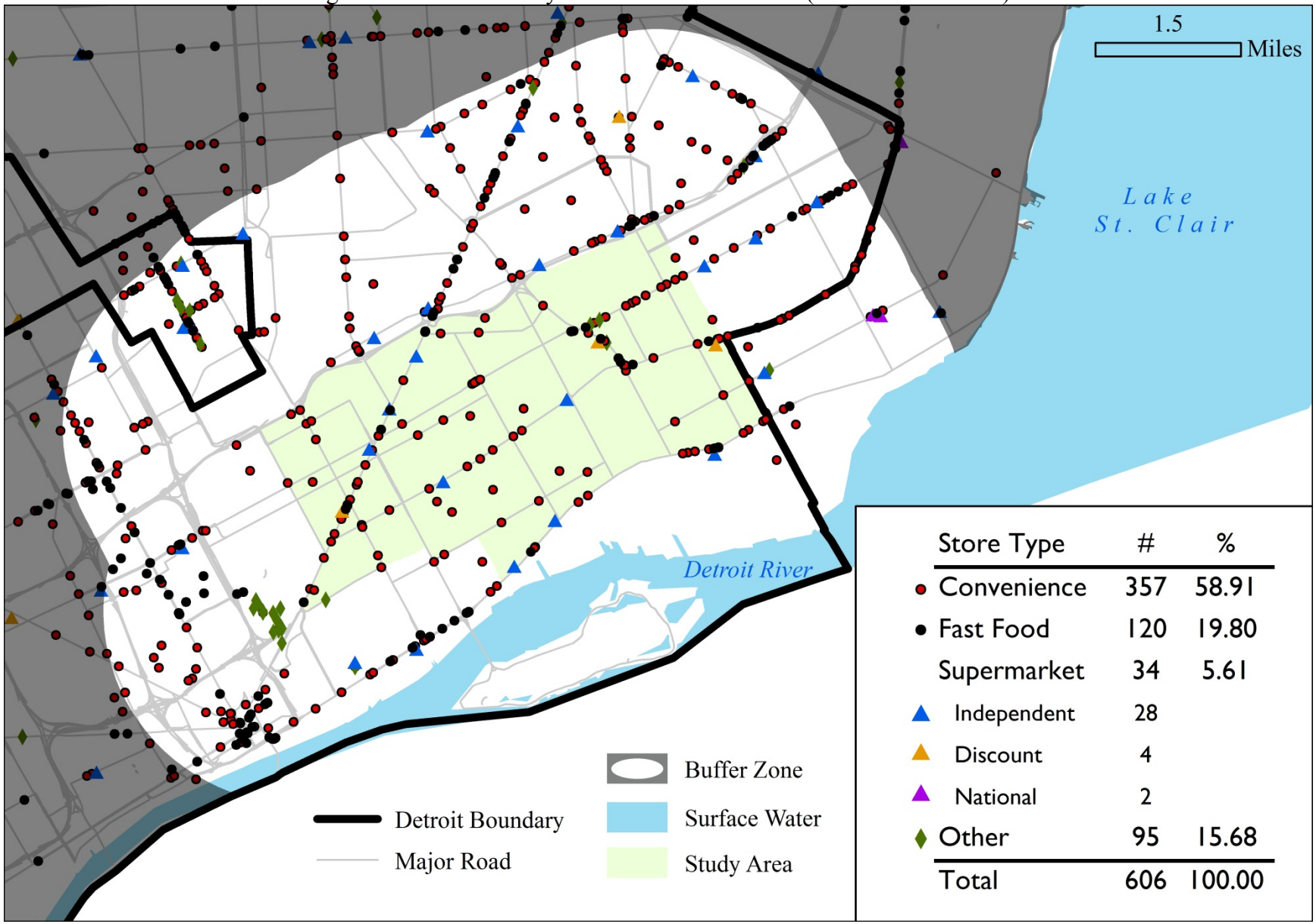
Figure 3-1: Detroit Study Area



Detroit Study Area Population

Race	#	%
Black	38,270	93.54
White	1,478	3.61
Hispanic	316	0.77
American Indian	138	0.34
Asian	54	0.13
Other	657	1.61
Total	40,913	100.00

Figure 3-2: Detroit Study Area Food Environment (2-mile Buffer Zone)



that has occurred across the city. In 1960, the study area contained over 15 national and regional supermarkets but by 2010, it had dwindled down to 3 national discount supermarkets (Aldi and Save-A-Lot) and a handful of independently owned supermarkets. Today, convenience (liquor, dollar, party and corner grocery) and fast food establishments (Figure 3-2) dominate the surrounding neighborhood food environment.

Data

The survey data utilized in this chapter is from an on-going project[2] examining the relationship between the built-environment and health outcomes in Metropolitan Detroit. The data was collected from a stratified random sampling frame that included six neighborhoods in the metropolitan Detroit region (two in the city of Detroit and four in the surrounding suburban municipalities of Ann Arbor, Birmingham, Bloomfield Hills and Bloomfield Township). These neighborhoods were stratified based on built-environment and demographic characteristics. The analysis here focuses on the two predominately African American and low-income Detroit neighborhoods.

An eight-page mail survey was used to collect socioeconomic, demographic, health, diet, travel (frequency of trips, purpose of trips, travel mode, destination and perceived distance) and attitudinal information from residents in the neighborhoods. Respondents were asked to report such information over a typical week and to consider seasonal distinctions in economic circumstances, travel patterns and shopping behavior. Postcards introducing the project two weeks prior to the mailing of the questionnaires were utilized. After the questionnaires were mailed, two reminder prompts were sent out, two weeks apart. A gift card for a national

[2] Michigan State Department of Geography's NSF Human Social Dynamics Grant: The Social Dynamics of Accessibility, Travel Behavior and Physical Activity: An Inner-City/Suburb Comparison in the Detroit Region.

supermarket[3] was offered as a monetary incentive to respondents 18 years or older who completed the survey. In the end, 286 households returned the survey out of 2,514 households, for a final response rate of 11.4 percent.

While the survey collected over 200 variables, this chapter utilizes a subsample of the diet, health, sociodemographic and travel variables. Diet related data included the monthly servings of soda (Soda), fruit juice (Juice), sweets (Sweets), salty snacks (Salty Snacks), fruits (Fruits), vegetables (Vegetables) and alcohol (Alcohol) consumed by a respondent. An exercise dummy variable was constructed from survey responses to capture whether or not a respondent exercises (Exercise (0N | 1Y)).

Sociodemographic data employed included gender (Gender (0 = F | 1 = M)), age (Age), household income (HI) and educational attainment. The original educational attainment variable was recoded to create a continuous variable that captured the years of schooling completed by a respondent (Education). Here, lack of a high school degree equaled 10-years of schooling, a high school degree equaled 12-years of schooling, some college and an associated degree equaled 14-years of schooling, a bachelor's degree equaled 16-years of schooling and a professional and advanced degree equaled 18-years of schooling. Several variables related to housing also were captured by the household survey. In particular, the number of vehicles in operating condition at a household was used to create a household car access dummy variable, Car Access (0 = N | 1 = Y).

The travel data was used to identify food shopping destinations and respondents' mode of travel as well as to calculate the monthly number of trips to such destinations. This data also was combined with a Michigan Department of Agriculture retail food licensing database and data

[3] The choice to utilize a national supermarket chain was done in consultation with the community.

from the Detroit Economic Group to create an inventory of the entire food environment within the tri-County Detroit region. This dataset also was augmented with the location of all fast food establishments from telephone and internet business directories located within 2-miles of the study area.

Last, in order to capture aspects of the neighborhood food environment, a series of cumulative opportunity accessibility measures were calculated from each respondent's house. The cumulative opportunity accessibility measures capture the total number of national and regional, discount and independent full-service supermarkets (Supermarkets 1mi), the total number of corner grocery, dollar, party and liquor stores (Convenience Store 1mi) and all fast food establishments (Fast Food 1mi) within 1-mile of a respondents house. While there were differences between the three types of supermarkets captured in the supermarket cumulative accessibility measure, all stores share in common that they were greater than 10,000 square feet, had a broad selection of and a preponderance of store sales (approximately 90%) in meat, baked goods, dairy/eggs, grocery items and produce. Moreover, each store carried at least 10 different types of fruits and 10 different types of vegetables (DEGC, 2011). The cumulative accessibility measures were formalized as:

$$CumOpp_i = \Sigma B_j a_j$$

Where

$CumOpp_i$ is the accessibility measured at house location i to a potential store destination in zone j;

a_j is the number of opportunities in zone j; and

B_j is a binary value that equals 1 if zone j is within a 1-mile network distance and 0 otherwise.

A 1-mile network distance was chosen based on a reasonable walking distance to purchase food in the absence of access to a private vehicle. The distance used in the

neighborhood accessibility measures were calculated over a road network using Environmental Systems Research Institute's (ESRI) Network Analyst in ArcMap 10.0 (ESRI, 2011).

Prior to the data analysis, 29 duplicate household members and 2 outliers were removed from the dataset. In the end, 255 households were used in the final analysis. On average, the typical respondent was a middle-age non-White female who owned their home, possessed at least a high school education and had spent roughly 20 years in the neighborhood. The respondents resided in highly segregated and impoverished neighborhoods with varying levels of accessibility to affordable, nutritious food sources.

Respondents lived on average 6,843m (4.25-miles) from a full-service national and regional supermarket, 1,850m (1.15-miles) from a discount supermarket and 1,116m (.69-miles) from an independent retail supermarket. Yet, they were on average 1,046m (.65-mile) from a fast food restaurant and 500m (.29-mile) from a neighborhood convenience store (corner grocery, dollar, party and liquor). Moreover, respondents were surrounded on average by 19 convenience, liquor and party stores within 1 network mile of their home. These dynamics were typical of past studies in the "food desert" literature.

Overall, the sample was representative of the underlying population in terms of race, household income, household size and educational attainment as measured by 2010 decennial census (Table 3-1). The main difference was that the survey respondents were older and possessed slightly higher education levels than the underlying population. In terms of age, this was no surprise as older household members are the most likely to fill out surveys and they tend to be the one responsible for food shopping. Moreover, the survey was restricted to individuals 18 years or older which also skewed the mean age upward. Last, the survey captured more homeowners than renters in the study area.

Table 3-1: Survey Verses Census Demographics

Neighborhood Demographics	Survey	Census 2010
Median Age	52.00	37.50
Race[a]		
Black	82.17%	93.54%
White	7.34%	3.61%
Hispanic	0.00%	0.77%
Asian	0.35%	0.13%
American Indian and Alaska Native	0.00%	0.34%
Native Hawaiian and Other Pacific Islander	0.00%	0.00%
Other	1.40%	1.49%
No Response	8.74%	-
Marital Status		
Never married	41.61%	55.20%
Now married (Not Including Separated)	17.83%	17.70%
Separated	4.20%	4.30%
Widowed	13.64%	11.10%
Divorced	20.63%	11.70%
Average Household Size	2.21	2.58
Educational Attainment (Population 25 Years and over)[a]		
Less Than High School	17.84%	28.80%
High School Graduate (includes equivalency)	47.96%	37.00%
Some college	10.78%	27.90%
Bachelor's degree	10.04%	4.10%
Graduate degree	8.55%	2.30%
No Response	4.83%	-
Tenure		
Owner Occupied	70.63%	46.90%
Renter Occupied	29.02%	53.10%
No Response	0.35%	-
Median Household Income	$20,000	$20,822
Households Lacking a Private Vehicle[b]	33.46%	30.20%

[a] Percentages do not sum to 100% due to rounding

[b] American Community Survey, 2006-2010 (5-year estimates)

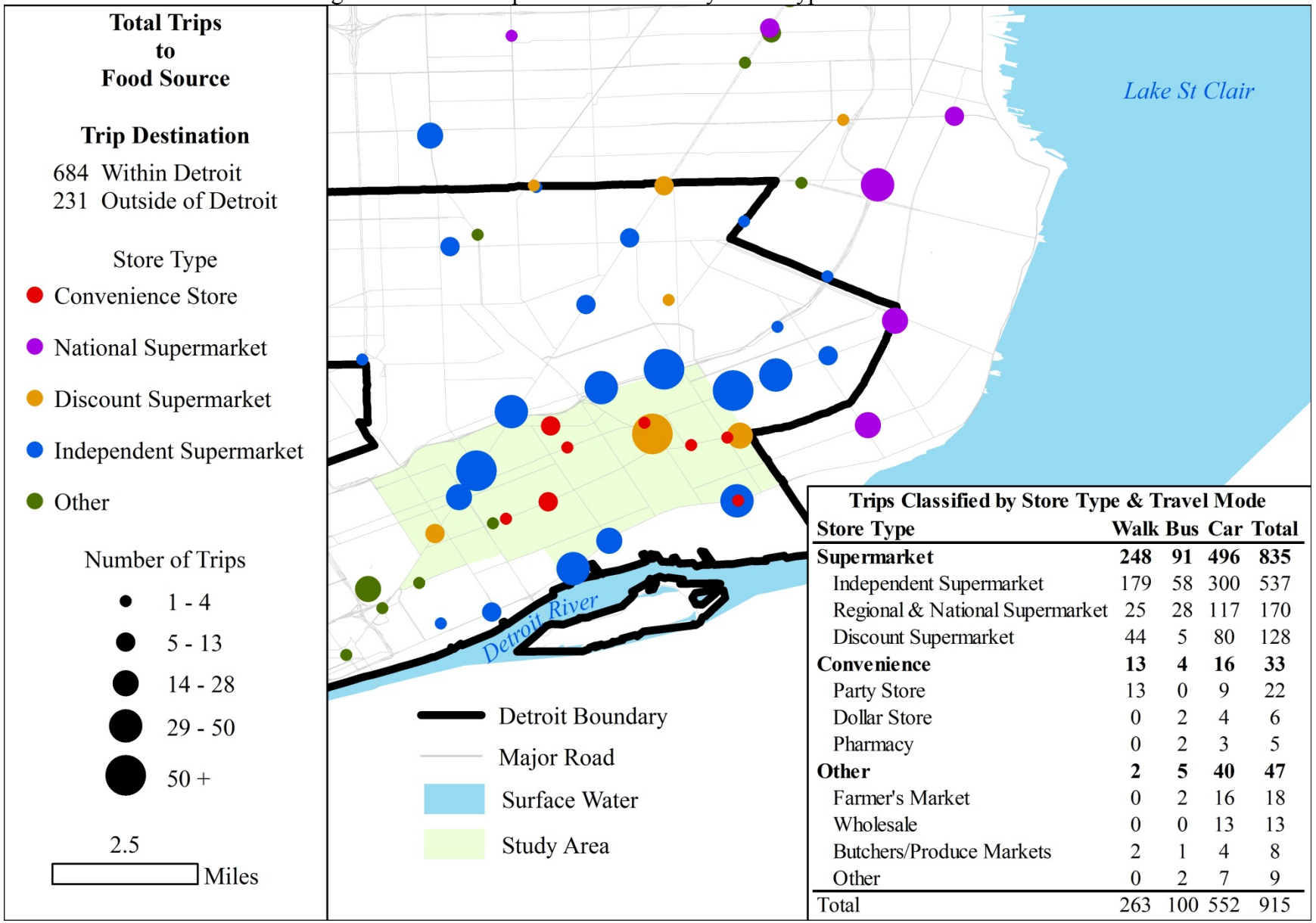
Food Shopping Travel Patterns

As highlighted in chapter 2, past U.S. "food desert" studies often assume that residents living in deprived food environments shop and consume within them. Given that such inferences contrast insights from past research on disadvantaged consumers and conflate census tract geographies for the delineation of a neighborhood, it was argued that individuals living in the sparse lower eastside of Detroit food environment would predominately utilize full-service supermarkets outside their immediate neighborhood rather than rely on nearby corner grocery, dollar, party and liquor stores for their food provisions. It also was hypothesized that residents despite potential economical, vehicle and physical constraints would rely on full-service supermarkets for their food provisions. Moreover, it was postulated that residents would not shop and consume within their neighborhood food environment.

In order to examine these hypotheses, survey respondents' food shopping trips were broken out by store type and along a set of sociodemographics (household income, access to private vehicle and age). These cross-tabulations captured the economical and physical constraints thought to restrict the spatial mobility of residents; thereby, making economically and physically disadvantaged consumers more reliant on their neighborhood food stores. The cross-tabulations were mapped and analyzed using a series of Analysis of Variance (ANOVA), Repeated Analysis of Variance (RANOVA) and difference of means t-tests.

Survey respondents' food shopping trips broken out by store type and travel mode were mapped (Figure 3-3). The store types shown in Figure 3-3 and utilized in the analysis were classified into 3 broad categories (supermarket, convenience and other). The supermarket category contained independent, discount and regional/national supermarkets. The convenience category contained corner grocery, dollar, party, liquor stores and pharmacies that offer food

Figure 3-3: Total Trips to Food Source by Store Type and Travel Mode



Trips Classified by Store Type & Travel Mode

Store Type	Walk	Bus	Car	Total
Supermarket	**248**	**91**	**496**	**835**
Independent Supermarket	179	58	300	537
Regional & National Supermarket	25	28	117	170
Discount Supermarket	44	5	80	128
Convenience	**13**	**4**	**16**	**33**
Party Store	13	0	9	22
Dollar Store	0	2	4	6
Pharmacy	0	2	3	5
Other	**2**	**5**	**40**	**47**
Farmer's Market	0	2	16	18
Wholesale	0	0	13	13
Butchers/Produce Markets	2	1	4	8
Other	0	2	7	9
Total	263	100	552	915

staples (predominately dry goods, snacks and alcoholic/nonalcoholic beverages). The other category consisted of farmer markets, meat and seafood vendors, green grocers and wholesale stores such as Costco. Given the relatively heavily skewed distribution of trips indicated by Figure 3-3, analyses throughout this chapter focused on the three subclasses of supermarkets with the broader classes of convenience and other store type.

The majority of trips occurred by car and a disproportionate amount of trips were to independent full-service supermarkets (repeated-one way ANOVA: $F(4,776) = 34.061$, $p < 2e\text{-}16$). Figure 3-3 shows that households bypassed neighborhood convenience stores (corner grocery, dollar, party and liquor) for the majority of their food shopping. Moreover, in comparison to their local food environment (Figure 3-2) which was made up disproportionately of convenience (corner grocery, party, liquor and dollar) stores, residents appeared to discriminate actively the type of store they visited. Residents shop at the independent, national and discount supermarkets located in the city and the suburbs. In order to examine how economic constraints shaped the broader shopping travel patterns, the total amount of shopping trips by household income, store type and travel mode were presented in Figure 3-4. Potential differences between the mean trips to each store type among the three household income levels shown in Figure 3-4 were examined using several repeated measure and one-way analyses of variance (Table 3-2).

The repeated measure one-way analysis of variances (read across the rows) was statistically significant for each household income group. Post-hoc comparisons using Tukey Honest Significant Differences test ($\alpha = .05$) revealed that statistically significant differences between mean independent supermarket trips and trips to national and discount supermarkets, convenience stores and other store types within households making less than $20,000 exist.

Figure 3-4: Total Trips to Food Source by Store Type, Travel Mode and Household Income

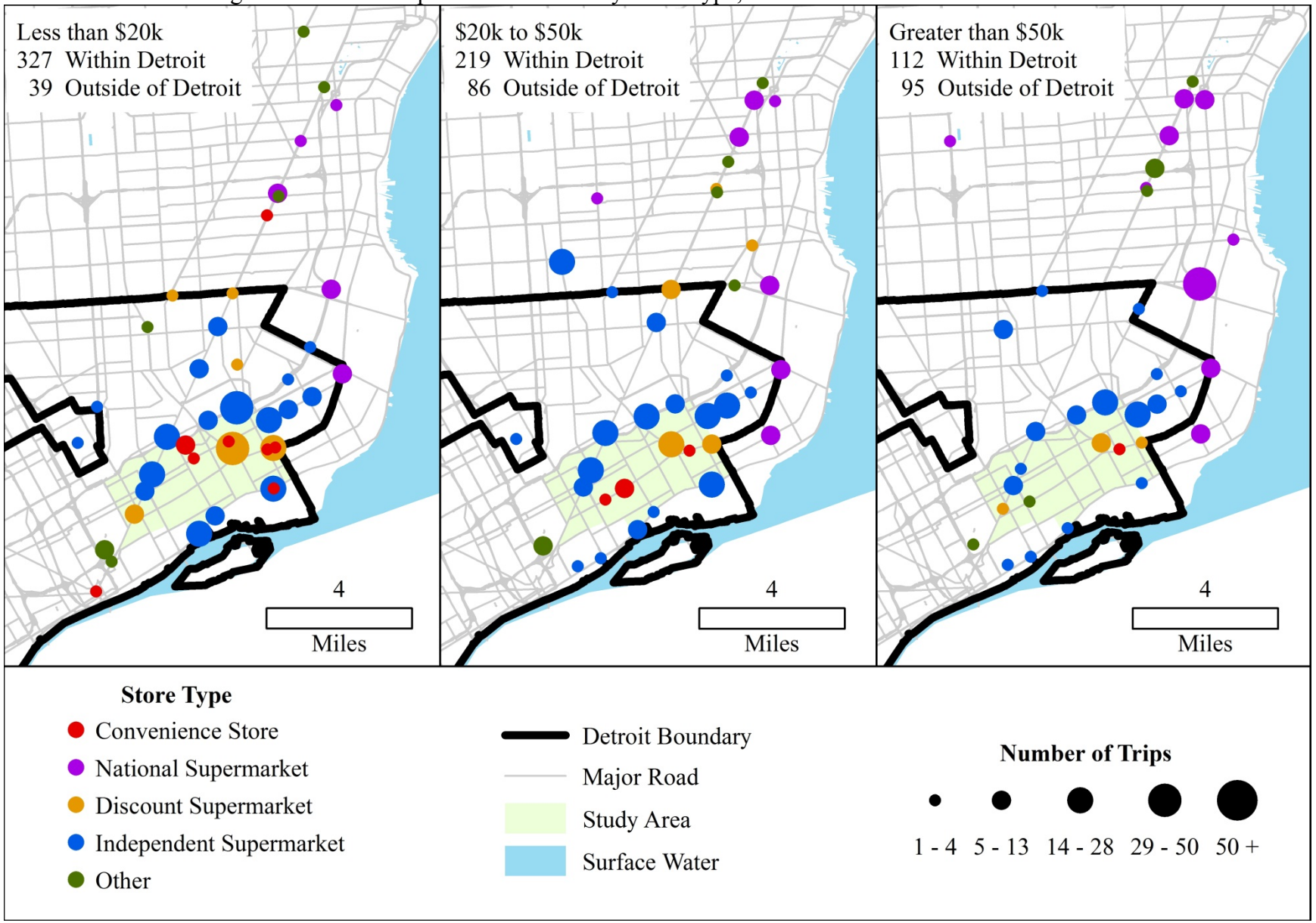


Figure 3-4 (Cont'd)

Store Type	Less than $20,000				$20,000 to $49,999				Greater than $50,000				NR
	Walk	Bus	Car	Total	Walk	Bus	Car	Total	Walk	Bus	Car	Total	Total
Supermarket	**114**	**26**	**190**	**330**	**74**	**14**	**194**	**282**	**53**	**44**	**94**	**191**	**32**
Independent Supermarket	80	19	129	227	59	8	120	186	34	29	36	98	25
Regional & National Supermarket	2	3	21	26	5	5	44	54	18	15	50	83	7
Discount Supermarket	33	4	41	78	10	1	31	42	1	0	8	9	0
Convenience	**11**	**4**	**8**	**23**	**2**	**0**	**7**	**9**	**0**	**0**	**1**	**1**	**0**
Party Store	11	0	3	14	2	0	5	7	0	0	1	1	0
Dollar Store	0	2	2	4	0	0	2	2	0	0	0	0	0
Pharmacy	0	2	3	5	0	0	0	0	0	0	0	0	0
Other	**0**	**2**	**10**	**13**	**0**	**0**	**14**	**14**	**2**	**1**	**13**	**16**	**5**
Farmer's Market	0	0	5	5	0	0	9	9	0	0	1	1	3
Wholesale	0	0	1	1	0	0	1	1	0	0	10	10	1
Butchers/Produce Market	0	0	2	3	0	0	1	1	2	1	0	3	1
Other	0	2	2	4	0	0	3	3	0	0	2	2	0
Total	126	32	208	366	76	14	215	305	55	45	108	207	37

Table 3-2: Repeated Measure and One-Way ANOVAs for Mean Number of Trips by Household Income and Store Type

	Independent Supermarket		National Supermarket		Discount Supermarket		Convenience Store		Other Store		RANOVA		
Household Income	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	F	df	p-value
Less than $20,000	2.72	3.15	0.31	0.76	0.95	1.65	0.29	1.34	0.14	0.41	30.61	(4,324)	1.67E-22
$20,000 to $49,999	2.87	3.96	0.92	1.96	0.70	1.29	0.51	2.75	0.24	1.09	11.17	(4,232)	3.09E-08
Greater than $50,000	2.72	6.14	2.31	5.57	0.26	0.70	0.03	0.17	0.44	1.02	4.37	(4,140)	0.002
F	0.027		6.423		3.094		0.776		1.606				
df	(2,174)		(2,174)		(2,174)		(2,174)		(2,174)				
p-value	0.973		0.002		0.048		0.462		0.204				

There also was a statistically significant difference between mean discount supermarket trips and other store trips within the same household income group. Low-income households shopped predominately at the independent supermarkets and picked the discount supermarkets over farmer markets, green grocers and specialty markets.

Statistically significant differences also existed between mean independent supermarket trips and mean trips to national supermarkets, discount supermarkets, convenience stores and other store types among households making between $20,000 and $49,999. Similar to low-income households, these middle tier income households overwhelming shopped at independent supermarkets located throughout the city. Last, post-hoc tests revealed statistically significant differences between mean independent supermarket trips and mean convenience and discount supermarket trips in households with incomes greater than $50,000. The more affluent households shopped at independent supermarkets and shunned discount supermarkets and convenience stores.

Next, a series of one-way ANOVAs were computed (read down the columns in Table 3-2) within each store type to determine if one household income group made more trips than another household income group to a particular store type. The one-way analysis of variance showed that the effect of household income was only significant in regards to national supermarkets and discount supermarkets. Post-hoc comparisons using the Tukey Honest Significant Differences test ($\alpha = .05$) indicated a statistically significant difference in the mean national supermarket trips between households making less than $20,000 and households making greater than $50,000. When examining discount supermarkets, there was a statistically significant difference between households making less than $20,000 and households making greater than $50,000. Overall, the higher income households made more trips to the national

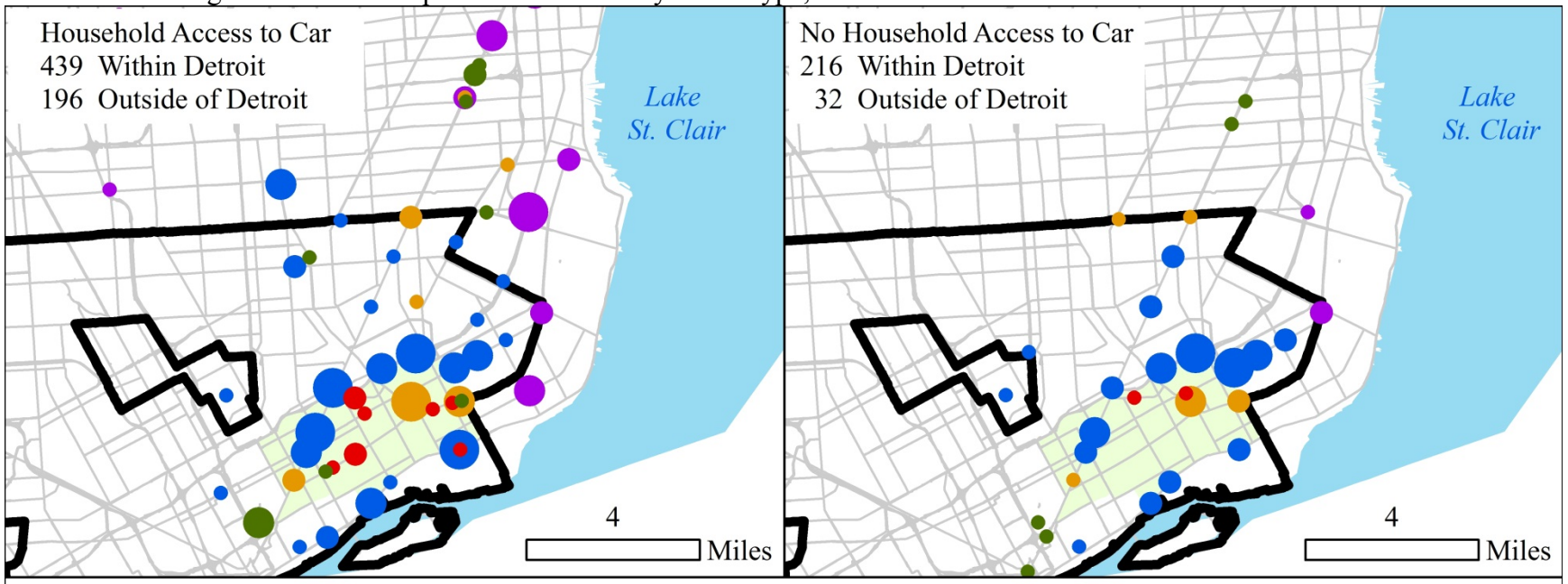
supermarket chains located outside the city than low-income households. Consequently, low-income households made more trips to the discount grocery stores, which were located closer to respondents' homes and contained many of the food staples one could find in the suburban stores at comparable or cheaper prices.

Economic constraints also can manifest themselves in terms of car ownership/access rates in which low-income households have less reliable transportation options. Figure 3-5 shows the total number of trips to different food sources broken out by access to a household vehicle (someone who has a car living in the same house) and travel mode. Lack of car access, like low household income levels, shortened the playing field in terms of spatial distance as indicated by fewer trips out into the suburbs. Roughly 48% of all trips from households lacking access to a household car were on foot and another 18% were via public transit. Despite these constraints, about a third of respondents lacking access to a household car were able to obtain a ride to a store.

Difference of means t-tests were used to determine if there were any statistical differences between the mean total trips between households lacking and having access to a vehicle between the various store types (Table 3-3). There were no statistically significant differences between the two groups with regards to all the store types. Next, to rule out the possibility that the most disadvantaged of the disadvantaged face restricted mobility thereby relegating them to shop in their neighborhood food environment, the mean total trips of respondents lacking access to a household vehicle stratified by household income levels was examined using several one-way analyses of variance (Table 3-4).

The one-way ANOVAs (read down the columns in Table 3-4) show that the effect of household income on respondents with no vehicle was only statistically significant with regard to

Figure 3-5: Total Trips to Food Source by Store Type, Travel Mode and Household Access to a Vehicle



	No Access to Car				Access to Car			
Store Type	Walk	Bus	Car	Total	Walk	Bus	Car	Total
Supermarkets	**112**	**42**	**82**	**236**	**124**	**45**	**401**	**570**
Independent Supermarket	96	36	54	186	76	21	237	333
Regional & National Supermarket	2	4	16	22	23	22	100	145
Discount Supermarket	15	2	12	29	25	2	65	92
Convenience	**3**	**2**	**1**	**6**	**10**	**2**	**15**	**27**
Party Store	3	0	1	4	10	0	8	18
Dollar Store	0	0	0	0	0	2	4	6
Pharmacy	0	2	0	2	0	0	3	3
Other	**0**	**2**	**4**	**6**	**2**	**1**	**35**	**38**
Farmer's Market	0	0	1	1	0	0	15	15
Wholesale	0	0	1	1	0	0	12	12
Butchers/Produce Market	0	0	0	0	2	1	3	6
Other	0	2	2	4	0	0	5	5
Total	115	46	87	248	136	48	451	635

Table 3-3: Difference of Means t-test for Mean Number of Trips between Households Lacking and Having Access to a Vehicle by Store Type

Store Type	μ_{NoCar}	μ_{Car}	t	df	p-value
Independent	3.35	2.24	1.473	82	0.145
National	0.93	0.80	0.225	67	0.823
Discount	0.53	0.76	-1.256	168	0.211
Convenience	0.10	0.43	-1.508	130	0.134
Other	0.10	0.30	-1.910	156	0.058

Table 3-4: Repeated Measure and One-Way ANOVAs for Mean Number of Trips by Households with no Access to a Vehicle Stratified by Household Income and Store Type

	Independent Supermarket		National Supermarket		Discount Supermarket		Convenience Store		Other Store		RANOVA		
Household Income	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	F	df	p-value
Less than $10,000	2.48	2.58	0.19	0.47	0.56	0.91	0.09	0.53	0.13	0.42	19.99	(4,124)	1.01E-12
$10,000 to $29,999	2.27	2.51	0.67	1.37	0.46	0.66	0.25	0.62	0.10	0.29	5.11	(4,44)	0.002
Greater than $30,000	8.18	10.39	3.73	9.93	0.73	1.35	0.00	0.00	0.00	0.00	2.43	(2,20)	0.113
F	5.599		2.674		0.225		0.755		0.522				
df	(2,52)		(2,52)		(2,52)		(2,52)		(2,52)				
p-value	0.006		0.0784		0.799		0.475		0.597				

independent supermarkets between the different household income groups. Post-hoc comparisons using Tukey Honest Significant Differences ($\alpha = .05$) showed a statistically significant difference in mean independent supermarket trips between households making less than $10,000 and households making more than $30,000. Statistically significant differences also existed between households making $10,000 to $29,999 and households with incomes over $30,000. The more affluent households made fewer trips to discount supermarkets than the lower household income groups.

Last, to examine whether or not low-income households lacking access to a car were restricted to convenience stores, another repeated measure ANOVA was calculated (read across each row in Table 3-4). There were statistically significant differences within households lacking access to a vehicle with incomes less than $10,000 and between $10,000 and $29,999. Of importance here were the households with less than $10,000 as they are the disadvantaged of the disadvantaged. Post-hoc comparisons showed statistically significant differences between independent supermarket trips and the remaining store types among the low-income households. The lowest household income levels lacking access to a private vehicle overwhelmingly shopped at the independent supermarkets.

Physical mobility constraints were the last potential barrier to residents shopping at corner grocery, dollar and liquor stores in their immediate food environment. In order to scrutinize how physical mobility constraints affected the shopping behavior of respondents, Table 3-5 breaks out the mean number of shopping trips by store type and age cohort. Here, it was expected that the greatest physical mobility constraints would be faced by respondents older than 64 years.

Table 3-5: Repeated Measure and One-Way ANOVAs for Mean Number of Trips by Age Cohort and Store Type

	Independent Supermarket		National Supermarket		Discount Supermarket		Convenience Store		Other Store		RANOVA		
Age	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	F	df	p-value
18 to 24	5.5	9.94	1.00	1.93	1.08	1.53	0.08	0.28	0.00	0.00	4.4	(4,48)	4.00E-03
25 to 44	2.55	2.90	1.04	4.50	0.94	1.4	0.11	0.49	0.08	0.26	9.6	(4,220)	3.56E-07
45 to 64	2.62	3.53	0.83	1.66	0.55	1.43	0.52	2.48	0.37	1.10	16.53	(4,368)	1.82E-12
65+	1.45	1.75	0.73	1.33	0.37	0.82	0.00	0.00	0.21	0.48	9.25	(4,120)	1.50E-06
F	4.473		0.105		1.776		1.064		1.963				
df	(3,189)		(3,189)		(3,189)		(3,189)		(3,189)				
p-value	0.005		0.957		0.153		0.366		0.121				

Repeated measure one-way ANOVAs used to examine differences among age cohorts in Table 3-5 showed statistically significant differences in mean trips among every age group. Post- hoc comparisons of elderly households (65 +) showed that they made more trips to independent grocery stores than any other store category. In addition, elderly households made more trips to national supermarkets than convenience stores. Similar patterns also existed for households between the age of 18 and 24 and households between 45 and 64 in that both groups made more trips to independent supermarkets than any other store type.

One-way analysis of variances across age groups within a store type showed that the effect of age was only statistically significant with regard to independent supermarket trips. Post-hoc comparisons using the Tukey Honest Significant Differences test ($\alpha = .05$) exhibited a statistically significant difference between 18 to 24 years old and every other age group. Younger households made more trips to independent supermarkets than the older households.

The above results capture one aspect of the hypothesis tested (residents shop at corner grocery, dollar and liquor stores), however, one also needs to test the implicit assumption within the "food desert" discourse that economic constraints force residents to shop at stores closest to them or located within their immediate "neighborhood." It was hypothesized that residents living in the poor lower eastside Detroit food environment would shop outside their neighborhood food environment.

While the concept of neighborhood is complex, Table 3-6 employed two different spatial configurations of neighborhood. The first spatial configuration synonymously equated a census tract with a neighborhood. Therefore, any trip made to a store that also resided in the same census tract as a respondent's household was equated to a neighborhood trip. On average, this spatial configuration created a neighborhood consisting of .44 square miles. The second spatial

Table 3-6: Repeated Measure One-Way ANOVAs for Mean Number of Trips by Household Income and Neighborhood Configuration

	Trips Made Inside Household Census Tract		Trips Made Inside Contigous Household Census Tract		Trips Made Outside of Contiguous Household Census Tracts		RANOVA		
Household Income	μ	σ	μ	σ	μ	σ	F	df	p-value
Less than $20,000	0.37	1.39	1.57	2.24	2.46	3.01	16.28	(2,162)	3.62E-07
$20,000 to $49,999	0.17	0.67	1.66	2.91	3.39	4.75	15.02	(2,116)	1.59E-06
Greater than $50,000	0.06	0.23	1.22	4.07	4.48	7.42	9.01	(2,70)	3.29E-04

μ = Mean

σ = Standard Deviation

configuration treated a neighborhood as the residents' census tract as well as all contiguous census tracts. While this configuration was based solely on spatial process rather than socio-spatial dynamics, it was a conservative if not generous conception of a neighborhood that eliminates any first order edge and boundary effects associated with adjacent tracts that often are problematic to the first spatial configuration. On average, this configuration created a neighborhood consisting of roughly 4 square miles.

Mean trips to each neighborhood configuration broken out by household income levels are displayed in Table 3-6. 95% of food shopping trips occurred outside of one's neighborhood according to the first spatial configuration and 64% of food shopping trips occurred outside of one's own neighborhood when defined by the second spatial configuration. Repeated measure one-way ANOVAs in Table 3-6 illustrated statistically significant differences in mean overall trips and trips within each income level between the neighborhood configurations. Among all household income groups, post-hoc comparison using Tukey Honest Significance Differences test ($\alpha = .05$) indicated that mean trips outside of the contiguous census tract neighborhood conception were statistically different from mean trips within the census tract neighborhood and mean trips within the contiguous neighborhood configurations. These results illustrate that more trips among all household income groups occurred outside the neighborhood food environment.

In order to determine whether there were statistically significant differences between the mean trips made within any particular neighborhood configuration among the different household incomes, a series of one-way ANOVAs were calculated. There were no statistically significant differences ($\alpha = .05$) in mean trips made between different household groups within the different configurations.

Dietary-Intake

This section examines the relationship between the neighborhood food environment, sociodemographics and disparities in dietary-intake levels. It was hypothesized that sociodemographic conditions would play a greater role in accounting for potential disparities in dietary-intake levels. Consequently, it was expected that low-income households would consume higher levels of unhealthful foods such as soda, fruit juice, sweets and salty snacks than more affluent households. These households also were expected to consume less fruits and vegetables than more affluent households. Finally, it was expected that the role of the neighborhood food environment in explaining potential disparities in dietary-intake would be partially mitigated by the travel behavior of residents.

Given that the primary dependent variables (monthly dietary-intake levels) were count data (positive integers without an explicit upper limit but bounded by a lower limit of zero), a negative binomial regression model was used. The choice of a negative binomial regression model over a standard Ordinary Least Squares (OLS) regression was based on the possibility that an OLS model might lead to the prediction of negative counts, the variance of the response variables are likely to increase with the mean and it is most likely that the errors would not be normally distributed (Cameron and Trivedi, 1998; Winkelmann, 2008). Following Zuur et al. (2009) the negative binomial regression model was formalized in three steps:

$$Y_i \sim NB(\mu_i, k)$$

$$E(Y_i) = \mu_i \text{ and } \operatorname{var}(Y_i) = \mu_i + \frac{\mu_i^2}{k}$$

$$\log(\mu_i) = \eta(X_{i1}, \ldots, X_{iq}) \text{ or } \mu_i = e^{\eta(X_{i1}, \ldots, X_{iq})}$$

Here, Y_i is a negative binomial distributed response variable with mean μ_i and a dispersion parameter k. The variance (var) of Y_i is also equal to μ_i and its variance is $\mu_i + \mu_i^2/k$. If k is large relative to μ_i^2 then μ_i^2/k approximates zero and the negative binomial distribution converges to a Poisson distribution. As the dispersion parameter (k) decreases the greater the overdispersion. The mean of Y_i and the predictor function, $\eta(Xi1, \ldots, Xiq) = \alpha + \beta 1 \times Xi1 + \ldots + \beta q \times Xiq$, are linked logarithmically to ensure that all fitted values are positive. Last a series of likelihood criterion and their derivatives are used to estimate the regression parameters.

The dependent variables were the respondent's monthly consumption of soda (Soda), fruit juice (Juice), salty snacks (Salty), sweets (Sweets), fruits (Fruit), vegetables (Vegetables) and alcohol (Alcohol). In order to maintain the fidelity of the count data, any serving sizes recorded as a fraction were rounded to the nearest whole number for the analysis. The dependent variables were regressed on a set of independent variables capturing the neighborhood food environment and respondents' sociodemographics. These independent variables included the cumulative accessibility measures for all full-service retail supermarkets (Supermarkets (1mi)), convenience (Convenience (1mi)) and fast food establishments (Fast Food (1mi)) within a 1-mile network distance of a respondent's home, household income (HI), age (Age), years of educational attainment (Education), gender (Gender 0F | 1M) and exercise (Exercise 0N | 1Y).

It was expected that the cumulative opportunity accessibility measure for convenience and fast food stores would have a positive relationship with monthly dietary-intake levels of soda, fruit juice, sweets, salty snacks and alcohol and a negative relationship with monthly dietary-intake levels of fruits and vegetables. If a neighborhood food environment were dominated by stores with limited options to purchase and consume affordable, nutritious foods,

then one would consume less of these nutritious foods. Conversely, they would be expected to consume an overabundance of unhealthful foods such as soda, sweets and salty snacks. The supermarket cumulative accessibility measure was expected to have a positive relationship with monthly fruit and vegetable dietary-intake and a negative relationship with monthly dietary-intake of soda, fruit juices, sweets, salty snacks and alcohol. Food environments with high levels of retail full-service supermarkets would have more opportunities to purchase affordable, culturally acceptable, nutritious foods.

The independent variables of age, educational attainment, household income and exercise were expected to have a positive relationship with monthly dietary-intake of fruits and vegetables and a negative relationship with monthly dietary-intake of soda, juices, sweets, salty snacks and alcohol. As individuals age, they increasingly encounter lifestyle and medical conditions that restrict or greatly reduce their intake of unhealthful foods while attempting to increase their intake of more nutritious foods. Individuals living in more affluent households also were expected to have the financial means to afford the costs associated with more healthful foods. Last, higher education levels correspond to better life opportunities and improved nutritional knowledge.

Table 3-7 shows the estimated relationships between the neighborhood food environment and sociodemographic measures with the monthly dietary-intake measures. In terms of monthly soda dietary-intake, age had a statistically significant negative relationship. That is, older respondents consumed fewer servings of soda than younger respondents. The remaining variables did not have a statistically significant relationship at the alpha threshold ($\alpha = .05$). There was a strong negative relationship between years of education, exercise and fruit juice intake. Overall, respondents with higher education levels and respondents who exercised drank

Table 3-7: Negative Binomial Regression Results

Variable	Soda (S.E.)		Juice (S.E.)		Sweets (S.E.)		Salty Snacks (S.E.)		Fruits (S.E.)		Vegetables (S.E.)		Alcohol (S.E.)	
(Intercept)	5.93	***	5.00	***	5.20	***	2.85	***	3.75	***	3.42	***	3.48	***
	(.79)		(.76)		(.71)		(.76)		(.68)		(.59)		(.95)	
Age	-0.01	*	0.002		-0.01		-0.01	*	0.005		0.001		-0.01	*
	(.01)		(.01)		(.01)		(.01)		(.005)		(.004)		(.01)	
Education	-0.07		-0.12	**	-0.08	*	0.01		-0.04		-0.01		-0.02	
	(.04)		(.04)		(.04)		(.04)		(.04)		(.03)		(.05)	
Gender (0F | 1M)	-0.14		0.15		0.26		-0.32		-0.38	*	-0.22		0.64	*
	(.21)		(.2)		(.18)		(.2)		(.18)		(.16)		(.25)	
Household Income	-2E-06		-8E-07		-8E-07		-3E-06		7E-06	*	1E-05	***	-2E-05	***
	(4E-06)		(3E-06)		(3E-06)		(3E-06)		(3E-06)		(3E-06)		(4E-06)	
Exercise (0N | 1Y)	-0.39		-0.61	*	-0.997	***	0.02		-0.06		-0.10		-0.54	
	(.29)		(.27)		(.25)		(.28)		(.25)		(.21)		(.34)	
Supermarkets (1mi)	-0.18	.	-0.06		0.04		0.01		-0.13	.	0.01		-0.08	
	(.09)		(.09)		(.08)		(.09)		(.08)		(.07)		(.11)	
Convenience Store (1m	0.02		0.01		-0.004		0.03	.	0.01		0.01		0.05	*
	(.02)		(.02)		(.02)		(.02)		(.02)		(.01)		(.02)	
Fast Food (1mi)	-0.04		0.03		-0.02		-0.04		0.01		-0.07	*	-0.06	
	(.04)		(.04)		(.04)		(.04)		(.04)		(.03)		(.05)	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1														
Null Deviance	231.32		223.89		225.18		213.43		213.77		226.56		226.37	
df	180		180		179		178		180		180		175	
Residual Deviance	211.31		206.26		199.13		199.60		204.27		199.07		197.04	
df	172		172		171		170		172		172		167	
AIC:	1710.00		1523.90		1397.80		1358.40		1628.10		1612.10		1158.80	
Theta:	0.71		0.78		0.96		0.83		0.97		1.30		0.52	
Std. Err.:	0.07		0.08		0.10		0.08		0.09		0.13		0.05	
2 x log-likelihood:	-1690.12		-1503.89		1377.75		-1338.43		-1608.12		-1592.08		-1138.79	

fewer servings of fruit juice than respondents with low education levels and individuals who did not exercise. Similar statistically significant negative relationships existed between educational attainment, exercise and monthly dietary-intake for sweets. Individuals with higher levels of education and individuals who exercised consumed fewer sweets than individuals did with lower levels of schooling and those who did not exercise. There were no statistically significant relationships between the cumulative accessibility measures and the monthly dietary-intake of fruit juices and sweets.

There was a statistically significant negative relationship between age and monthly intake of salty snacks. Like soda consumption, older individuals consumed fewer amounts of salty snacks than younger respondents. There were no statistically significant relationships between the neighborhood food accessibility measures and dietary-intake of salty snacks. There existed a statistically significant negative relationship between gender and dietary fruit intake and a positive relationship between household income and fruit consumption. Respondents with higher household income levels ate more fruits than low-income households while men consumed less fruits than females. None of the neighborhood food accessibility measures were statistically significant at the alpha threshold ($\alpha = .05$).

With regard to vegetable dietary-intake, the fast food cumulative accessibility measure exhibited a strong statistically significant negative relationship and household income had a strong statistically significant positive relationship with vegetable dietary-intake. The more fast food establishments within a mile of a respondent's home the lower amount of vegetables one consumed. Conversely, higher household income was translated into higher monthly vegetable consumption. Last, there was a statistically significant positive relationship between gender, the convenience store cumulative accessibility measure and alcohol consumption. Males consumed

significantly more alcohol than females. Residents, with a greater amount of convenience stores within one network mile of their house, also drank more alcohol than residents with fewer convenience stores near them. There also was a socioeconomic gradient in alcohol consumption, which was supported by the strong negative relationship between household income and alcohol consumption. Low-income respondents drank more alcohol than affluent respondents did. Age had a statistically significant negative relationship indicating that older respondents consumed less alcohol than younger respondents did. Last, there was a statistically significant positive relationship between the cumulative convenience store accessibility measure and alcohol intake. A higher number of convenience stores near a respondent's home increased alcohol consumption levels.

Post regression diagnostics indicated no multicollinearity issues between the independent variables. Last, in order to ensure the assumption that the conditional means are not equal to the conditional variances underlying the negative binomial model was not violated, a series of Poisson regressions were estimated and compared against the negative binomial regressions with a series of likelihood ratio tests (results omitted). The results confirmed that the model assumptions were not violated.

Discussion

It has been shown that respondents—regardless of economical and physical mobility constraints—overwhelmingly shop for their groceries at independent supermarkets. Very few trips are made to local convenience stores (corner grocery, dollar, party and liquor). While increased socioeconomic status and physical mobility increases the spatial choices of residents, enabling them to shop more frequently at regional and national supermarket chains located in the suburbs, respondents of all household income levels utilized the independent supermarkets

located in the city. In particular, households making less than $20,000 rely more than any other economic group on independent supermarkets. They also choose overwhelmingly to visit discount supermarkets rather than neighborhood convenience stores. Given the higher transportation costs to reach the national and regional supermarkets and the lack of reliable public transit routes from the city to the suburbs, the outcomes seem plausible. Not surprising households making greater than $50,000 shop more than low-income households do at the national and regional supermarkets located further from the study area and less at discount supermarkets. Such households have the means to travel freely at will across the built-environment.

Even low-income households lacking access to a household vehicle shopped at the independent supermarkets in the city rather than relying on smaller neighborhood convenience stores. While it was not ascertained in the survey design, this finding might confirm the importance that social capital and social networks play overcoming neighborhood and household obstacles pertaining to the food environment (Morton et al., 2005; Smith et al., 2010). It long has been noted that jitney services and other informal travel arrangements play a role in meeting travel needs of households lacking access to a car in historically black inner-city neighborhoods (Eckert and Hilton, 1972; Kirby et al., 1974).

In the end, the travel results confirm the general notion that higher-income groups have the necessary fiscal, temporal, and social capital to expand their realm of shopping options, whereas low-income households simply do not have such opportunities. Even without access to a car, higher-income groups are able to make more trips and shop at higher rates at the network of independent supermarkets located inside the city. Despite these barriers, low-income

residents are able to travel outside their neighborhood to national, discount and independent supermarkets.

Similar to economic constraints, physical constraints restrict the spatial mobility of an individual thereby narrowing their range of options. Within the "food desert" discourse, it is assumed that physical constraints restrict mobility to the point that individuals must rely on their local neighborhood food environment, which is disproportionately composed of convenience and liquor stores that have few nutritious and affordable food options. Yet, the results suggest that elderly households who potentially have the highest physical mobility constraints are not spatially restricted in their shopping behavior. Similar to the overall trends, the elderly population tends to utilize primarily the independent and regional supermarkets. Overall, these findings appear to show limited physical mobility constrained placed upon the sample population, although the findings do illustrate the extensive distances and associated costs (in terms of time and money) that the lower income, lower eastside Detroit population travels to access basic food staples. Extensive numbers of these residents also travel these long distances by walking and utilizing public transit, showing the unique nature of "burdens" that are faced by the urban poor who live in communities experiencing disinvestment and decline (Vojnovic et al., 2013).

These results also show that the majority of trips made by the respondents occur outside of the neighborhood food environment. It appears that households consciously bypass their immediate food environment, which is disproportionately composed of unhealthful convenience stores (corner grocery, dollar, party and liquor stores). Even low-income households make trips outside of traditional neighborhood configurations to reach independent and discount supermarkets located throughout the city. On average, residents travelled 3.6 miles to their retail

food store of choice. These results help to explain the mixed results encountered when examining the relationship between dietary-intake and the food environment.

The neighborhood food environment measures were only statistically significant with regards to vegetable and alcohol intake. Surprisingly, the supermarket cumulative accessibility measures were not statistically significant. Past research has shown that fruit and vegetable dietary-intake of respondents significantly increased with the presence a supermarket even after individual sociodemographic factors were controlled (Morland et al., 2002b; Laraia et al., 2004; Zenk et al., 2005a, 2009; Bodor et al., 2008; Michimi and Wimberly, 2010; Izumi et al., 2011; Adu-Nyako and Okafor, 2011). Yet, the results above show no such relationship between the neighborhood food environment and monthly fruit intake, confirming past US research that has shown no relationship between the neighborhood food environment and dietary-intake (Wang et al., 2007b; An and Sturm, 2012; Lee, 2012). The role of the fast food environment and decreased vegetable consumption would lend tangential support to the previous studies that have shown a negative impact on dietary-intake and the fast food environment and consumption (Bowman and Vinyard, 2004; Moore et al., 2009). While there is mixed support for the neighborhood food measures, there is a strong support for a socioeconomic gradient in dietary-intake patterns.

Consumption of healthful foods such as fruits and vegetables tend to occur disproportionately among households with higher income levels. This is directly related to the fact that a healthful diet often has a higher cost associated with it. In a similar vein, higher education levels deter the consumption of fruit juices and sugary sweets. Not surprising individuals who exercise consume less fruit juices and sweets. The role of gender in explaining increased dietary fruit intake is in line with previous findings.

Past research has shown a gender difference in fruit and vegetable intake within modern western societies (Baker and Wardle, 2003; Granner et al., 2004; Prattala et al., 2009; Arganini et al., 2012). While food choices are dependent on an array of lifestyle factors, sociocultural and economic factors (Smith and Smith, 1994), males tend to have lower levels of health related nutritional knowledge and higher levels of skepticism towards nutritional guidelines than females (Baker and Wardle, 2003) which depresses their fruit and vegetable intake. Moreover, females face greater gendered societal pressures to maintain certain weight and body images than men which also shapes their levels of fruit and vegetable intake (Arganini et al., 2012).

Overall it should be noted that the entire sample lags significantly behind the recommended guidelines for fruit and vegetable consumption. Federal guidelines recommend between 4 to 6 daily servings of fruits and vegetables depending on one's caloric need. In contrast, like the typical American household, respondents also consume higher than recommended levels of sweets and salty snacks (USDA and USDHHS, 2010). This is reinforced by the limited differences found between different household income levels in terms of dietary-intake levels of unhealthful foods.

With regards to the public health outcomes discussed above, there needs to be caution in overall interpretation of the models presented. While generalized linear models such as the negative binomial regression do not have R^2 to help assess overall fit, one can use the null (only the intercept) and residual deviances (model of interest) to assess the overall explained deviance of the models. The models are only capturing a portion of the overall deviance of the dependent variable, monthly dietary-intake levels. This could indicate a missing variable, low sample size, model misspecification or an error in the overall survey design.

A missing covariate in the model could potentially explain the missing deviance. However, the above models include the most common variables found to contribute to differential levels of dietary-intake used in similar studies (An and Sturm, 2012). In addition, the results of the negative binomial regression could be limited by the relatively small sample size (n = 255) used in the analysis. Given the missing responses in some of the control variables and dietary-intake variables, most food categories lost on average 86 cases (SD = 1.21), which further reduced the overall sample size used in the models. In order to rule out model misspecification, several Poisson models that were adjusted using a quasi-GLM model to correct the standard errors produced similar results. Likewise, log-linear OLS regressions that used the $\log_{10}$ of the dependent variable produced similar results. The most plausible source of error is the survey design. In particular, the dietary questions asked in the mail survey were not complete dietary recalls with explicit guidance on serving sizes and food classification. Rather, the dietary-intake questions were single item questions that could lead to measurement error. Despite these limitations, there appears to be mixed support for the role of the neighborhood food environment on influencing levels of dietary-intake even when individual level factors are controlled and strong support for the role that socioeconomic conditions play in explaining variation in dietary-intake levels.

Overall, there are two salient findings that emerge in support of the initial hypotheses. First, it should not be assumed that residents living in a 'food desert' shop or consume with in it. Consequently, public health studies (Morland et al., 2002b; Laraia et al., 2004, Morland et al., 2006; Jago et al., 2007; Powell et al., 2007a; Galvez et al., 2009; Michimi and Wimberly, 2010) that simply correlated the neighborhood food environment with longitudinal health data but fail

to account for the travel and shopping patterns of residents risk making inaccurate associations and conclusions.

As past research has noted, food environments where people work and go to school could be just as important as the neighborhood food environment (Engbers et al., 2005; Shimotsu et al., 2007; Larson and Story, 2010). Moreover, if respondents do not shop and consume in their neighborhood food environment, whether by choice or store absence, then direct relationships between health, dietary-intake and the urban food environment are unlikely. This does not necessarily mean that the local environment does not impact household food choices and their public health, but it does highlights the need to incorporate the shopping preferences of respondents. These insights help to expand upon and provide a possible explanation for recent work that has found no association between the neighborhood health environment and public health outcomes (Boone-Heinonen et al., 2011; Lee, 2012; An and Sturm, 2012).

It has been argued for some eight decades that consumers will tend to shop for convenience (or every day) goods closer to home; with food generally being considered a convenience good (Christaller, 1933; Jones and Simmons, 1990; Dennis et al., 2002; Wang et al., 2007a). However, the role of distance as being the key criterion in determining the store of choice for grocery shopping has been challenged. Scholars have long noted that the physical quality and experience of the store, price, cultural considerations, perceptions, structural conditions and the built-environment have played important roles in shaping the selection of store choice (Guy, 1998; Dennis et al., 2002; Kirkup et al., 2004; Giskes et al., 2007; Pettinger et al., 2007; Kumar et al., 2011; Vojnovic et al., 2013).

While the Detroit urban poor do access stores selling nutritious food sources—although at a greater monetary and temporal cost when compared to the wealthier Detroit suburbanites

living directly adjacent to the major national supermarkets—there are other factors that could impede their purchase of produce and vegetables. The extra travel cost imposed on residents having to travel outside their neighborhood food environment could reduce money that would otherwise be spent on produce and vegetables. It also could impose a temporal cost. Research in the Michigan context also has shown that the poor, due to the more limited vehicle ownership and access, walk or take public transit, and in large numbers, to reach basic food staples, while wealthier suburban populations mainly drive (Vojnovic et al., forthcoming). The costs of produce and vegetables might still be cost prohibited for residents on fixed incomes and the available foods might be of poorer quality in the independent supermarkets (Pothukuchi et al., 2008). Moreover, numerous socio-cultural constraints have been highlighted in the literature that might influence the consumption of fruits and vegetables (Treiman et al., 1996; Williams et al., 2010). In addition, consumer perception about their neighborhood food environment, the availability and choices of nutritious food and a balance diet also play an important role in their shopping and consumption behavior (Williams and Hubbard, 2001; Kirkup et al., 2004; Giskes et al., 2007).

While no major national supermarket chain existed in Detroit at the time of the survey, the disproportionate number of food-shopping trips by respondents was met by shopping at independent and major national supermarkets within Detroit and its suburbs. Recent media coverage, by not considering independent supermarkets, has tended to exaggerate the lack of access among Detroit residents to food suppliers (Grossman, 2009; Hargreaves, 2009; Longworth, 2011). This reinforces the importance of store preferences and understanding the actual food environment that residents utilize. This also means that there are likely variables

other than access to stores with nutritious food options contributing to dietary related public health issues within these neighborhoods.

Second, the paucity of traditional neighborhood boundaries is exposed. Conventional studies assume that an administrative boundary, often census geography, represents/delineates a neighborhood. Yet such conceptualization fails to adequately capture and reflect the lived experience, cultural practices and social interactions that shape human behavior. People's perceptions of neighborhood do not neatly align with arbitrary administrative boundaries. Neighborhoods are rooted in dynamic and fluid cultural and social practices that operate at multiple scales. As a result, neighborhoods are heterogeneous lived spaces composed of complex social meanings, which are maintained and transformed through power relationships. Ignoring these practices and power relationships limits our understanding of the neighborhood dynamics.

The concept of neighborhood will vary based on individual life experiences and broader structural constraints imposed upon individuals. For example, it is apparent that many of the eastside Detroit residents avoid the Kroger in Grosse Pointe despite it being relatively close to their homes. This is explicitly tied to the strident racial hostility between the suburbs and the city of Detroit. Moreover, the administrative boundaries fail to capture the perceptions of residents. For example, if a supermarket is located only two blocks away from an apartment building but the residents view the surrounding area as unsafe, then they will be less inclined to walk to the store and may choose to visit another store that is further away in a different direction. Additionally, conflicts between neighborhood residents and the owners of stores also will deter residents from shopping at a particular location (e.g. African Americans and Chaldeans). Thus, uncritical conceptions of neighborhoods in which accessibility and other measures of access are

examined will fail to capture these dynamics. Moreover, an uncritical conception of neighborhoods fails to challenge critically assumptions about where people shop and how far they are willing to travel (Ball et al., 2006; Matthews et al., 2009; Odoms-Young et al., 2009). This is clearly reflected in the findings supporting the hypothesis that residents do not shop in the immediate food environment.

Last, it must be noted that many of these findings illustrate how the agency of socially and economically marginalized communities has been overlooked. There is a great danger in assuming that such communities are incapable of responding to their local environment. It opens the door to projecting a culture of poverty that diverts attention from the structural conditions exploiting them. Moreover, it enables policy to focus solely on the composition of the food environment rather than on programs that could uplift people out of poverty.

Conclusion

It has been shown that respondents—regardless of economical and physical mobility constraints—overwhelming shop for their groceries at independent full-service supermarkets. Very few trips are made to local convenience stores even though such stores dominant the overall composition of the neighborhood food environment. While increased socioeconomic status and physical mobility increases the spatial choices of residents, enabling them to shop more frequently at regional and national supermarket chains located in the suburbs, respondents of all classes tend to visit in great numbers the independent supermarkets located in the city. In particular, households making less than $20,000 rely more than any other economic group on independent supermarkets. They also choose overwhelmingly to visit discount supermarkets rather than neighborhood convenience stores. Even low-income households lacking access to a household vehicle still shop at the independent supermarkets in the city rather than relying on

smaller neighborhood stores. Moreover, the majority of food shopping occurs outside the neighborhood food environment.

The results in this chapter also lend strong support for the role that sociodemographics play in shaping dietary-intake. Levels of educational attainment, age and household income play a crucial role in shaping the consumption rates of certain food groups. In contrast, many of the neighborhood food environment variables do not play a role in explaining dietary outcomes. It would appear that respondent's ability to shop at national, independent and discount supermarkets outside the immediate food environment mediate potential direct neighborhood effects. However, indirect neighborhood effects are likely a result of the additional burdens placed on residents who have to navigate a built-environment that has been characterized by excessive disinvestment. Consequently, low-income households have to expand more money and time on travel than more affluent households do.

Such findings indicate that research needs to focus more on the interplay between structural conditions and agency. Rather than assuming living in a neighborhood food desert adversely impacts one's health, research needs to explore the complex social interactions that mediate purchasing and consumption practices. Conversely, by solely focusing on accessibility, research will only lose site of the crushing burden that place plays in marginalized communities.

CHAPTER 4
NATIONAL AND REGIONAL SUPERMARKET DECENTRALIZATION IN TRI-COUNTY DETROIT, MICHIGAN (1970-2010)

This chapter seeks to answer the question: how has the decentralization of retail supermarkets led to the creation of spatial inequalities in the food environment of tri-County Detroit, Michigan? An implicit assumption in the "food desert" literature is that retail decentralization combines with racially restrictive residential suburbanization patterns to create unevenly developed retail food landscapes. Despite the apparent narrative there has been little work examining how national and regional supermarkets decentralized in the tri-County Detroit region. It is expected that national and regional supermarket decentralization has steadily occurred since 1970 in the tri-County Detroit region. It is believed that these decentralization patterns were largely brought about by the major restructuring trends that occurred within the supermarket industry. Consequently, when this retail deconcentration is combined with the historically racially selective residential suburbanization patterns in the region, it is envisaged that an uneven food environment will emerge. This uneven food environment will be characterized by a city-suburb dichotomy in which the city of Detroit lacks the supermarket activity warranted by its population and the suburban communities have an overabundance of supermarket activity. Last, it is anticipated that this pattern of retail decentralization will create a niche for liquor, party and other convenience stores to emerge as dominant retail outlets in the city of Detroit.

Data & Methods

In order to reconstruct the historical tri-County Detroit retail food environment, data from Michigan Bell and Ameritech telephone directories and R. L. Polk & Company city directories were collected from 1970 to 2000 (Appendix A). The Michigan Department of Agriculture retail

food licensing database and data from the Detroit Economic Group described in chapter 3 also were used to generate the 2010 data. In several cases, city directories falling one year before or after the decade was used. These typically involved smaller communities that had very little change to warrant yearly publication. In some cases, city directories from odd years also were used to cross validate the location of some national and regional supermarkets. While all data sources are comprehensive, it should be noted that there could be stores that came into existence, went out of business or changed hands after publication of a directory. It also should be noted that the publication of city directories curtailed throughout the latter decades of the study. As a result, earlier historical data was more reliant on information contained in city directories while more recent data was disproportionately taken from telephone directories and other data sources.

Stores falling under several categories in the city, telephone and business directories were entered into a Microsoft (MS) Access 2003 database. Categories included bakers-retail, beer-retail, beer & ale-retail, beer and wine-retail stores, confectionery-retail, delicatessens-retail, fruit & vegetable-retail, fruit dealers-retail, gas stations, gasoline stations, grocery stores & markets, groceries and meats-retail, liquors, liquor and wines, meats-retail, party stores, pharmacies, pizza, produce, poultry-retail, restaurants, taverns and wines-retail. Once entered, duplicate records were identified and removed from the database using a series of queries in MS Access 2003 and the street address format of the remaining records were standardized. From this cleaned up database, a subset of records that focused on stores falling into four broad categories (national and regional supermarket chains, corner grocery stores, green grocers and liquor store) was created for each decade.

National and regional supermarket chains were classified as any retailer or company that owned more than 10 stores. Typically, these stores conducted business not only in the tri-County

Detroit region but also in other parts of Michigan, the Midwest and United States. Exceptions were made for supermarket chains that might have had fewer stores at the point of entry or exit from the region. The logic underpinning this classification rests on the notion that organizations with multiple stores can take advantage of vertical integration and economies of scale which translates into lower prices, increased sales volumes and bigger revenues (Lebhar, 1963). Moreover, all of the stores within this category contained a full-line of grocery items including meat and produce.

Independent supermarkets, ethnic markets, convenience stores, family run 'mom and pop' stores and more recently dollar stores, gas stations and pharmacies were combined into the corner grocery store category. While considerable support could be made for including independent supermarkets into the national and regional supermarket category or their own category, there was not enough publically available historical material to successfully track their evolution over the past 50 years. Moreover, many of these establishments were no different in size and operations than many of the 'mom and pop' neighborhood markets during the 1960s and 1970s.

The green grocer category consisted of fruit and vegetable markets, produce vendors and establishments in Eastern and the now defunct Western Market in Detroit. Last, liquor stores were retail establishments that identified themselves as liquor, beer, wine or party stores. This also included stores that were listed in a different category but had "liquor," "beer," "keg" or "party" in the name of their establishment. When a store had multiple identifications across the categories, they were placed into the corner grocery store category (unless they were a national or regional retail supermarket chain). This decision was to ensure that all store type categories were mutually exclusive. All remaining categories of stores remaining in the initial database

were excluded from the analysis. The exclusion of other retail food environment establishments such as bakeries, confectionaries, restaurants and taverns was on the basis that few of these stores carried a broad selection of supermarket goods and produce; nor did they carry a large enough selection of alcohol to warrant inclusion into the liquor store category. With that said, it should be noted that that the main scope of this section is to track the decentralization of the national and regional supermarket chains and to see if their departure led to a concentration of unhealthful store types such as liquor store.

After the retail food store database was cleaned up and categorized, the street addresses for an establishment were geocoded using ESRI's Geocoding[4] service with a North America composite address locator and interactive rematch in ArcMap 10. Once geocoded, the initial geocodes were mapped and checked for accuracy. Records that did not match to an individual street segment were flagged, researched and recoded. A major source of geocoding error was the renaming and incorporation of new municipalities. For example, in order to disassociate itself from the city of Detroit, the city of East Detroit changed its name to Eastpointe in 1992. In several cases, sections of geocodes had to be manually recoded. In the majority of these cases, the error was due to the eradication of neighborhoods by large scale urban development projects such as the General Motors Poletown plant, the Detroit Medical Center, the Central Industrial Park, the Conner Creek Industrial Park and the creation of the Chrysler Freeway (I-75). In some cases, once thriving residential communities such as St. Cyril were abandoned then later demolished by the turn of the 21st century. No matter the case, these geocoding errors were manually identified and corrected using Michigan Georeferenced National Agriculture Imagery Program (NAIP) Digital Ortho Photos, Bing ortho-rectified high-resolution imagery and

[4] Geocoding is the process of matching a street address to a georeferenced address-ranged street segment with an interpolation algorithm.

historical topographic maps from the Michigan Center for Geographic Library and the United States Geological Survey (USGS) National Map Seamless Data Server. Records that could not be reconciled were removed from the analysis.

In order to capture the spatial distribution of the food environment, a series of location quotients (LQ) were calculated for national and regional supermarkets and liquor stores. A LQ is an index used to compare an area's share of an activity to a broader whole or base (Burt & Barber, 1996). In this case, the index was used to compare an area's share of a particular retail store category/activity in relation to the total food environment (all the retail food stores). The LQ was formalized as:

$$LQ_j = \frac{S^i_j / S^i_T}{F_j / F^T}$$

Where

S^i_j is the total number of stores in category i in census tract j;
S^i_T is the total number of stores in category i in all census tracts;
F_j is the total number of all retail stores in census tract j; and
F^T is the total number of all retail stores in all census tracts.

LQ values greater than 1 indicate a relative concentration of retail food activity in a census tract while LQ values less than 1 indicate that the census tract has less retail activity than what is found in the entire study area. These LQs capture the concentration of a particular retail activity in relation to the entire food environment across the tri-County Detroit region. In order to capture the spatial distribution of a particular retail activity in relation to the spatial distribution of population, a second set of LQs were calculated utilizing population as the base. By utilizing the total population as the standard of comparison, one is able to detect subtle patterns that capture the interaction between population and retail deconcentration. The

population data utilized was taken from United States decennial census summary files for each decade (U.S. Census, 1972, 1981, 1991, 1992, 2001, 2002, 2012). In some decades, the population based LQ produced one or two extreme LQ values. These values were removed from the data. The choice to calculate LQs for national and regional supermarkets and liquor stores was based on the desire to capture the two extremes of the food environment.

In order to statistically test the spatial patterns emerging from the location quotients, a series of local Getis-Ord statistics (Gi*) were calculated. The local Getis-Ord Gi* statistic was used to determine if there were any statistically significant hot (high values clustering) or cold spots (low values clustering). The Getis-Ord local statistic was formalized as:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{ij} x_j - \bar{X} \sum_{j=1}^{n} w_{ij}}{S \sqrt{\frac{n \sum_{j=1}^{n} w_{ij}^2 - \left(\sum_{j=1}^{n} w_{ij} \right)^2}{n-1}}}$$

$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n}$$

$$S = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n} - \left(\bar{X}\right)}$$

Where

x_j is the LQ for census tract j;
w_{ij} is the spatial weight matrix between census tract i and j; and
n is equal to the total number of census tracts.

The local Getis-Ord Gi* statistic provides each census tract with a z score that can be used to interpret the statistical significance of any spatial patterning found among the LQs. The larger the z-score value the greater the clustering of high values (hot spots) and the smaller the z-score the greater the clustering of low values (cold spots). The benefits of the local Gi* measures rests in its ability to indicate whether any observed spatial clustering of high or low values is more pronounced than a random spatial distribution. Moreover, such a local spatial association measure allows different trends across space to be detected that otherwise would be undetected by equivalent global measures (Ord and Getis, 1995; Fotheringham, et al., 2000). The calculation of the local Gi* statistics in this study conceptualized spatial relationships as a fixed distance band in order to ensure that each feature had at least one neighbor, to counter the large variation in census tract size and to ensure a consistent scale for the analysis (Mitchell, 2005).

Results

The local Getis-Ord GI* statistics for the national and regional supermarkets compared against all retail food store activity and against the spatial distribution of the population for each decade is presented in Figure 4-1 and 4-2 respectively. Figure 4-1 shows that there were statistically significant ($\alpha = .05$) high and low clusters of national and regional supermarket activity across the study area in each decade. In 1970, there was a scattering of statistically significant clusters of high national and regional supermarket location quotients in the suburbs of Wayne County (Southgate, Taylor and Woodhaven), the suburbs of Oakland County (West Bloomfield and Bloomfield Hills) and in the Rouge and Cody neighborhoods of Detroit. A statistically significant cold spot covered Hamtramck, most of Highland Park and the central, lower eastside and southwest sections of Detroit. By 1980, this clustering of low location quotients expanded to cover Highland Park and most of the city of Detroit. In contrast, a

Figure 4-1: National and Regional Supermarket LQ (Base Retail) Hot Spot Analysis 1970 to 2010

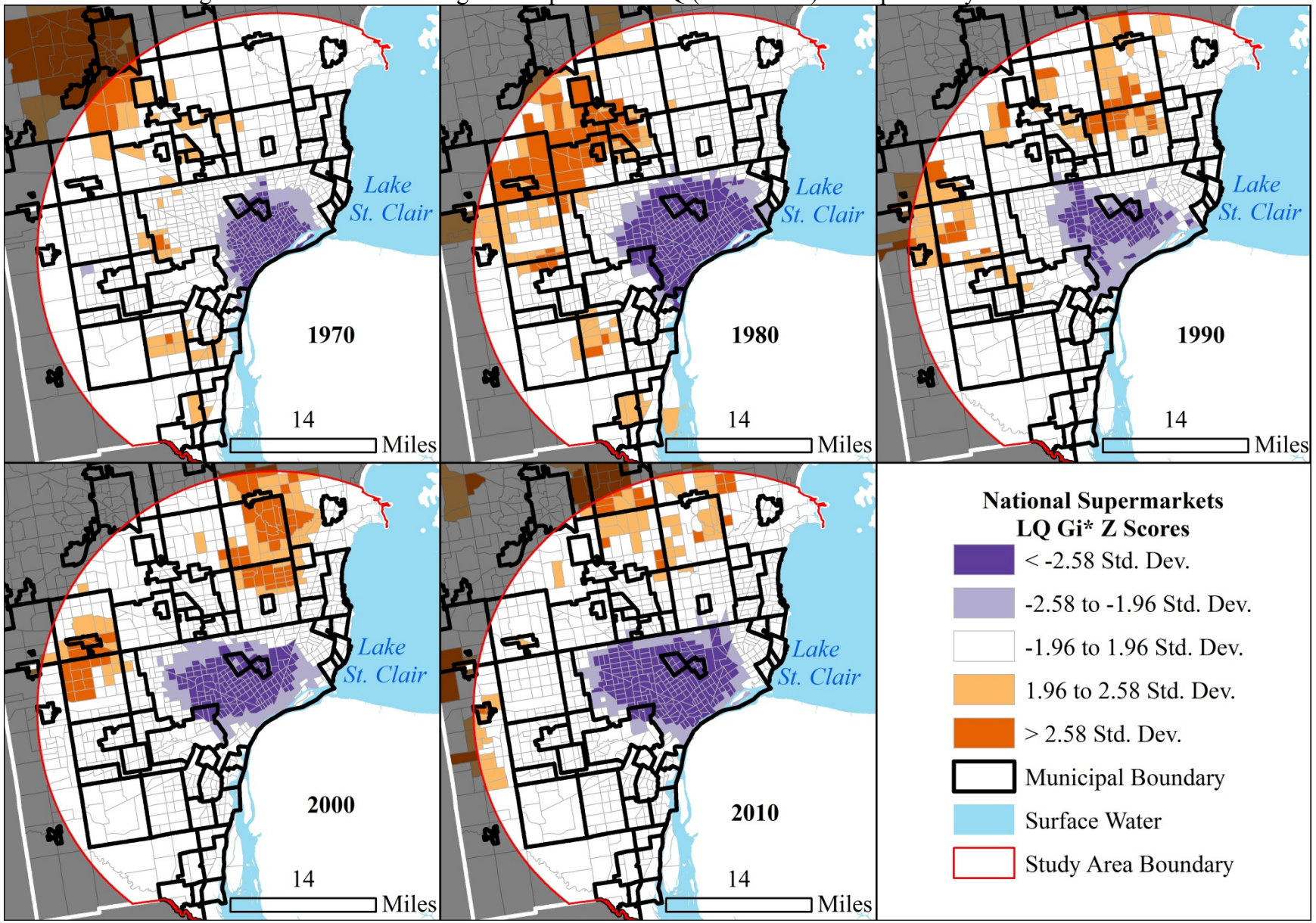
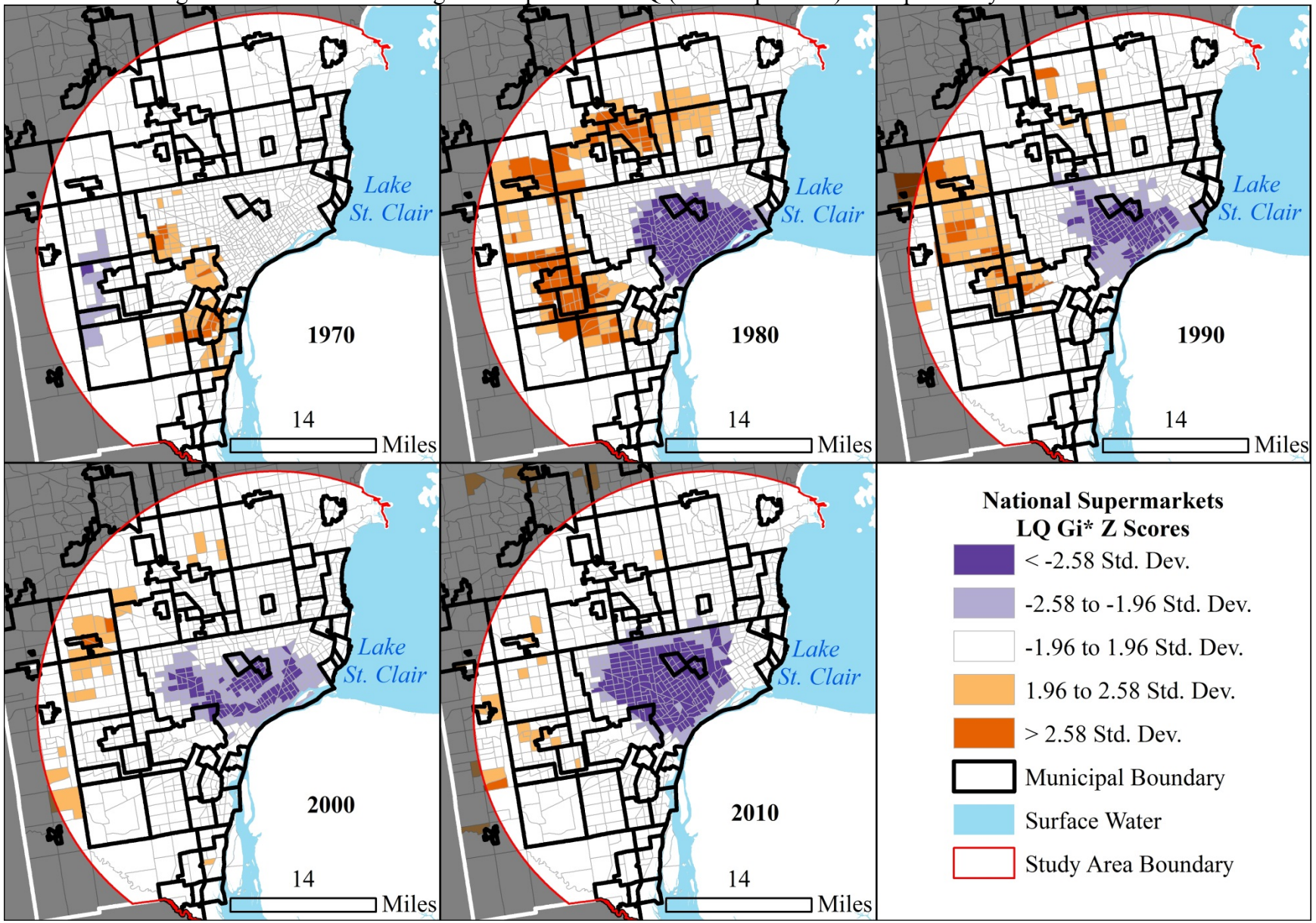


Figure 4-2: National and Regional Supermarket LQ (Base Population) Hot Spot Analysis 1970 to 2010



statistically significant hot spot formed around the city of Detroit. In particular, the hot spot began in the suburban Oakland county communities of Clawson, Royal Oak and Berkley and extended through the Birmingham, Bloomfield Hills, Southfield, Farmington and Farmington Hills communities before entering into the Wayne County communities of Livonia, Westland, Taylor and Woodhaven.

In 1990, the hot spot in Oakland County had dissipated with only a handful of statistically significant high clusters found in West Bloomfield, Troy, Royal Oak and on the western edges of Farmington and Farmington Hills. However, there was a statistically significant concentration of national and regional supermarkets in the Macomb County municipalities of Warren and Sterling Heights as well as the Wayne County communities of Livonia, Westland and Garden City. The statistically significant cold spot of national and regional supermarkets continued to dominate the heart of Detroit, Highland Park and Hamtramck. By 2000, the high clusters of national and regional supermarket activity around the city of Detroit had lessened. There were only two concentrations of national and regional supermarket activity. The first occurred in the Macomb communities of Warren, Sterling Heights, Utica and Fraser. The second was shared between the communities of Livonia (Wayne), Farmington (Oakland) and Farmington Hills (Oakland). The statistically significant low clusters of national and regional supermarket activity in the heart of Detroit, Highland Park and Hamtramck from the previous decade remained.

In 2010, the statistically significant high clusters of supermarket activity had been pushed to the edge of the study area in Wayne County. The statistically significant clusters in Macomb County shifted further north and in Oakland County a cluster formed in the northern portions of Troy and in Rochester Hills. The statistically significant cold spot of national and regional

supermarket activity also expanded to cover every section of Highland Park, Hamtramck and Detroit with the exception of the far eastern neighborhoods of Burbank, Denby and Finney.

The Getis Ord Gi* statistics for the LQs derived against the spatial distribution of the population are shown in Figure 4-2. Figure 4-2 shows that there were statistically significant high and low clusters among the national and regional supermarkets location quotients in each decade. In particular, there was a strong clustering of national and regional supermarkets in the Wayne County Downriver suburbs of Melvindale, Allen Park, Lincoln Park, Ecorse, Wyandotte, Southgate, Taylor and Riverview in 1970. This hot spot extended north into Dearborn and into the predominately-White western Detroit neighborhoods of Rouge, Cody and Brightmoor. There also was a cold spot in the Wayne County suburbs of Romulus, Wayne and Westland.

By 1980, the initial statistically significant hotspot had become a well-defined semi-circle running through the inner suburbs and the western sections of Detroit. This ring started in the western Wayne County suburbs of Taylor, Inkster, Garden City and worked its way north through parts of Livonia before moving into the Oakland County suburbs of Farmington, Farmington Hills, Southfield, Royal Oak, Birmingham, Clawson and Madison Heights. It ended in the Macomb Counties of Warren and Sterling Heights. There also was a statistically significant cold spot that encompassed Highland Park, Hamtramck and the central and lower east and west sides of the city of Detroit.

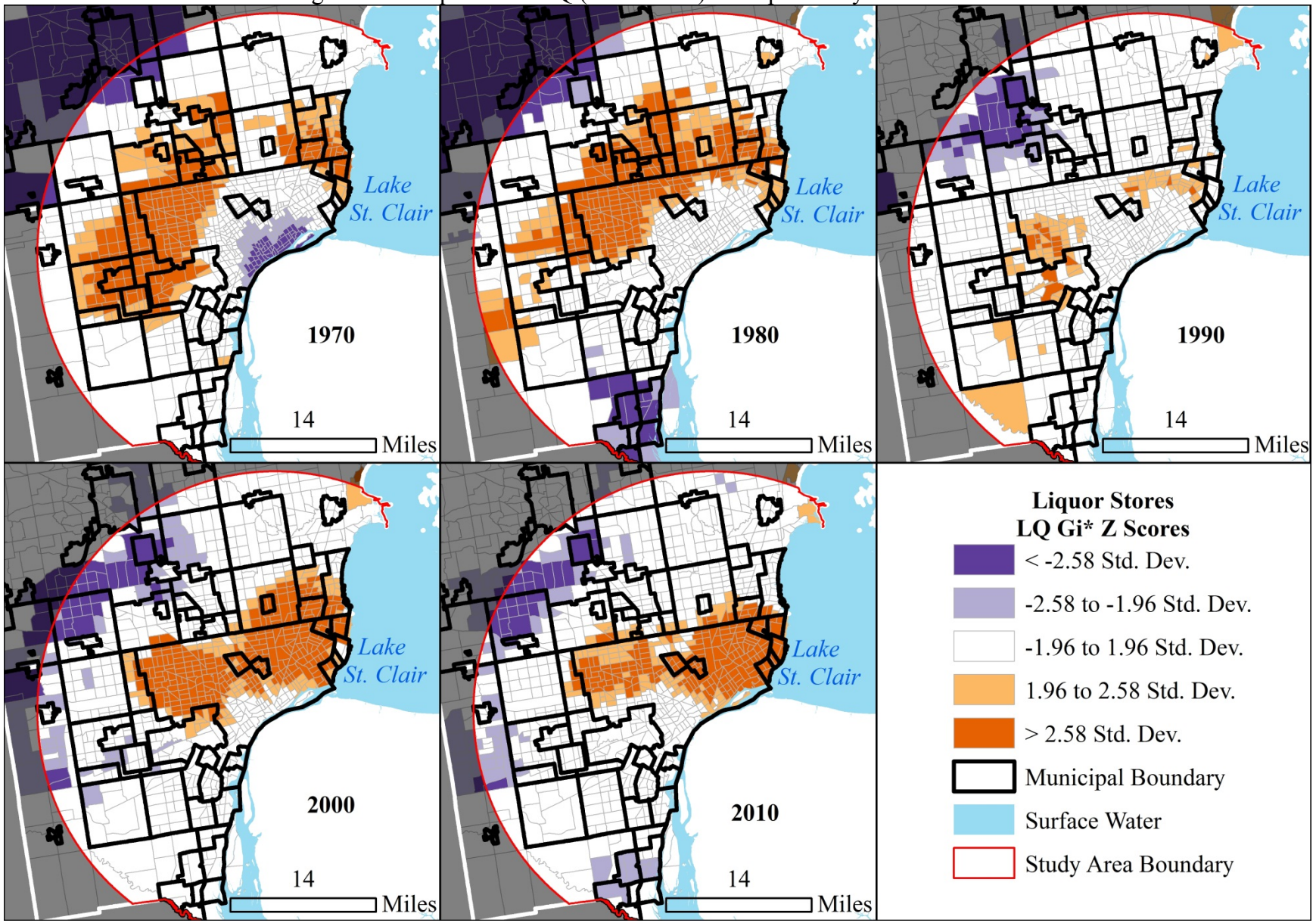
In 1990, there were statistically significant hot spots in the western suburban communities of Dearborn Heights, Inkster, Garden City and Livonia. This cluster extended north into the Oakland Counties communities of Farmington and Farmington Hills. Again, a statistically significant cold spot encompassed Highland Park, Hamtramck and the central, lower east and lower west sides of Detroit. By 2000, the clusters of hotspots had diminished from

earlier decades. There was a sparse ring of statistically significant cluster of high national and regional supermarket location quotients near the edge of the study area in Wayne and Oakland County. In addition, a statistically significant low cluster formed in Highland Park, Hamtramck and most of the city of Detroit. Last, there were scattered statistically significant hotspots in the unincorporated portion of Wayne County as well as Livonia in 2010. This wisp of hot spots extended into Farmington before moving north and out of the study area. Last, there was a statistically significant cold spot that covered Highland Park, Hamtramck and most sections of Detroit with the noticeable exception of the eastside of Detroit.

Figure 4-3 maps the Getis-Ord Gi* results for the liquor store location quotients derived from the base retail activity. In 1970, a statistically significant cluster extended from the western suburbs of Wayne County through the west side of Detroit into the inner suburban communities in Oakland County. It arced downward into the Macomb communities of Warren, Eastpointe, Fraser and St. Clair Shores before ending in the eastern Wayne County communities of Grosse Pointe Woods, Grosse Pointe Farms, Grosse Point and Grosse Pointe Park. A statistically significant cold spot occurred in the lower central corridor, the African American neighborhoods just east of the downtown and southwest Detroit. By 1980, the previous cold spot in the city of Detroit had disappeared and the statistically significant hot spot of liquor store concentration intensified across the city. This hot spot also extended through the older inner suburban communities of Oakland and Macomb Counties.

In 1990, the statistically significant hotspot of past decades broke apart. There was only a statistically significant hotspot of liquor stores in the west and northeast sections of Detroit. A statistically significant cold spot existed in the wealthier suburban Oakland County municipalities of Bloomfield Hills and West Bloomfield. By 2000, the statistically significant

Figure 4-3: Liquor Store LQ (Base Retail) Hot Spot Analysis 1970 to 2010



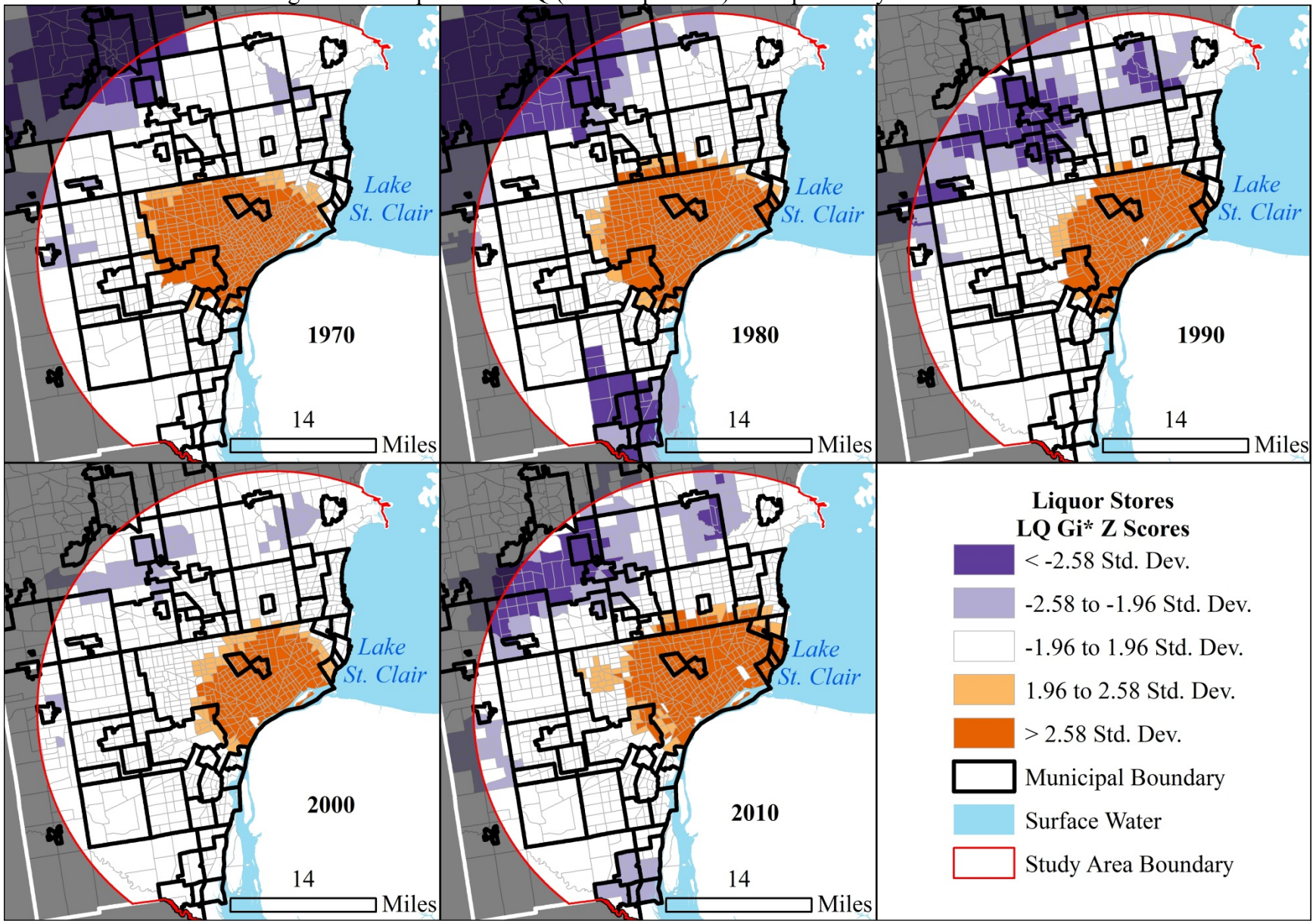
hot spot reappeared across most of Detroit, Highland Park, Hamtramck, Warren, Eastpointe, Harper Woods, Roseville and the Grosse Pointe communities. The statistically significant cold spot continued into the northwestern Oakland County communities within the study area. In 2010, the statistically significant high cluster of liquor store activity in Highland Park, Hamtramck, Harper Woods, Eastpointe, the Grosse Pointe communities and large sections of the city of Detroit remained. As in 1990 and 2000, statistically significant cold spots of liquor store activity occurred near the edge of the study area in Oakland County.

Figure 4-4 displays the hot spot analysis for liquor store LQs compared against the spatial distribution of the population. The dominate trend is that in every decade, a statistically significant hot spot dominated the city of Detroit, Highland Park and Hamtramck. Interestingly, the high clusters of liquor stores in comparison to the population abated in the western portion of the city during 1990 and 2000. Statistically significant cold spots of liquor stores also were present in every decade. However, they were found predominately on the edges of Oakland and Macomb Counties.

Discussion

The results show the suburbanization of national and regional supermarket activity was underway by 1970. Concentrations of national and regional supermarket activity were already present in the outer Oakland County suburbs and concentrations in comparison to the underlying food environment were present in the Downriver communities. In contrast, the predominately African American sections of the city of Detroit along with Highland Park and Hamtramck had an underrepresentation of national and regional supermarket activity in comparison to the larger food environment. This indicates that national and regional supermarkets made up only a small portion of the overall food economy in these communities by 1970.

Figure 4-4: Liquor Store LQ (Base Population) Hot Spot Analysis 1970 to 2010



These trends intensified by 1980. The Oakland County suburbs were awash in national and regional supermarkets. The clusters of national and regional supermarket activity moved into the western suburbs of Wayne County resulting in a semi ring of overrepresentation surrounding the city. During 1990, 2000 and 2010, the ring of national and regional supermarket concentration began to push further into the suburbs before gradually fading away. In many ways, these trends mimic the continued movement of Whites deeper into the exurbs and into the rapidly growing Macomb County.

The dominate trend over the past 3 decades has been one in which the city of Detroit lacks national and regional supermarket activity. This underrepresentation of national and regional supermarket activity expanded to consume almost every African American neighborhood. This is a byproduct of the racially restrictive bounded space encountered by the African American community. Due to extensive discriminatory practices in the housing market the community could not follow the national and regional supermarket activity into the inner suburbs let alone the exurbs (Darden et al., 1987; Darden and Thomas, 2013).

These broader trends are reinforced by the findings in Figure 4-2. When national and regional supermarket activity is compared against the spatial distribution of the population, a clear pattern of retail decentralization occurs. By 1980, a ring of concentrated national and regional supermarket activity surrounded the city of Detroit. This indicates that there were more stores than warranted by the underlying suburban populations. Overtime, this ring continued to extend further out into the suburbs before disappearing in 2010.

In stark contrast, the patterns in the city of Detroit indicate that there was not enough national and regional supermarket activity to meet the demand. This unbalance became apparent in 1980 and continued throughout the remaining decades. Consequently, it was the African

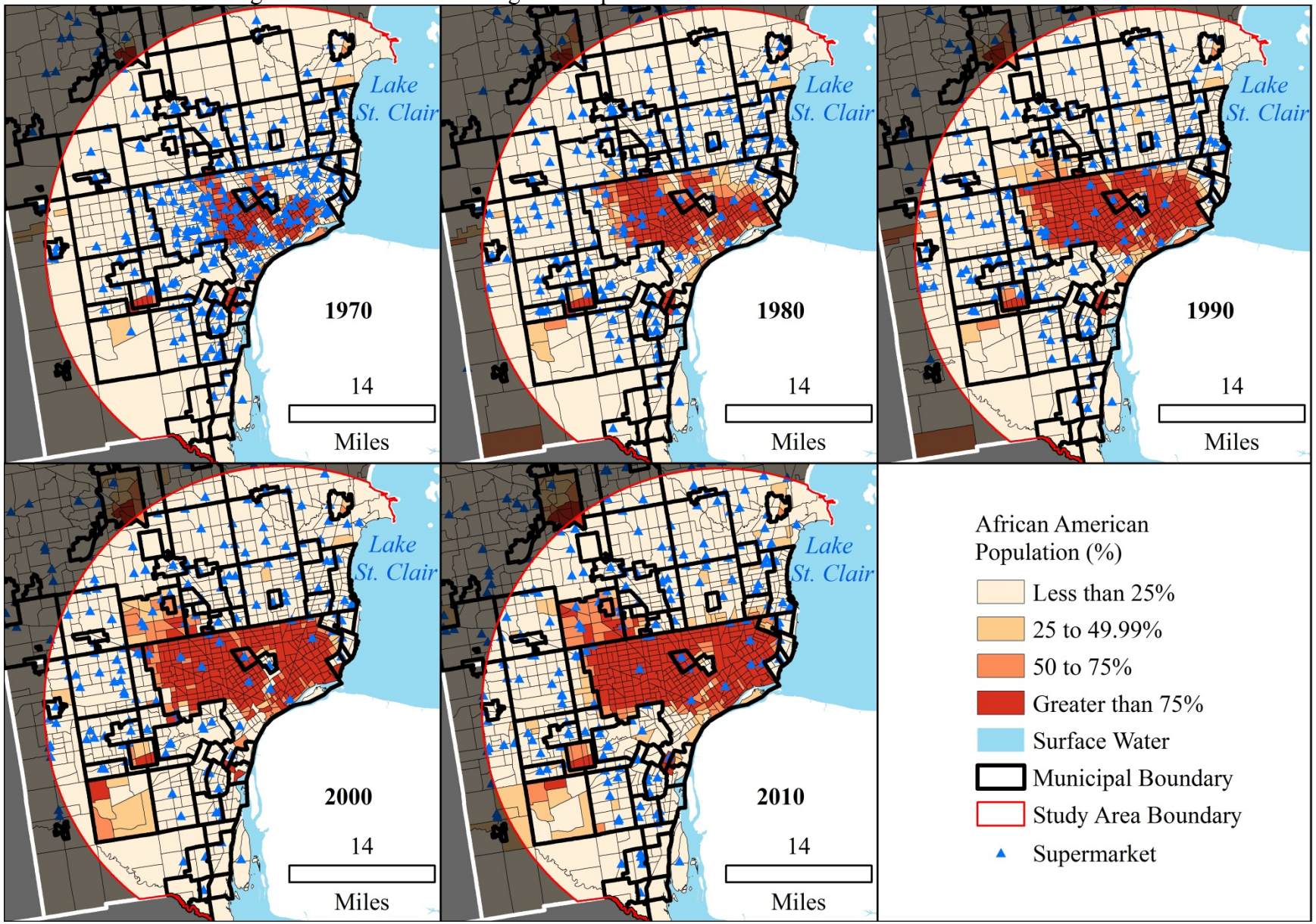
American population that bore the brunt of underrepresentation. Even when African Americans were able to reach some of the older inner suburbs by the 1990s and early 2000s, the national and regional supermarket concentrations were occurring in the exurbs. As indicated by Figures 4-3 and 4-4, the void left by national and regional supermarket activity leaving the city was filled by smaller stores, such as liquor stores that have a limited supply of affordable, nutritious food supplies.

Figure 4-4 indicates that the city of Detroit had more liquor stores than warranted by its population since the 1970s. In terms of retail activity, liquor stores used to be overrepresented in the food environment of the predominately-White suburban communities and White neighborhoods of Detroit during the 1970s and 1980s. Overtime, a gradual transition occurred in which this activity became concentrated into the city of Detroit. By 2000 and 2010, the entire city had a concentration of liquor store activity and underrepresentation of national and supermarket activity.

Taken together, there is a clear pattern in which retail and national supermarkets were overrepresented and concentrated in the predominately-White suburbs. Overtime, such retail activity continued to push further into the White suburbs leaving the predominately-African American central city devoid of national and regional supermarket activity to meet the underlying population. Instead of having their choice of supermarkets to patronize, African Americans in the city of Detroit had an unlimited choice of liquor stores to visit.

Overall, the national and regional supermarket decentralization trends mirror the well-documented racially restrictive population decentralization that occurred across the region (Figure 4-5). Since the 1970s, the White population has migrated to more distant suburban

Figure 4-5: National and Regional Supermarket and African American Suburbanization



locations. The national and regional supermarkets also appear to follow a similar pattern. While it is no surprise given the tenacious legacy of racial discrimination in the region, a crucial piece missing from this story is how economic restructuring and economic conditions within the broader regional and national supermarket industry exacerbated these conditions. These changing conditions help to explain the apparent major shift in the tri-County Detroit food environment that occurred during the 1970s and 1980s.

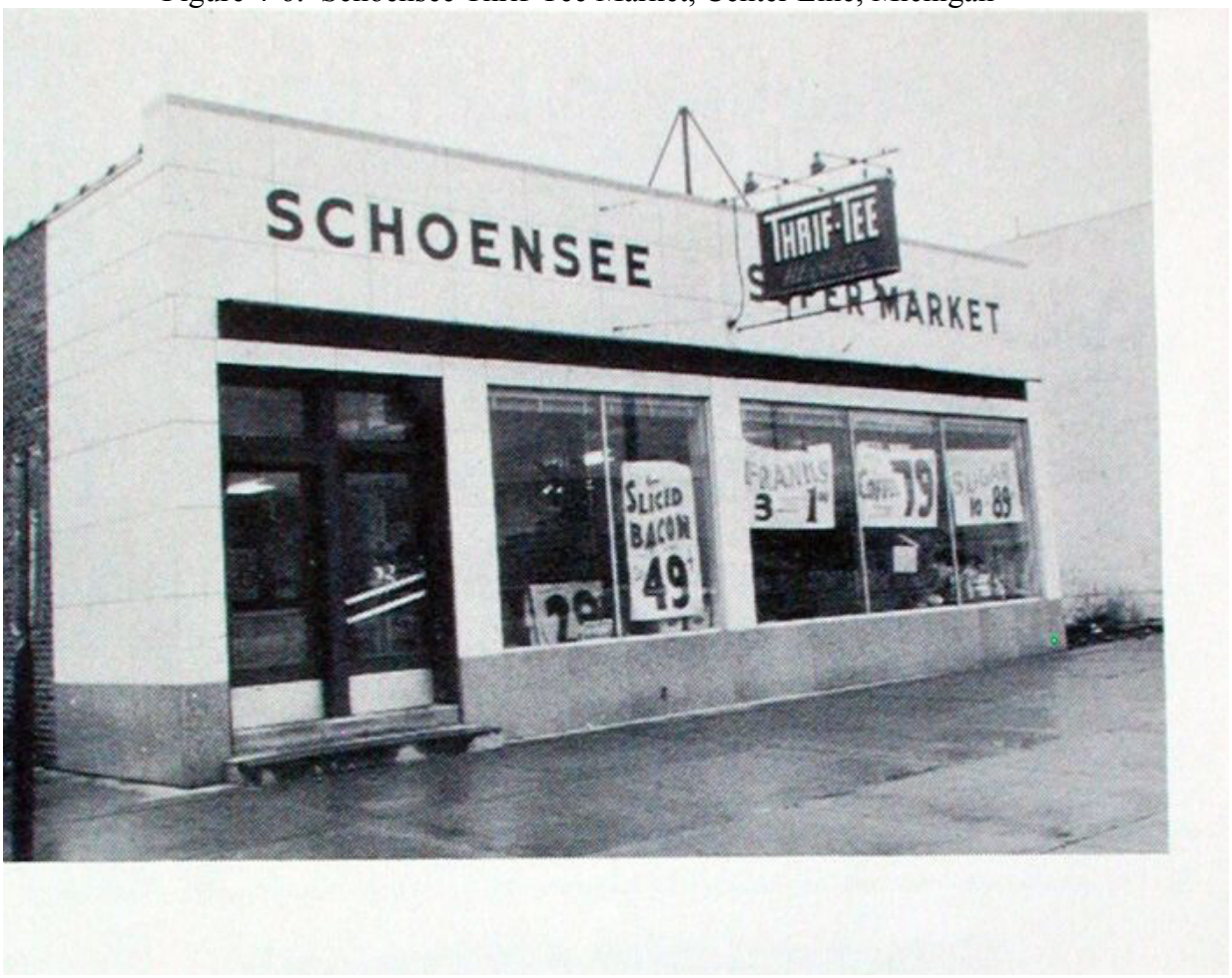
At the turn of the 1970s, the tri-County Detroit market was one of the most competitive in the nation. Five national and regional supermarket companies, the Great Atlantic & Pacific Tea Company (A&P), Kroger, Allied Supermarket, Borman's Inc. (Farmer Jack) and Great Scott! dominated the tri-County Detroit food environment (Table 4-1). A&P and Kroger were the largest and third largest supermarket chains in the nation and Great Scott!, Borman's Inc. and Allied Supermarkets were the largest regional supermarket chains in the tri-County Detroit region. Such a composition mirrored broader national patterns which saw a mix of national and regional supermarket chains vying for control of the major metropolitan markets with strong competition from home grown institutions and smaller independent and "mom & pop" supermarkets (Figure 4-6).

Despite the presence of these five national and regional supermarket chains, only A&P had more stores in the city of Detroit than in the suburbs. This was not only a reflection of the competitive market but a sign of the level of disinvestment underway by 1970 as well as the rapid changes occurring within the supermarket industry. In the preceding decades, both Allied Supermarkets and Borman's Inc. had undergone rapid growth through acquisition of smaller independent supermarket chains. This rapid expansion had become an economic liability for the companies.

Table 4-1: Top 5 Tri-County Detroit Study Area National and Regional Supermarkets 1970 to 2010

Year	Store Name	Total	Detroit	Suburbs
1970	A&P	83	51	32
	Farmer Jack	79	25	54
	Allied Supermarkets (Wrigley & Packers)	57	26	31
	Kroger (Bi-Lo)	37	16	21
	Great Scott!	29	11	18
	Other	11	5	6
	Total	296	134	162
1980	Farmer Jack	70	14	56
	Chatham Complete	43	4	39
	A&P	30	5	25
	Allied Supermarkets (Great Scott!)	28	4	24
	Kroger	14	1	13
	Other	12	1	11
	Total	197	29	168
1990	A&P (Farmer Jack)	93	17	76
	Kroger (Meadowdale/Great Scott!)	52	2	50
	Danny's Foodland	11	0	11
	Meijer	8	0	8
	Other	1	0	1
	Total	165	19	146
2000	A&P (Farmer Jack)	60	7	53
	Kroger	51	0	51
	Meijer	15	0	15
	Save-A-Lot	9	3	6
	Gordon Food Services	5	0	5
	Other	11	0	11
	Total	151	10	141
2010	Kroger	58	0	58
	Aldi	22	2	20
	Save-A-Lot	21	7	14
	Meijer	19	0	19
	Gordon Food Service	11	0	11
	Other	43	1	42
	Total	174	10	164

Figure 4-6: Schoensee Thrif-Tee Market, Center Line, Michigan



The early 1970s saw Borman's Inc. weakened by the relatively poor performance of its Yankee department chain, increased competition from A&P, and a 10-week United Auto Workers strike against the General Motor Corporation (Wall Street Journal, September 29, 1969, November 28, 1969, December 10, 1970, March 29, 1971). Financially, the company had to omit its fourth quarterly dividend in order to preserve working capital and it was forced to sell its Yankee department stores in 1971 in order to assuage its financial losses (Wall Street Journal, March, 11, 1971, November, 5, 1971). Conditions became worse when a warehouse, distribution and drivers' strike brought to a standstill Farmer Jack and several other major national and regional supermarkets in the region in 1974 (Wall Street Journal, January, 17, 1974). This economic strife was followed by Borman's Inc. posting its biggest financial loss ($4.5 million) in its history. The loss stemmed from a $5.3 million special charge related to the bankruptcy of its discount stores (Wall Street Journal, March 31, 1975). Despite the economic turmoil, Borman's Inc. recovered and began to expand through the latter half of the 1970s.

In contrast, the 1970s was an economic disaster for Allied Supermarkets. Allied Supermarkets' aggressive expansion in the previous decade finally caught up to the organization as it began to run deficits. By 1972, Allied Supermarkets was nearing default on several of its loans. In an attempt to restructure the organization, Allied Supermarkets sold several of its West Coast and Midwest divisions, converted all of its remaining stores into a discount price format and it issued new common shares to raise equity. Despite shedding nearly 80 stores in this reorganization, Allied still had over 300 stores across 31 states with 103 in Michigan at the start of 1972 (Wall Street Journal, August 26, 1970, October 7, 1970, September 9, 1971, November 2, 1971).

Notwithstanding these efforts, Allied Supermarkets tri-County Detroit stores were still in the red causing the organization to shutter several additional Detroit stores (Wall Street Journal, November 5, 1971, November 3, 1972). This was a major blow to an organization that prided itself on its commitment to the city. Just two years prior, the organization worked with a coalition of African American ministers to open up the Inner-City Greater Detroit Community Supermarket at the corner of Gratiot Avenue and East Grand Boulevard (Sacramento Observer, October 22, 1970). Known for its fair hiring practices, Allied Supermarkets was the first national supermarket in the region to promote African Americans to management positions (Chicago Daily Defender, March 7, 1968). In spite of its past commitment to the city of Detroit and the African American community, the financial losses forced the organization to relocate its offices, processing and warehousing facilities out of the city of Detroit into Livonia (Wall Street Journal, February 23, 1973).

Despite a short uptick in profit, Allied Supermarkets was back in the red by 1974 (Wall Street Journal, May 10, 1974). Operating losses continued through 1975 causing Allied Supermarkets to sell off and close 55 of its remaining 248 stores in another major restructuring effort. This major restructuring left Allied with 193 stores concentrated in Michigan, Oklahoma and Kansas at the end of 1975 (Wall Street Journal, January 27, 1976).

In a last ditch effort to turn things around, Allied Supermarkets took over Ferndale based Great Scott! Supermarkets in 1976. Even with the acquisition, it closed 26 additional Michigan stores, which brought its Michigan and national totals to 87 and 176 stores respectively (Wall Street Journal, June 15, 1976, September 15, 1976, December 16, 1976). Unfortunately these store closings and acquisition of Great Scott! did little to return the company to profitability. Allied Supermarkets lost over $33 million dollars between 1976 and 1978.

Allied Supermarkets filed for Chapter 11 bankruptcy protection in November of 1978. At the time of the bankruptcy filing, it had 114 supermarkets in Michigan, Oklahoma and Texas. In bankruptcy, the company continued to operate its remaining Great Scott! stores in the tri-County Detroit region while selling off certain assets and noncompetitive stores to pay back creditors (Ettore, 1978; New York Times, November 8, 1978; Wall Street Journal, September 24, 1979).

While the 1970s was a difficult time for Allied Supermarket, it was an outright failure for the region's leading national supermarket chain, A&P. At the turn of the 1970s, A&P had found itself facing stiff price cutting from its competitors. In an attempt to hold onto its dominant market position, the company began to switch many of its stores to a discount-pricing model. Despite record sales of over $6-billion, A&P reported a net loss of $51.3 million in 1972, prompting it to close over 400 stores across the United States (Reckert, 1972; Wall Street Journal, April 30, 1973). In light of these store closings, the net losses continued. The company was found guilty of a price fixing scheme costing them an addition $32 million in 1974 (Chicago Tribune, July 26, 1974). Eventually, A&P lost its position as the nation's largest supermarket chain to Safeway, forcing the company for the first time in 115 years to go outside the company to bring in new management (Bralove, 1974).

The new management quickly enacted a major restructuring of the organization. This led to the closure of more than one-third of existing A&P stores across the country as well as warehouses and other facilities (Barmash, 1975). While these closings were deemed necessary, the closings forced the company to post a net loss of $157 million in 1975 (Washington Post, April 24, 1975). These initial moves returned some profitability to the company but by the late 1970s the company was in the red again. The company was struggling with high prices,

escalating labor costs and increased competition from Safeway and Kroger, which passed A&P for the number 2 spot in 1979 (Wall Street Journal, January 10, 1978; Barmash, 1979). With net losses of $52 million and $3.8 million to end the decade, a vulnerable A&P was taken over by the Germany based Tengelmann group and the company began to scale back its operations to focus on its more profitable markets.

With the scaling back of A&P and the bankruptcy of Allied Supermarkets, the city of Detroit became vacant of its two most committed national and regional supermarket chains. Overall, the massive economic restructuring in the region fundamentally altered the composition of the tri-County Detroit food environment. The 1970s saw a massive consolidation and reorganization in many of the national and regional supermarkets in the region. These changes combined with the economic recessions and stagflations of the 1970s, rising operating costs and increased competition altered the retail food landscape. In response, national and regional supermarket chains closed smaller and older stores in favor of new larger stores in the suburban periphery. This latter process played into the region's racially restricted suburbanization history to create massive disparities in terms of access to national and regional supermarkets between the now predominately African American city of Detroit and its predominately-White suburbs. In a 10-year span, the city of Detroit saw its stores per capita drop from roughly 1 store for every 11,000 residents in 1970 to 1 store for every 41,000 residents in 1980. These external and internal pressures within the supermarket industry continued throughout the 1980s.

During the early 1980s, Allied Supermarkets (Great Scott!) reemerged from bankruptcy and with the backing of a large private capital investment firm looked to expand its holdings (Lane-Wilke, 1986). After some minor expansions, Allied Supermarkets merged with The Vons Cos. Inc. in 1987. Allied Supermarkets sold its unprofitable stores in the Great Plain states and

spun off its Detroit stores to Meadowdale Foods Inc., a newly created public company established in the deal (Wernle, 1987a). Embolden with a new corporate structure and infused with private equity, Meadowdale Foods began to embark on a rapid expansion across the region. Within 3 years of the merger, Meadowdale had opened up 15 new stores under the Great Scott! moniker and rebranded its existing stores. Unfortunately, this expansion caused Meadowdale to amass a sizeable amount of long-term debt. In May of 1990, Kroger took over the debt-ridden Meadowdale stores thus bringing an end to the long history of Allied Supermarkets in the region (Wilson, 1990). While such an acquisition normally would be considered monumental within a region, it paled in comparison to the realignment that occurred among the region's top national and regional supermarket chains, Borman's Inc. (Farmer Jack) and A&P.

During the early 1980s, Borman's Inc. saw deficits three out of first four years. The company was unable to compete with the price cutting of its competitors. In addition, the tri-County Detroit economy was adversely affected by the national recession which cut into the company's sales figures. In response, Borman's Inc. cut labor costs (their largest cost), shed money losing units and closed smaller stores in order to open up larger efficient suburban stores averaging over 50,000 sq. feet. The company reduced labor costs by renegotiating pay raises with their unions, implementing wage cuts, reducing fringe benefits and changing work rules (von Hoffman, 1981; Maturi, 1986).

Despite the rocky start to the early 1980s, Borman's Inc. was the leading national and regional supermarket chain in the tri-County Detroit region with a commanding 20% of the market. Looking to build off its market share, the company began to expand outside the Midwest. Borman's Inc. bought 60 supermarkets in Utah, Idaho and Wyoming from a realigning Safeway (Wall Street Journal, March 5, 1987, February 05, 1988). However, these stores proved

to be a bust for the company. Borman's Inc. took a huge loss and was forced to sell them within a year of their initial purchase (Driskill, 1988).

During this time, the company struggled to keep its Detroit-area stores operating during a strike by clerks and cashiers who were supported by the meat cutters and the Teamsters unions. This began a crucial round of labor negotiations within the company. After many hard fought rounds, the organization took an $8.5 million loss after spending $12.9 million to buy out the contracts of 800 full-time employees. Despite this massive loss, the company was able to negotiate a historic union contract that made part-time labor the norm in the region (Wernle, 1987b; Wall Street Journal, Sept 29, 1987, October 15, 1987).

The failed western venture and the historic buyout of its union contracts placed Borman's Inc. into a precarious financial state and it led to the speculation that the company would soon be taken over by A&P (Wall Street Journal, February 24, 1988, May 11, 1988). By the end of 1988, A&P bought all Borman's Inc. stores for $76 million, ending the historic legacy of the longest tenured supermarket chain in the region (Wall Street Journal, December 13, 1988, December 27, 1988).

The purchasing of Farmer Jack by A&P marked one of the comeback stories of the decade. Upon taking control at the end of the 1970s, the Tengelmann group began to over haul A&P. They implemented a major cost cutting program and closed all stores that were in the red. In addition, A&P closed all of its U.S. production facilities and renegotiated its union contracts. While these changes brought the number of stores closed over the past decade to 3,000, these changes also lead to A&P posting its first full year profit since 1976 (Wall Street Journal, December 21, 1982; Siegert, 1983, 1984).

Embolden by these results, A&P began to look towards reengaging the tri-County Detroit market. It launched a bid to take over the Chatham supermarket chain. However, the bid was blocked in court by an anti-trust case brought forward by Allied Supermarkets (Wall Street Journal, January 27, 1983). The delay and legal proceedings eventually led to the merger falling apart. This forced A&P to close 12 of its Detroit stores by 1983 and it lead to the company launching an aggressive 5 year plan to overtake Farmer Jack. The plan invested millions into new stores and remodeling efforts as well as a massive advertisement campaign. By 1985, the tri-County Detroit division of A&P was turning a profit and slowly increasing its market share. This all culminated three years later with the purchase of Farmer Jack by A&P.

The acquisition of Farmer Jack by A&P led to more store closures and a focus by the company on the suburban market. In addition, the implosion of several regional supermarket chains left the city struggling to support its population base. By 1990, there was 1 national and regional supermarket per roughly 54,000 residents in the city of Detroit.

The economic restructuring in the aftermath of the A&P and Farmer Jack merger continued to promote retail decentralization across the region as the remaining national and regional supermarket chains focused on building large new stores further into the suburbs. This left for the emergence of the national discount chain, Save-A-Lot to enter the tri-County Detroit market. Consequently, the restructuring and decentralization when overlaid against the prevalent residential suburbanization trends during the 1990s aggravated the disparities captured in the hot spot analysis and in Figure 4-5. By 2000, the city of Detroit had roughly 1 national and regional supermarket for every 95,000 residents.

It is during this era that one also begins to see the widespread successional pattern of smaller convenience and liquor/party stores into the abandoned central city. As a result, such

stores became one of the primary sources of food provisioning in the city. These conditions were further exacerbated by the closing of all A&P's Farmer Jack stores in the region in 2007.

While Farmer Jack was still the dominant national and regional supermarket chain in the tri-County Detroit region during the early 2000s, it began to experience stiff competition not only from its main competitors, Kroger, but also from independent supermarket chains such as Hollywood Supermarkets, major superstores such as Meijer and from drug stores such as CVS and Rite Aid (Snavely, 2001). This competitive pressure started to take a toll on Farmer Jack. The company struggled to maintain its market share and its attempts to expand into new markets were hampered by internal management turnover (Snavely, 2002). At the same time, Farmer Jack's parent company, A&P, was experiencing huge financial losses across the board. These financial troubles combined with a massive regional price war between Meijer, Kroger and Farmer Jack in 2003 led to increased speculation that A&P would either sell or spin off its Farmer Jack stores (Snavely, 2003ad).

While A&P's competitors were cutting prices, many of the local independent supermarkets in the suburbs were focusing on providing better service and higher quality goods (Carter, 2003; Snavely, 2003e). These pressures, combined with A&P's continuing struggles, forced Farmer Jack to close all its stores for 37 hours in 2003. These closures lead to a massive realignment within the organization. Farmer Jack began to close its smaller stores and it opened up immediate negotiations with its labor unions in order to cut costs (Snavely, 2003bf). Despite these initiatives, Farmer Jack's market share continued to slip. With Farmer Jack losing money and looking for emergency wage concessions from its unions, it began to close more of its stores across the region (Crain's Detroit, July 7, 2003, January 12, 2004; Snavely, 2003c, 2004).

If things were not bad enough for Farmer Jack, A&P continued to suffer huge losses in its other operating divisions across the nation (Snavely, 2004, 2005ab). This resulted in A&P undergoing a major restructuring. In an effort to focus on its Northeast stores, A&P made the decisions to disinvest its operations in the Midwest. Despite A&P seeking to sell Farmer Jack, it struggled to find any potential suitors. This was in part hampered by a union contract which mandated that roughly 60 stores needed to stay open until 2007 (Goldschmidt and Major, 2005; Harrison, 2007a; Progressive Grocer, Oct 18, 2007). A&P's dreams of finding a suitor were dashed when an independent report was released at the beginning of 2007 that found almost 40% of the Farmer Jack stores to be unprofitable (Progressive Grocer, May 7, 2007). Unable to find a suitor for the Farmer Jack division, A&P sold off the most profitable stores and closed the remaining stores in the summer of 2007 (Smith and Youssef, 2007; Harrison, 2007b).

With the closing of Farmer Jack, the city of Detroit lost its last remaining major national and regional supermarket. The residents in the city had to rely on the national discounters Save-A-Lot and Aldi and one Super K Mart located on the northwest edge of the city. By the beginning of 2010, the city of Detroit had roughly 1 national and regional supermarket for roughly every 71,000 residents. The improvement in stores per capita reflected not more national and regional supermarkets but the erosion of a quarter of million people from the city between 2000 and 2010.

Overall, the remaking of the tri-County Detroit food environment was partly tied to broader economic conditions occurring within the supermarket industry. In many ways, the increasing concentration within the supermarket industry allowed the spatial configuration of the tri-County Detroit food environment to become dictated by economic decisions and conditions made elsewhere. Decisions about the region were made often in relation to how the supermarket

companies were doing in their core markets. Companies like A&P with no local ties to the region were quick to off load and close stores in order to sure up their core markets. As the central city supermarkets were closed in favor of larger suburban supermarkets, the residents in the city of Detroit found themselves devoid of options. This was especially difficult on the African American sections of the city that were unable to follow the national and regional supermarkets out of the city.

Conclusion

This chapter has documented how the tri-County Detroit food environment has evolved from 1970 to 2010. It has shown that national and regional supermarket decentralization has created an uneven landscape in which the city of Detroit and its predominately-African American population have less stores and supermarket activity than warranted by their population. In contrast, the predominately-White suburbs are flush in national and regional supermarkets. In the absence of such stores, smaller convenience, corner grocery and liquor stores have filled the void, resulting in a potential nutritional apartheid.

While this trend is clearly tied to the well documented racially restrictive residential suburbanization patterns in the region, it is also tied to the economic restructuring of the supermarket industry. At one level, national and regional supermarkets were firmly established in the suburbs prior to 1970. However, the acceleration of the decentralization process occurred during a turbid time within the supermarket industry. Many of the major national and regional supermarket chains went out of business or greatly curtailed their involvement in the tri-County Detroit region. By 2010, the uneven food environment mirrored in many ways the racially stratified population patterns in the region. The coming together of these broader trends also has

hollowed out the food environment on the lower eastside of Detroit. The residents described in chapter 3 are attempting to negotiate how these processes have altered their food environment.

Based on these trends, it would be expected that African American neighborhoods would have neighborhood food environments that not only lack national and regional supermarkets but also have lower levels of neighborhood accessibility to national and regional supermarkets when compared to suburban White neighborhoods. The next chapter explores any potential relationships between the movement of the national and regional supermarkets, neighborhood accessibility and composition, and the socioeconomic and racial makeup of neighborhoods across the region. It also will scrutinize if these processes hold up after closer scrutiny of how neighborhood boundaries are delineated.

CHAPTER 5
THE IMPACTS OF NATIONAL AND REGIONAL SUPERMARKET DECENTRALIZATION ON NEIGHBORHOOD STORE COMPOSITION AND ACCESSIBILITY

This chapter analyzes the potential spatial inequalities in the tri-County Detroit food environment brought about by the racially restricted population suburbanization, retail supermarket decentralization and economic restructuring within the supermarket industry. Given that the existing "food desert" literature is silent on how such inequities evolve overtime, this chapter scrutinizes the way in which the transformation of the tri-County Detroit urban food environment since 1970 has impacted the composition of the neighborhood food supply and neighborhood accessibility levels within the tri-County Detroit study area (Figure 1-2). In particular, it examines whether or not disparities exist with regards to the types of stores that make up different neighborhood food environments as well as in the levels of neighborhood accessibility to certain types of retail establishments. At a broader level, this chapter investigates whether racial or economic stratification processes explain potential disparities or if such disparities are a byproduct of how one delineates and operationalizes the concept of neighborhood.

With regard to neighborhood store composition, it is expected that predominately African American census tracts, especially those in the city of Detroit, will have fewer national and regional supermarkets and a greater number of corner grocery and liquor stores in comparison to predominately-White census tracts. It is believed that such conditions will worsen overtime and occur regardless of neighborhood socioeconomic status. In relation to neighborhood accessibility levels, it is hypothesized that African American census tracts in tri-County Detroit will have the greatest spatial inequities in access to national and regional supermarket stores regardless of their neighborhood socioeconomic status. That is, African American census tracts

will have to travel greater distances than White census tracts to shop at national and regional supermarkets located throughout the region. Accordingly, it also is hypothesized that African American census tracts will have shorter distances to sources of unhealthful food such as corner grocery and liquor stores than White census tracts.

Consequently, it is postulated that the salience of race in explaining such outcomes will increase overtime. This is in direct contrast to market based accounts and elements within social ecology that see neighborhood accessibility and store composition tied directly to economic outcomes and conditions. Within these frameworks, it would be expected that food access and availability would play out predominately along a socioeconomic gradient. Furthermore, it is hypothesized that the spatial inequities and the role of racial stratification are not a byproduct of unexamined arbitrary neighborhood delineation but rather of much broader processes that have restructured the tri-County region.

In order to peel back these dimensions and to see how they have played out over time in the region, this chapter is divided into 4 additional sections. The first section outlines the data and measures used to capture the economic and racial dimensions associated with neighborhood store composition and accessibility levels. The second section presents the findings from a series of statistical analyses used test the hypothesized relationships. The third section discusses the statistical results and outlines potential limitations to the analysis, while the last section offers concluding remarks.

Data

Historical decennial population and housing data from 1970 to 2010 was collected at the census tract level from the National Historical Geographic Information System (NHGIS) housed at the University of Minnesota (U.S. Census, 1972, 1981, 1991, 1992, 2001, 2002, 2012; Fitch

and Ruggles, 2003). These census datasets have been translated into electronic format from the original Census Bureau Population and Housing reports and summary tape files. The historical census datasets were used to create a series of measures that capture major socioeconomic and demographic characteristics of the region: poverty level, vehicle ownership rates, housing tenure and status, room occupancy, employment levels, population counts and race. These variables were used to create a neighborhood poverty area, neighborhood deprivation index and a racial composition measure.

Neighborhood poverty areas were defined as census tracts with poverty rates greater than 20% (Gabe, 2012). It was operationalized as a dichotomous variable, PovArea (0 = N, 1 = Y). This measure captures the spatial concentration of poverty in which individuals living in areas with high rates of poverty face additional burdens beyond their own circumstances (Federal Reserve System, 2008). Poverty areas were utilized instead of another commonly used spatial measure of poverty, concentrated poverty (census tracts with poverty rates higher than 40%) since many government programs target resources to communities based on its poverty threshold (Bishaw, 2011).

While there is considerable latitude in the literature as to what constitutes the best measure of neighborhood deprivation (Morris and Carstairs, 1991), this study utilized the Townsend Material Deprivation Index (TMDI). The TMDI is composed of four census variables that attempt to capture the direct and indirect aspects of material forms of neighborhood deprivation: the unemployment rate, the percentage of rental occupied housing, the percentage of dwelling units with more than one person per room and the percentage of households that do not have access to a car. The percentages for unemployment and crowding were transformed using a natural log function in order to produce symmetrically distributed variables in an attempt

to minimize relative absolute differences (Gilthorpe, 1995). The TMDI uses the summation of the standard z scores of each variable to create an overall deprivation index for each census tract. The higher the overall score, the more disadvantaged an area is considered (Townsend et al., 1988; Townsend, 1988, 1993).

The choice to utilize the TMDI occurred on two grounds. First, traditional poverty measures such as median household income and concentrated poverty fail to reflect adequately the ability of individuals, groups or neighborhoods to own and use material resources to participate in society (Mayer and Jencks, 1989ab; Callan et al., 1993; Gordon and Pantazis, 1997; Beverly 2001; Iceland and Bauman, 2004; Iceland, 2005). The TMDI is an attempt to address such limitations in order to capture better the direct and indirect outcomes associated with being in poverty (Hallerod, 1995). Second, the multicollinearity between race and class in the tri-County Detroit region is second to none. Any analysis of the tri-County Detroit region is confronted with how best to tease apart racial and economic dimensions. It is believed that utilizing a deprivation measure, which captures the ability of individuals to participate in society, will help reduce such methodological concerns while retaining analytical capabilities.

The percentage of African Americans within a census tract was used to create a dichotomous variable, Black Neighborhood 0 = N, 1 = Y. If the percentage of African Americans in the tract was greater than 50% then the census tract was considered to be a predominately African American. A population density measure (PopDen) also was created from the historical census data. It was calculated as the total population divided by the census tract area in square meters. Last, the neighborhood poverty area variable (PovArea) was used in conjunction with the Black Neighborhood variable to create four neighborhood typologies: African American and White nonpoverty and poverty area neighborhoods. These groupings will

be used to examine potential disparities in neighborhood store composition and accessibility levels.

Neighborhood Accessibility and Store Composition Measures

While accessibility can be measured in many different ways, two commonly used measures from the literature were used in this study, coverage/distance and cumulative opportunities (Smoyer-Tomic et al., 2006; Apparicio et al., 2007; Sparks et al., 2009). For the coverage/distance based accessibility measures, two sets of variables were calculated: mean distance (meters) to the closest 5 supermarkets and liquor stores respectively and the minimum distance (meters) to the nearest supermarket and liquor store respectively. The closest 5 store accessibility measure reflects the concentration of stores available to respondents. Since chapter 3 shows that individuals do not necessary shop at the nearest store it attempts to determine if individuals have choices located near them. The minimum distance measures capture the shortest distance needed to reach a store. The mean distance to the nearest 5 stores was formalized as:

$$\bar{d} = \frac{\sum_i^N d_{ij}}{N}$$

Where

d_{ij} is the distance from neighborhood centroid i to destination store j; and
N is the number of nearest stores to search.

The minimum distance measure was formalized as:

$$MinDist_i = Min_j(d_{ij})$$

Where

Min_j is the minimum distance (d_{ij}) between the neighborhood centroid i and destination store j.

The cumulative opportunity accessibility measure was formalized as:

$$CumOpp_i = \Sigma B_j a_j$$

Where

$CumOpp_i$ is the accessibility measured at neighborhood centroid i to a potential destination in zone j;

a_j is the number of opportunities in zone j; and

B_j is a binary value that equals 1 if zone j is within a 1-mile network distance and 0 otherwise.

A 1-mile distance was chosen for the cumulative opportunity measure based on a reasonable walking distance to purchase food in the absence of a private vehicle. The distance used in the neighborhood accessibility measures were calculated over a road network using ESRI Network Analyst (ESRI, 2011). In addition, distances were allowed to be calculated to stores that exist outside of the study area when available. This was done to reduce the boundary effects associated with most accessibility studies (Sadler et al., 2011).

There are three potential issues with such distance calculations. First, initial distances were calculated from the centroid of a census tract. This would equate to an individual standing in the center of the tract. However, the centroid calculation can lead to results that fall outside the census tract boundary. This is a byproduct of the polygon geometry. In order to counteract this potential, all neighborhood centroids were constrained to fall inside the polygon.

Second, the initial distance calculations were from the unweighted geometric center of a census tract to the retail store of interest. Such measures ignore the spatial distribution of populations and are susceptible to aggregation errors (Hillsman and Rhoda, 1978; Current and Shilling, 1987; Hodgson et al., 1997). In order to account for the spatial distribution of the population while minimizing the aggregation effects inherent in census geographies, the accessibility measures were calculated from the population weighted centroid of the smallest

level of census geography available (Hewko et al., 2002). In the case of the 1970 and 1980 census data, there was no publically available smaller unit of census geography available for the tri-County Detroit region than the census tract. Consequently, the neighborhood distance calculations used in the 1970 and 1980 analyses were from the unweighted census tract centroid. While it is a tradeoff and potential source of error, it was the best available data at the lowest level of census geography available. The neighborhood distance calculations for 1990, 2000 and 2010 were from population-weighted centroids derived from the census block group.

The last issue is directly tied to the road network used in the calculations. All network distance measurements are directly impacted by the quality of the road network as well as the construction of the network topology. This study relied on a road network constructed from the 2003 Tele Atlas Dynamap Transportation road dataset. The use of the dataset rests on the assumption that the overall road network has not undergone major alterations prior to or after the creation of the dataset. While potential changes in the network will introduce error, this error will by systematic. That is each distance calculation is equally impacted thereby preserving relative differences. Such assumptions are a byproduct of using the best available data source and the general abstraction of reality inherent in any geospatial model and dataset (Longley et al., 2011).

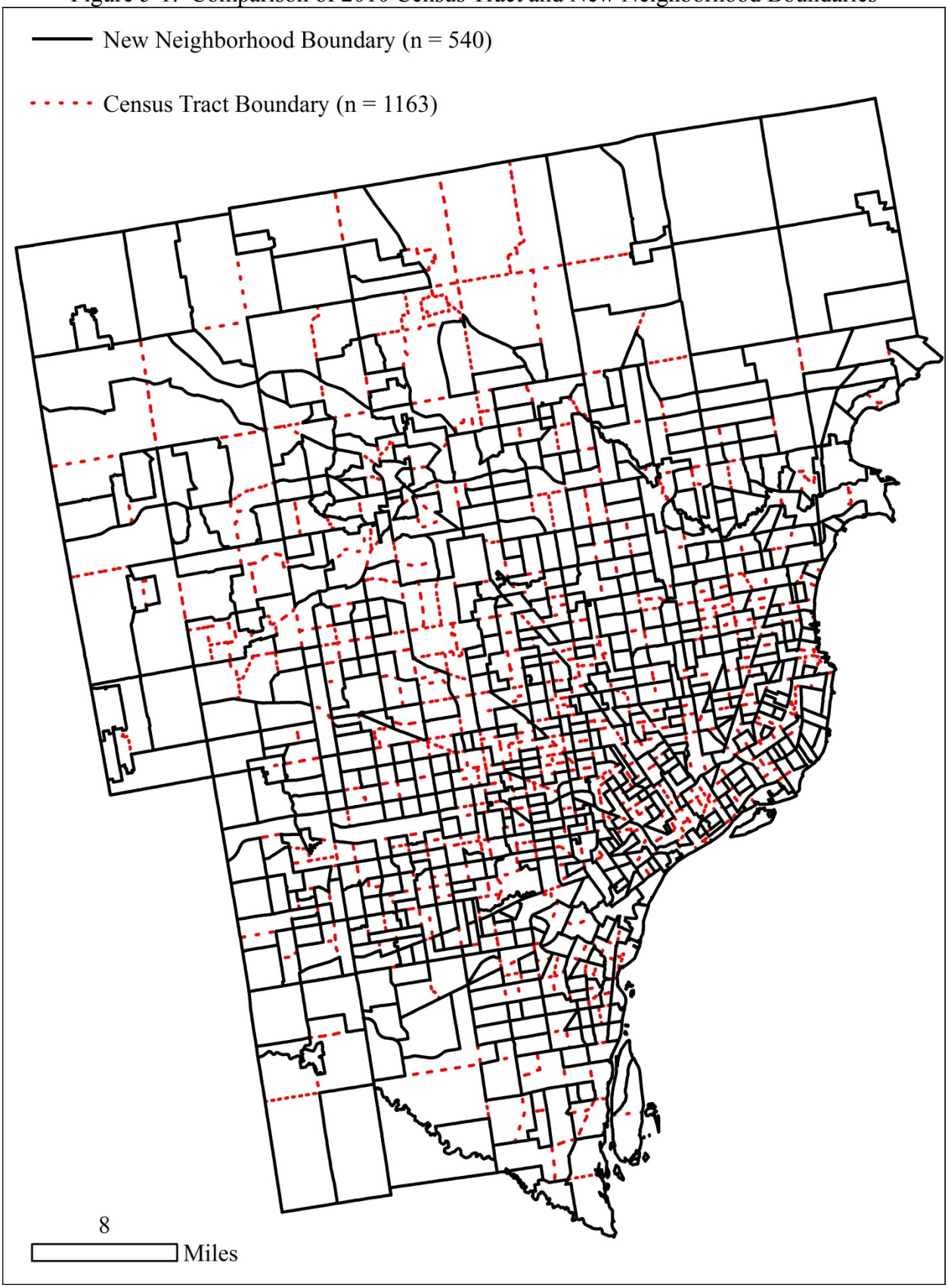
Neighborhood store composition was the number of a defined store type (see chapter 4) that falls within a respective census tract. Overall, all the measures discussed above were calculated initially from census tract geography. That is, the census tract geography is assumed to be a neighborhood. However, in order to assess the impact of relying on the conceptualization and operationalization of neighborhoods as census tract geographies, a new set of neighborhood boundaries was created using BioMedware's BoundarySeer (BioMedware, Inc., 2011).

New neighborhood boundaries were created using a "spatially constrained clustering" iterative algorithm that examines the adjacency and similarity of neighboring values in a dataset to create clusters that form contiguous areas. The new boundaries were delineated based off the underlying total population data and the cluster boundaries were furthered refined using a k-means clustering method. This resulted in a new configuration of neighborhood boundaries that were based on the clustering of population (Figure 5-1). In order to determine the most appropriate number of "neighborhoods" to select, a series of goodness of fit graphs contrasting the variability between and within clusters was used. Here, the highest value of the index that created the greatest differences between clusters than within clusters was utilized to determine the number of new clusters to generate (Gordon, 1999).

Such boundaries do not presume anything about the racial/social processes or economic conditions that would have sorted out the population across the region. That is, by ignoring the previous neighborhood socioeconomic and racial compositions, a new set of potential neighborhood boundaries was created. If these alternative boundaries are used to rerun the analysis and similar results appear, then it provides some validity that the findings are not a byproduct of how one defines a neighborhood but rather the broader processes hypothesized earlier. Moreover, it will lend credence to the use of census geographies to capture neighborhood processes. With this in mind, a second set of measures corresponding to the new boundaries were created from the previously described datasets.

With the data, neighborhoods and measures defined, the next section turns to examining the potential relationships between the neighborhood economic and racial composition variables, neighborhood store composition and food accessibility. The forthcoming analysis is broken thematically into two subsections, neighborhood store composition and neighborhood food

Figure 5-1: Comparison of 2010 Census Tract and New Neighborhood Boundaries



accessibility. The store composition analysis examines potential disparities between the neighborhood typologies with regards to the total number of different store types in the local food environment. The neighborhood food accessibility section scrutinizes how neighborhood food accessibility levels are differentiated along socioeconomic and racial gradients.

Neighborhood Store Composition

It was believed that the historically racially selective residential suburbanization of the tri-County Detroit region, when combined with the retail decentralization and economic restructuring within the supermarket industry documented in chapter 4, would create an uneven food environment that is fundamentally characterized by racial disparities in terms of neighborhood store composition. It was hypothesized that low-income and predominately African American neighborhoods would have fewer national and regional supermarkets than predominately wealthier and White neighborhoods. These neighborhoods also were expected to have more corner grocery and liquor stores than wealthier and White neighborhoods. Last it was postulated that neighborhood differences along racial dimensions in the tri-County Detroit would be more prevalent than those along economic dimensions. In order to test potential neighborhood disparities, a series of analysis of variances (ANOVAs) were calculated in R (R Development Core Team, 2011).

Neighborhood Store Composition Results

The results in Table 5-1 for the census tract based ANOVAs indicated that there were statistically significant differences in the mean number of corner grocery stores and national and regional supermarkets between the neighborhood typologies for every decade. The results also showed statistically significant differences in the mean number of liquor stores within the

Table 5-1: Store Composition ANOVAs for Census Tract Boundaries

		Total Stores		National and Regional Supermarkets		Corner Grocery		Green Grocer		Liquor Store	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	4.89	3.22	0.25	0.47	3.19	2.57	0.10	0.30	1.35	1.16
	AA Poverty	6.56	5.08	0.21	0.49	4.89	3.29	0.38	2.54	1.08	1.06
	White NonPoverty	3.31	2.93	0.36	0.62	1.62	1.92	0.15	0.42	1.19	1.29
	White Poverty	3.73	3.30	0.23	0.53	2.32	2.06	0.32	0.72	0.86	1.25
	F	31.12		2.682		69.31		2.24		1.401	
	df	(3,902)		(3,902)		(3,902)		(3,902)		(3,902)	
	p value	<2e-16		0.046		<2e-16		0.082		0.241	
1980	AA NonPoverty	2.97	2.17	0.10	0.30	1.20	1.39	0.08	0.27	1.58	1.43
	AA Poverty	4.56	2.71	0.09	0.29	2.50	1.68	0.04	0.19	1.93	1.68
	White NonPoverty	2.46	2.03	0.27	0.52	0.87	1.11	0.12	0.34	1.20	1.24
	White Poverty	3.75	3.58	0.06	0.23	2.33	2.68	0.03	0.17	1.33	1.43
	F	37.91		10.17		69.38		3.495		12.87	
	df	(3,905)		(3,905)		(3,905)		(3,905)		(3,905)	
	p value	<2e-16		1.36E-06		<2e-16		0.015		3.06E-08	
1990	AA NonPoverty	2.34	2.03	0.07	0.25	1.31	1.21	0.02	0.13	0.95	1.12
	AA Poverty	3.75	2.34	0.07	0.27	1.81	1.45	0.05	0.24	1.82	1.49
	White NonPoverty	2.62	2.00	0.24	0.49	1.10	1.22	0.12	0.34	1.17	1.19
	White Poverty	3.65	3.05	0.10	0.30	1.73	2.03	0.25	0.72	1.57	1.25
	F	18.06		11		17.25		6.91		16.44	
	df	(3,905)		(3,905)		(3,905)		(3,905)		(3,905)	
	p value	2.18E-11		4.26E-07		6.71E-11		1.33E-04		2.07E-10	
2000	AA NonPoverty	2.30	1.65	0.13	0.39	1.01	1.06	0.03	0.16	1.14	1.15
	AA Poverty	2.71	1.78	0.03	0.18	1.08	1.09	0.01	0.12	1.58	1.27
	White NonPoverty	2.41	1.96	0.22	0.48	1.21	1.35	0.05	0.23	0.92	0.99
	White Poverty	4.69	4.39	0.15	0.37	2.73	3.11	0.35	0.69	1.46	1.14
	F	11.91		9.795		12.49		16.35		19.21	
	df	(3,895)		(3,895)		(3,895)		(3,895)		(3,895)	
	p value	1.19E-07		2.32E-06		5.27E-08		2.37E-10		4.45E-12	
2010	AA NonPoverty	3.80	2.34	0.11	0.31	2.91	2.10	0.02	0.12	0.77	0.76
	AA Poverty	4.25	3.06	0.06	0.25	3.11	2.44	0.08	0.84	1.00	0.99
	White NonPoverty	3.90	2.79	0.26	0.56	2.99	2.25	0.05	0.23	0.59	0.82
	White Poverty	6.94	4.25	0.18	0.43	5.57	3.64	0.14	0.39	1.05	1.07
	F	20.62		11.37		22.47		0.917		14.48	
	df	(3,881)		(3,881)		(3,881)		(3,881)		(3,881)	
	p value	6.41E-13		2.56E-07		5.07E-14		0.432		3.28E-09	

neighborhoods for every decade except 1970. Last, there were statistically significant differences in the mean number of green grocers in 1980, 1990 and 2000 across the neighborhoods.

Tukey Honest Significant Differences (HSD) post-hoc tests ($\alpha = .05$) revealed that White nonpoverty area census tracts had a greater number of national and regional supermarkets than their African American counterparts in 1980, 1990 and 2010. These White tracts also contained more national and regional supermarkets than poverty area African American tracts in every decade except for 1970. In 1980, White nonpoverty area census tracts also had more national and regional supermarkets than poverty area White census tracts. Despite a significant omnibus F-test, there were no post hoc differences in the number of national and regional supermarkets between the neighborhoods in 1970.

Post-hoc tests showed that White nonpoverty area census tracts had fewer corner grocery stores than African American poverty area tracts in 1970, 1980 and 1990. These White tracts also contained fewer corner grocery stores than equivalent African American neighborhoods in 1970 and fewer stores than White poverty area tracts from 1980 through 2010. Likewise, poverty area White census tracts were comprised of fewer corner grocery stores than equivalent African American census tracts in 1970. However, this trend was switched in 2000 and 2010. These predominately-White tracts also had a greater number of corner grocery stores than nonpoverty African American tracts in 1980, 2000 and 2010. Last, African American nonpoverty area census tracts contained fewer corner grocery stores than poverty area African American census tracts in 1970, 1980 and 1990.

With regards to liquor stores and green grocers, Tukey HSD post-hoc tests ($\alpha = .05$) indicated that African American poverty area census tracts contained a greater number of liquor

stores than nonpoverty area White census tracts from 1980 through 2010. These neighborhoods also had more liquor stores than nonpoverty African American tracts in 1990 and 2000. In 2010, nonpoverty area White census tracts contained less liquor stores than their poverty area counterparts. With respect to green grocers, White poverty area census tracts had a greater number of stores than all remaining tracts in 1990 and 2000 while White nonpoverty area census tracts had more green grocers than poverty area African American tracts.

The ANOVA results for the reconfigured neighborhoods in Table 5-2 denoted statistically significant differences in the mean number of national and regional supermarkets as well as liquor stores between the reconfigured neighborhoods in every decade except 1970. There also were statistically significant differences in the number of corner grocery stores in every decade except 2000. Statistically significant differences in the mean number of green grocers only occurred in 1970 and 2000.

Tukey HSD post-hoc tests ($\alpha = .05$) showed that nonpoverty area White reconfigured neighborhoods possessed more national and regional supermarkets than poverty area African American reconfigured neighborhoods in every decade except 1970. They also had more stores than nonpoverty area African American neighborhoods in 1990. In terms of corner grocery stores, African American poverty area neighborhoods contained a greater number of stores than nonpoverty area White neighborhoods in every decade except for 1990. White nonpoverty area neighborhoods had fewer corner grocery stores than equivalent African American neighborhoods in 1970 and a greater number of stores than poverty area White neighborhoods in 1980.

Post-hoc tests also indicated that White nonpoverty area reconfigured neighborhoods possessed fewer liquor stores than poverty area African American reconfigured neighborhoods in 1980, 1990, 2000 and 2010. These neighborhoods also contained less liquor stores than

Table 5-2: Store Composition ANOVAs for Reconfigured Neighborhoods

		Total Stores		National and Regional Supermarkets		Corner Grocery		Green Grocer		Liquor Store	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	13.24	10.88	0.87	0.98	8.59	7.77	0.26	0.57	3.52	3.05
	AA Poverty	15.54	17.74	0.46	0.69	11.00	12.46	1.21	4.51	2.86	2.41
	White NonPoverty	6.89	14.83	0.72	1.25	3.47	10.53	0.28	0.68	2.42	3.66
	White Poverty	7.08	7.91	0.46	1.13	4.54	5.72	0.69	1.25	1.38	1.33
	F	5.171		0.86		7.236		4.573		1.91	
	df	(3,417)		(3,417)		(3,417)		(3,417)		(3,417)	
	p value	1.61E-03		0.462		9.62E-05		3.65E-03		0.127	
1980	AA NonPoverty	7.78	9.79	0.34	0.60	3.41	4.08	0.25	0.57	3.78	5.65
	AA Poverty	11.20	13.10	0.20	0.40	6.02	7.56	0.11	0.31	4.88	6.00
	White NonPoverty	4.90	6.50	0.54	0.98	1.71	2.68	0.23	0.54	2.41	3.38
	White Poverty	7.69	8.90	0.23	0.44	4.92	5.85	0.08	0.28	2.46	3.15
	F	11.24		3.287		22.37		1.406		7.11	
	df	(3,418)		(3,418)		(3,418)		(3,418)		(3,418)	
	p value	4.15E-07		0.021		1.89E-13		0.240		1.14E-04	
1990	AA NonPoverty	5.45	8.97	0.10	0.31	2.70	4.28	0.10	0.31	2.55	4.58
	AA Poverty	11.86	15.12	0.22	0.48	5.61	7.21	0.17	0.53	5.86	7.72
	White NonPoverty	5.86	8.99	0.55	0.86	2.46	4.04	0.26	0.62	2.59	4.52
	White Poverty	7.60	7.21	0.15	0.37	3.95	5.00	0.50	1.00	3.00	2.25
	F	6.577		6.316		8.193		1.934		7.664	
	df	(3,365)		(3,365)		(3,365)		(3,365)		(3,365)	
	p value	2.44E-04		3.47E-04		2.72E-05		0.124		5.58E-05	
2000	AA NonPoverty	7.23	11.83	0.31	0.66	2.92	4.32	0.13	0.41	3.87	6.95
	AA Poverty	6.86	8.52	0.06	0.25	2.78	3.87	0.04	0.19	3.97	4.89
	White NonPoverty	5.25	7.69	0.49	0.90	2.65	4.29	0.12	0.36	1.99	3.07
	White Poverty	8.35	8.55	0.35	0.61	4.94	5.67	0.59	1.12	2.47	2.15
	F	1.678		6.138		1.537		8.775		6.449	
	df	(3,389)		(3,389)		(3,389)		(3,389)		(3,389)	
	p value	0.171		4.37E-04		2.04E-01		1.21E-05		2.86E-04	
2010	AA NonPoverty	6.50	6.79	0.35	0.99	5.00	5.17	0.15	0.37	1.00	1.12
	AA Poverty	15.28	23.84	0.17	0.45	11.17	17.46	0.27	1.63	3.67	5.73
	White NonPoverty	8.57	11.24	0.57	1.09	6.59	8.76	0.11	0.34	1.30	1.94
	White Poverty	14.31	12.84	0.38	0.68	11.34	10.24	0.34	0.61	2.24	2.39
	F	5.175		3.496		4.694		1.233		11.7	
	df	(3,363)		(3,363)		(3,363)		(3,363)		(3,363)	
	p value	1.64E-03		0.016		3.14E-03		0.298		2.46E-07	

analogous African American neighborhoods in 2000. Last, nonpoverty area African American neighborhoods had a greater amount of liquor stores than poverty area African American neighborhoods in 2010. With respect to green grocers, White poverty area neighborhoods had the greatest amount of establishments than all other neighborhood typologies in 2000. In 1970, African American poverty area neighborhoods had more stores than nonpoverty area African American neighborhoods. Such neighborhoods also contained more green grocers than poverty area African American neighborhoods.

While the results of the ANOVAs are able to capture the potential disparities in the food environment, they cannot ascertain the role that economic and racial factors play in driving neighborhood store composition. Therefore, to tease out how neighborhood economic and racial composition influences the location of a national and regional supermarket, a logistic regression framework was established.

The dependent variable was a binary variable, SP, that measures whether or not there was a national or regional supermarket present in the census tract (0 = N, 1 = Y). The independent variables were TMDI, Black Neighborhood (0 = N, 1 = Y) and PopDen. National and regional supermarkets were chosen over the other store types due to the fact that these stores provide the largest selection of nutritious foods at affordable prices. It was expected that both the TMDI and the Black Neighborhood variable would have a negative relationship with the dependent variable. Last, the population density (PopDen) was expected to have a negative relationship as lower density suburbs are predominately-White enclaves in the region. The logistic regression model is formalized was:

$$\log it\ p = \alpha + \beta X$$

Where

p = log [p/(1-p)] and is commonly referred to as the log odds;
α is a constant;
X is a k x n matrix of independent variables; and
β is a vector of regression coefficients.

The model parameters were estimated using maximum likelihood estimation. If the hypothesis that neighborhood racial factors regardless of economic levels were the driving factor in neighborhood national and regional supermarket composition disparities was accurate, then it would be expected that the Black Neighborhood variable would be statistically significant in every decade or at the very least in the waning decades while the role of neighborhood deprivation (TMDI) would decline. The logistic regression results for the census tract neighborhood configurations are shown in Table 5-3

Table 5-3 indicates that census tract deprivation levels had a statistically significant (α = .05) negative relationship with the presence of a national or regional supermarket within a neighborhood in 1970. As levels of census tract deprivation increase, the likelihood of a national or regional supermarket being located within a neighborhood decreases. In particular, tracts with high levels of economic deprivation were .91 (odds ratio = .916) times less likely to contain a national and regional supermarket than census tracts with low levels of economic deprivation. During the remaining decades, there was no statistically significant relationship between census tract deprivation levels and the presence of national and regional supermarkets.

While there was no statistically significant relationship in 1970 and 1980, there was a statistically significant negative relationship between the African American dummy variable and the dependent variable in the remaining decades. In particular, African American census tracts were .45 (odds ratio = .446), .46 (odds ratio = .455) and .37 (odds ratio = .368) times less likely to have a national or regional supermarket located within them than White tracts in 1990, 2000

Table 5-3: National and Regional Supermarket Logistic Regressions (Census Tracts)

Store Composition	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
Intercept	-1.25 (.156)	***	-0.93 (.179)	***	-1.16 (0.2)	***	-1.13 (.193)	***	-0.72 (.211)	***
TMDI	-0.09 (.035)	*	-0.06 (.036)	.	-0.04 (0.04)		-0.04 (.041)		-0.02 (.042)	
Black Neighborhood (0 = N, 1 = Y)	-0.38 (.247)		-0.44 (.296)		-0.81 (0.33)	*	-0.79 (.328)	*	-1.00 (.303)	***
Population Density (sq. m.)	97.48 (39.74)	*	-179.83 (72.41)	*	-153.38 (91.72)	.	-255.69 (93.59)	**	-441.46 (118.62)	***
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Null deviance	1061.6		903.0		816.7		762.18		802.02	
df	905		917		924		937		930	
Residual deviance	1046.9		866.42		783.47		723.77		753.12	
df	902		914		921		934		927	
AIC	1054.9		874.42		791.47		731.77		761.12	
LR chi^2	14.64		36.57		33.23		38.41		48.9	
d.f.	3		3		3		3		3	
Pr(> chi^2)	0.0022		<0.0001		<0.0001		<0.0001		<0.0001	
Nagelkerke R^2	0.023		0.062		0.060		0.072		0.089	

and 2010. The population density measure had a statistically significant positive relationship in 1970. Increased population density led to a greater number of national and regional supermarkets than lower density tracts did. However, this relationship changed into a statistically significant negative relationship in 1980, 2000 and 2010. The negative relationship indicates that low density tracts had more national and regional supermarkets than higher density census tracts.

The logistic regression results for the reconfigured neighborhoods in Table 5-4 revealed a statistically significant negative relationship between population density and the presence of a national and regional supermarket in 1980, 1990 and 2000. Lower density neighborhoods had a greater likelihood than higher density neighborhoods to contain such stores. Both TMDI and the African American dummy variable were not statistically significant in any decade. Post regression diagnostics of all the models indicate no multicollinearity concerns (VIF levels are below 2) and each model is an improvement over the null model (Nagelkerke's R).

Neighborhood Accessibility

The uneven food environment created from the historical processes documented in chapter 4 also were believed to differentially impact the neighborhood accessibility levels of communities to certain types of stores. It was hypothesized that neighborhood accessibility levels to national and regional supermarkets deteriorated over time for the African American community. Consequently, it was postulated that African American neighborhoods would have poorer accessibility levels (increased distances and less cumulative opportunities) to national and regional supermarkets in comparison to White neighborhoods regardless of neighborhood socioeconomic status. These same communities also would have improved access (shorter

Table 5-4: National and Regional Supermarket Logistic Regressions
(Reconfigured Neighborhoods)

Store Composition	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)
Intercept	-0.58	**	-0.32		0.20		0.25		-0.37
	(.191)		(.214)		(.199)		(.21)		(.264)
TMDI	-0.01		-0.04		-0.02		-0.02		-0.07
	(.045)		(.044)		(.0497)		(.054)		(.049)
Black Neighborhood (0 = N, 1 = Y)	-0.01		-0.10		-0.65		-0.81	.	-0.55
	(.342)		(.359)		(.411)		(.42)		(.374)
Population Density (sq. m.)	78.32		-181.08	*	-618.82	***	-934.18	***	-293.35
	(56.09)		(89.05)		(128.11)		(163.7)		(151.18)
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1									
Null deviance	574.4		535.1		473.1		469.5		457.6
df	422		425		374		407		388
Residual deviance	571.7		523.2		428.8		401.0		438.4
df	419		422		371		404		385
AIC	579.7		531.2		436.8		409.0		446.4
LR chi^2	2.77		11.95		44.28		68.48		19.26
d.f.	3		3		3		3		3
Pr(> chi^2)	0.4286		0.0076		<0.0001		<0.0001		0.0002
Nagelkerke R^2	0.009		0.039		0.155		0.226		0.070

distances and greater cumulative opportunities) to unhealthful food sources such as corner grocery and liquor stores than White neighborhoods.

Like the neighborhood store composition analysis, a series of ANOVAs were calculated in R to determine if there were disparities between the neighborhood typologies in relationship to cumulative opportunity (Table 5-5) and coverage accessibility (Table 5-6) levels. The coverage accessibility analysis was restricted to national and regional supermarkets and liquor stores. This was based on national and regional supermarkets being the most ideal store types while liquor stores were considered to be the worst store types with the most limited food options.

Neighborhood Cumulative Accessibility Results

The findings for the census tract cumulative accessibility ANOVAs in Table 5-5 indicate that there were statistically significant differences in the mean number of overall establishments, liquor and corner grocery stores and national and regional supermarkets within 1 network mile of a neighborhood between the different groupings for every decade. The results also revealed statistically significant differences in the mean number of green grocers within 1 network mile among the neighborhood groupings for every decade except 1980.

Tukey HSD post-hoc tests ($\alpha = .05$) illuminate that there were statistically significant differences between nonpoverty area White and poverty area African American census tracts. In particular, nonpoverty White tracts had a greater number of national and regional supermarkets within 1-mile of their neighborhood than poverty area African American tracts in every decade except 1970. Here, the trend was reversed. These nonpoverty area White census tracts also contained a greater number of supermarkets than their equivalent African American census tracts

Table 5-5: Cumulative Opportunity Accessibility ANOVAs (Census Tracts)

		Total Stores		National and Regional Supermarkets		Corner Grocery		Green Grocer		Liquor Store	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	36.19	18.85	1.71	1.27	23.78	14.53	1.14	2.93	9.57	4.62
	AA Poverty	49.47	22.13	1.49	1.31	36.42	16.94	2.10	5.38	9.46	4.22
	White NonPoverty	11.81	13.41	1.11	1.28	6.37	9.15	0.52	1.32	3.81	3.70
	White Poverty	40.23	22.69	1.68	1.52	28.55	17.42	1.55	1.77	8.45	5.01
	F	225.9		9.712		258.9		14.28		118.3	
	df	(3,902)		(3,902)		(3,902)		(3,902)		(3,902)	
	p value	<2e-16		2.60E-06		<2e-16		4.27E-09		<2e-16	
1980	AA NonPoverty	14.00	6.70	0.44	0.56	6.02	3.65	0.35	0.57	7.18	4.14
	AA Poverty	25.17	10.27	0.28	0.51	13.83	6.44	0.26	0.57	10.81	4.78
	White NonPoverty	6.05	5.58	0.55	0.74	2.35	2.90	0.27	0.51	2.88	2.78
	White Poverty	17.11	10.76	0.42	0.50	10.31	6.94	0.22	0.42	6.17	4.40
	F	335.4		6.609		365.9		0.846		243.3	
	df	(3,905)		(3,905)		(3,905)		(3,905)		(3,905)	
	p value	<2e-16		2.03E-04		<2e-16		0.469		<2e-16	
1990	AA NonPoverty	12.31	6.62	0.25	0.60	6.00	3.91	0.17	0.42	5.88	3.34
	AA Poverty	17.35	6.85	0.26	0.51	8.49	4.46	0.24	0.53	8.36	3.64
	White NonPoverty	5.53	4.50	0.46	0.67	2.32	2.29	0.24	0.49	2.50	2.42
	White Poverty	12.59	7.55	0.39	0.60	6.33	4.47	0.47	0.81	5.39	3.44
	F	261.6		7.291		211.9		3.622		229.9	
	df	(3,905)		(3,905)		(3,905)		(3,905)		(3,905)	
	p value	<2e-16		7.81E-05		<2e-16		0.013		<2e-16	
2000	AA NonPoverty	8.61	4.76	0.26	0.46	3.65	2.61	0.13	0.33	4.56	3.05
	AA Poverty	12.99	4.95	0.13	0.35	5.30	2.72	0.08	0.30	7.47	3.40
	White NonPoverty	4.87	4.12	0.38	0.63	2.44	2.69	0.11	0.37	1.94	1.80
	White Poverty	14.42	9.17	0.54	0.71	8.54	6.41	0.92	1.47	4.42	2.70
	F	178.5		10.97		79.35		31.66		262.5	
	df	(3,895)		(3,895)		(3,895)		(3,895)		(3,895)	
	p value	<2e-16		4.42E-07		<2e-16		<2e-16		<2e-16	
2010	AA NonPoverty	11.70	7.29	0.21	0.48	8.73	5.66	0.08	0.32	2.68	2.11
	AA Poverty	17.57	6.62	0.21	0.44	12.75	5.38	0.29	1.34	4.31	2.41
	White NonPoverty	7.80	5.64	0.44	0.73	5.94	4.37	0.10	0.32	1.32	1.44
	White Poverty	16.32	11.65	0.29	0.52	13.05	9.07	0.46	0.75	2.52	2.53
	F	132.6		8.351		111.3		6.719		138.5	
	df	(3,881)		(3,881)		(3,881)		(3,881)		(3,881)	
	p value	<2e-16		1.77E-05		<2e-16		1.75E-04		<2e-16	

in 1990 and 2010. Interestingly, this trend also was reversed in 1970 between the neighborhoods. Last, White poverty area census tracts possessed more national and regional supermarkets within 1-mile than equivalent African American census tracts in 2000.

African American poverty and nonpoverty census tracts had a greater number of corner grocery stores than equivalent White census tracts in 1970, 1980 and 1990. In addition, poverty area African American tracts had a larger number of corner grocery stores than nonpoverty White tracts in each decade. Poverty area White census tracts contained a greater number of corner stores than equivalent African American census tracts in 2000 and nonpoverty area African American tracts in 1980, 2000 and 2010. In both African American and White census tracts, poverty area tracts had more corner grocery stores than nonpoverty area tracts in each decade.

With regard to liquor stores, African American census tracts contained a greater number of stores than comparable White tracts in each decade except 1970. Here, nonpoverty area African American census tract had more stores than similar White census tracts. In addition, poverty area African American tracts had a greater number of liquor stores than nonpoverty area White tracts. In both communities, nonpoverty census tracts possessed less liquor stores than poverty area census tracts in every decade except 1970. During 1970, this relationship only held within White census tracts.

Last, post-hoc tests ($\alpha = .05$) bring to light that White poverty area census tracts had more green grocers than nonpoverty African American and White census tracts in 1990, 2000 and 2010. These tracts also possessed more stores than equivalent African American tracts in 1990 and 2000. White nonpoverty census tracts contained less green grocers than poverty area African American census tracts in 1970 and 2010. In 1970, poverty area African American

census tracts had more green grocers than nonpoverty area African American census tracts. In addition, White nonpoverty area tracts had fewer stores than comparable African American tracts.

The findings for the cumulative opportunity accessibility ANOVAs for the reconfigured neighborhoods in Table 5-6 showed statistically significant differences in the mean number of green grocers and national and regional supermarkets between the reconfigured neighborhoods in every decade except for 1980. Statistically significant differences also existed in the mean number of corner grocery and liquor stores in every decade.

Post hoc tests ($\alpha = .05$) show that African American poverty area reconfigured neighborhoods had more national and regional supermarkets than nonpoverty area White reconfigured neighborhoods in 1970. A similar pattern appeared between nonpoverty area African American and White neighborhoods in 1970. However, in 1990, 2000 and 2010 nonpoverty area White neighborhoods possessed a greater number of national and regional supermarkets than poverty area African American neighborhoods. In 2000, poverty area African American neighborhoods contained fewer national and regional supermarkets than nonpoverty area African Americans.

There were statistically significant differences in the mean number of corner grocery stores between nonpoverty and poverty area reconfigured neighborhoods in each decade. White poverty area neighborhoods contained a greater amount of corner grocery stores than White nonpoverty area neighborhoods in each decade and African American poverty area neighborhoods possessed a greater amount of corner grocery stores than African American nonpoverty area neighborhoods in every decade except 2010. Moreover, African American poverty area neighborhoods had more stores than equivalent White neighborhoods in 1970 and

Table 5-6: Cumulative Opportunity Accessibility ANOVAs (Reconfigured Neighborhoods)

		Total Stores		National and Regional Supermarkets		Corner Grocery		Green Grocer		Liquor Store	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	32.52	18.50	1.80	1.34	21.04	13.86	0.76	0.77	8.91	4.88
	AA Poverty	47.04	16.04	2.00	1.28	33.86	13.50	2.04	3.96	9.14	3.67
	White NonPoverty	9.20	11.08	0.96	1.27	4.66	7.01	0.46	1.64	3.11	3.33
	White Poverty	32.00	17.91	1.38	1.39	22.31	12.70	1.77	2.09	6.54	4.31
	F	119.8		10.53		141.9		8.185		56.36	
	df	(3,417)		(3,417)		(3,417)		(3,417)		(3,417)	
	p value	<2e-16		1.09E-06		<2e-16		2.64E-05		<2e-16	
1980	AA NonPoverty	12.88	6.37	0.63	0.66	5.63	3.82	0.31	0.47	6.31	3.67
	AA Poverty	23.29	10.09	0.31	0.56	12.82	6.17	0.26	0.54	9.91	4.87
	White NonPoverty	5.48	5.48	0.50	0.71	2.12	2.79	0.23	0.47	2.63	2.75
	White Poverty	15.54	11.06	0.23	0.44	9.38	7.53	0.23	0.44	5.69	4.05
	F	136.2		2.563		153.3		0.291		94.97	
	df	(3,418)		(3,418)		(3,418)		(3,418)		(3,418)	
	p value	<2e-16		0.054		<2e-16		0.832		<2e-16	
1990	AA NonPoverty	9.85	5.99	0.25	0.44	5.00	3.42	0.15	0.37	4.45	3.20
	AA Poverty	17.83	7.41	0.24	0.46	8.49	4.83	0.30	0.54	8.80	3.82
	White NonPoverty	5.05	4.10	0.45	0.64	2.22	2.25	0.19	0.42	2.19	2.11
	White Poverty	12.55	7.67	0.25	0.44	6.50	4.25	0.70	1.03	5.10	3.82
	F	119.8		3.317		83.8		7.418		117.4	
	df	(3,365)		(3,365)		(3,365)		(3,365)		(3,365)	
	p value	<2e-16		0.020		<2e-16		7.79E-05		<2e-16	
2000	AA NonPoverty	8.97	5.00	0.38	0.49	3.97	2.86	0.21	0.41	4.41	2.77
	AA Poverty	12.85	4.58	0.10	0.31	5.42	2.63	0.08	0.27	7.24	3.37
	White NonPoverty	4.50	3.78	0.38	0.58	2.23	2.37	0.11	0.34	1.78	1.80
	White Poverty	16.06	9.64	0.29	0.59	10.00	7.08	1.06	1.56	4.71	2.28
	F	97.74		5.651		59.86		24.42		117.8	
	df	(3,389)		(3,389)		(3,389)		(3,389)		(3,389)	
	p value	<2e-16		8.47E-04		<2e-16		1.70E-14		<2e-16	
2010	AA NonPoverty	11.80	6.53	0.15	0.37	9.05	5.53	0.05	0.22	2.55	1.79
	AA Poverty	16.16	7.37	0.16	0.37	11.87	5.89	0.29	1.32	3.84	2.25
	White NonPoverty	7.55	5.55	0.45	0.78	5.78	4.35	0.10	0.33	1.22	1.32
	White Poverty	15.31	12.67	0.28	0.53	11.93	9.90	0.48	0.91	2.62	2.85
	F	37.29		4.355		31.85		3.6		46.53	
	df	(3,363)		(3,363)		(3,363)		(3,363)		(3,363)	
	p value	<2e-16		0.005		<2e-16		0.014		<2e-16	

1980, but in 2000, the trend was reversed. They also had a greater number of stores than nonpoverty area White neighborhoods in each decade. In addition, nonpoverty area African American neighborhoods contained more corner grocery stores than comparable White neighborhoods in every decade with the exception of 1970. Last, White nonpoverty area neighborhoods contained a larger number of liquor stores than nonpoverty area African American neighborhoods in 1970 and 2000.

With regard to green grocers, poverty area African American reconfigured neighborhoods possessed more green grocers than nonpoverty area White and African American reconfigured neighborhoods in 1970. White poverty areas neighborhoods had more green grocers than nonpoverty White areas in 1990, 2000 and 2010. In addition, these neighborhoods also contained a greater amount of stores than African American neighborhoods regardless of economic status in 1990 and 2000. In terms of liquor stores, nonpoverty area White neighborhoods had the least amount of liquor stores than all other White and African American neighborhoods in each decade. Even White poverty area neighborhoods had fewer liquor stores than equivalent African American neighborhoods in each decade with the exception of 1970. In addition, they also contained fewer stores than nonpoverty area African American neighborhoods in 1980. Last African American poverty area neighborhoods had a greater amount of liquor stores than nonpoverty area African American neighborhoods.

Coverage/Distance Accessibility Results

The results in Table 5-7 signify that there were statistically significant differences in the mean 5-nearest stores (5-NS) and minimum distances to national and regional supermarkets between the neighborhood typologies in 1970, 2000 and 2010. Statistically significant

Table 5-7: Coverage Accessibility ANOVAs (Census Tracts)

		National & Regional Supermarkets 5-NS Mean Distance		National & Regional Supermarket Minimum Distance		Liquor Store 5-NS Mean Distance		Liquor Store Minimum Distance	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	1986	683	1201	617	940	366	570	293
	AA Poverty	1997	594	1300	659	928	369	562	351
	White NonPoverty	3256	2033	1959	1642	1922	1307	1230	997
	White Poverty	1968	607	1165	654	1041	453	635	361
	F	29		14.33		41,94		32.34	
	df	(3,902)		(3,902)		(3,902)		(3,902)	
	p value	<2e-16		3.98E-09		<2e-16		<2e-16	
1980	AA NonPoverty	3552	700	1950	789	1101	373	712	324
	AA Poverty	4031	727	2179	883	836	289	515	259
	White NonPoverty	3711	1671	2177	1399	2051	1385	1339	1204
	White Poverty	4225	1641	2166	1611	1481	1418	946	1215
	F	3.747		0.824		52.59		31.66	
	df	(3,905)		(3,905)		(3,905)		(3,905)	
	p value	0.011		0.481		<2e-16		<2e-16	
1990	AA NonPoverty	4401	899	2555	1080	1295	715	842	626
	AA Poverty	4341	968	2450	1034	948	295	565	255
	White NonPoverty	4058	1894	2274	1459	2055	1094	1270	871
	White Poverty	4486	1457	2474	1584	1324	783	770	517
	F	2.76		1.618		85.38		54.42	
	df	(3,905)		(3,905)		(3,905)		(3,905)	
	p value	4.12E-02		0.184		<2e-16		<2e-16	
2000	AA NonPoverty	4711	1097	2555	1125	1443	600	855	494
	AA Poverty	5404	994	3143	1387	998	327	598	267
	White NonPoverty	4194	1528	2337	1308	2274	1171	1346	962
	White Poverty	4321	811	1997	958	1292	582	745	485
	F	40.3		20.71		97.9		50.23	
	df	(3,895)		(3,895)		(3,895)		(3,895)	
	p value	<2e-16		5.58E-13		<2e-16		<2e-16	
2010	AA NonPoverty	4612	1270	2662	1146	1835	728	1105	606
	AA Poverty	5268	1188	2816	1345	1337	431	791	353
	White NonPoverty	3813	1383	2272	1218	2853	1582	1707	1231
	White Poverty	4612	1384	2547	1356	1965	1003	1058	763
	F	69.67		11.05		85.51		52.27	
	df	(3,881)		(3,881)		(3,881)		(3,881)	
	p value	<2e-16		4.01E-07		<2e-16		<2e-16	

differences also existed between the neighborhoods with regards to the mean 5 nearest liquor stores (5-NL) and minimum distances to liquor stores in every decade.

Tukey HSD post-hoc tests ($\alpha = .05$) revealed that African American nonpoverty and poverty area census tracts travelled shorter mean distances to national and regional supermarkets than their White nonpoverty area counterparts in 1970, however, in 2000 and 2010, these census tracts had to travel a greater mean distance than the White nonpoverty area tracts. Poverty area African American census tracts also travelled greater mean distances than equivalent White tracts and nonpoverty African American tracts in 2000 and 2010. Last, White nonpoverty area census tracts had greater mean distances in 1970 than poverty area White census tracts, however, this trend flipped in 2010.

With regard to minimum distances to national and regional supermarkets, post-hoc tests showed that White nonpoverty census tracts travelled greater minimum distances than African American poverty and nonpoverty area census tracts in 1970. However, in 2000 and 2010 these White tracts had shorter minimum distances than African American poverty area tracts. African American poverty area census tracts also travelled greater minimum distances to national and regional supermarkets than their less economically deprived African American counterparts in 2000. Last, White poverty area tracts travelled shorter minimum distances than equivalent African American census tracts in 2000.

Post-hoc tests also revealed that nonpoverty area African American census tracts had shorter mean and minimum distances to liquor stores than their White counterparts in every decade. White nonpoverty area tracts journeyed greater mean and minimum distances than poverty area African American tracts in every decade. These census tracts also had greater mean distances to national and regional supermarkets in every decade and greater minimum distances

in every decade except 1980 than poverty area White census tracts. African American poverty area census tract had shorter mean distances than nonpoverty area White census tracts in 1980 and 2010. Last, residents in these census tracts also travelled shorter mean distances in 1990, 2000 and 2010 and shorter minimum distances in 1990 and 2000 to national and regional supermarkets than nonpoverty African American census tracts.

The findings from the coverage accessibility ANOVAs for the reconfigured neighborhoods in Table 5-8 established statistically significant differences in mean distance to the nearest 5 national and regional supermarkets in each decade except 1980. With the exception of 1990, differences in minimum distances to national and regional supermarkets also existed. There also was a statistically significant difference in mean distance to the nearest 5 liquor stores and minimum distances to liquor stores between neighborhoods in each decade.

Tukey HSD post-hoc tests ($\alpha = .05$) revealed that White nonpoverty area reconfigured neighborhoods had larger mean distances to national and regional supermarkets than nonpoverty African American and poverty area White and African American reconfigured neighborhoods in 1970. However, in 1990 and 2010 White nonpoverty area neighborhoods had shorter mean distances than poverty area White neighborhoods. In addition, White nonpoverty area neighborhoods also travelled shorter mean and minimum distances than poverty area African American neighborhoods in 2000 and 2010. White nonpoverty area neighborhoods also journeyed shorter minimum distances than comparable White neighborhoods in 2000. African American poverty area neighborhoods had greater mean and minimum distances to national and regional supermarkets than nonpoverty area African American neighborhoods in 2000. In 1970 and 1980, White nonpoverty area neighborhoods had bigger minimum distances to national and

Table 5-8: Coverage Accessibility ANOVAs (Reconfigured Neighborhoods)

		National & Regional Supermarkets 5-NN Mean		National & Regional Supermarket Minimum Distance		Liquor Store 5-NN Mean Distance		Liquor Store Minimum Distance	
Year	**Neighborhood**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**	**μ**	**σ**
1970	AA NonPoverty	2053	937	1217	861	1051	591	670	540
	AA Poverty	1849	453	1037	442	908	350	562	412
	White NonPoverty	3459	1925	2077	1576	2073	1345	1305	991
	White Poverty	2100	548	1462	682	1121	504	607	364
	F	16.13		8.807		17.31		12.86	
	df	(3,417)		(3,417)		(3,417)		(3,417)	
	p value	6.15E-10		1.13E-05		1.31E-10		4.77E-08	
1980	AA NonPoverty	3350	643	1591	655	1201	389	791	342
	AA Poverty	4013	784	2213	910	902	359	556	300
	White NonPoverty	3931	1836	2304	1500	2232	1586	1460	1441
	White Poverty	4048	696	2160	848	1291	771	818	594
	F	1.399		2.673		20.73		11.47	
	df	(3,418)		(3,418)		(3,418)		(3,418)	
	p value	0.242		0.047		1.54E-12		3.08E-07	
1990	AA NonPoverty	4545	748	2380	1174	1509	689	977	547
	AA Poverty	4342	963	2447	1027	928	339	550	304
	White NonPoverty	4000	1567	2170	1394	2072	978	1261	864
	White Poverty	4910	1651	2725	1790	1288	813	737	633
	F	3.745		1.722		37.21		18.73	
	df	(3,365)		(3,365)		(3,365)		(3,365)	
	p value	0.011		0.162		<2e-16		2.53E-11	
2000	AA NonPoverty	4548	1010	2352	1140	1462	649	867	541
	AA Poverty	5347	914	3270	1388	1003	334	598	293
	White NonPoverty	4197	1460	2251	1216	2302	1102	1395	973
	White Poverty	4607	1217	2021	1024	1226	545	618	329
	F	15.3		14.4		45.32		23.27	
	df	(3,389)		(3,389)		(3,389)		(3,389)	
	p value	1.98E-09		6.44E-09		<2e-16		7.10E-14	
2010	AA NonPoverty	4538	1038	2554	1128	1816	599	1049	419
	AA Poverty	5240	1185	2905	1322	1402	484	845	455
	White NonPoverty	3927	1612	2337	1420	2885	1552	1671	1197
	White Poverty	4809	1639	2688	1658	2132	1250	1153	898
	F	15.87		3.333		25.88		13.99	
	df	(3,363)		(3,363)		(3,363)		(3,363)	
	p value	1.03E-09		0.020		3.41E-15		1.19E-08	

regional supermarkets than equivalent African American neighborhoods. These neighborhoods also had a larger minimum distance than poverty area African American neighborhoods in 1970.

With regards to liquor stores, African American nonpoverty area reconfigured neighborhoods had shorter mean distances in every decade and shorter minimum distances in every decade except for 1990 than comparable White reconfigured neighborhoods. African American poverty area neighborhoods also journeyed shorter mean and minimum distances to liquor stores than nonpoverty area White neighborhoods in each decade. Equally, poverty area White neighborhoods had shorter mean distances in 1970, 1990, 2000 and 2010 and shorter minimum distances in 1970, 1990 and 2000 than nonpoverty area White neighborhoods. Last, poverty area African American neighborhoods had shorter mean distances to liquor stores than nonpoverty area African American neighborhoods in 1990.

Last, to test whether racial or economic stratification processes explained the disparities documented in the ANOVAs, a series of multiple Ordinary Least Squares (OLS) regression models were established. The OLS regression model was formalized as:

$$y = a + \beta X + \varepsilon$$

Where

y is an n x 1 vector of dependent variables;
α is a constant;
X is a k x n matrix of independent variables;
β is a vector of regression coefficients, and
ε is a vector of random error terms.

The dependent variables were the mean distance to the 5 nearest and the minimum distance to national and regional supermarkets and liquor stores respectively. The independent variables were neighborhood deprivation (TMDI), predominately African American neighborhood (Black Neighborhood 0 =N, 1 = Y) and population density (people per square

meter) (PopDen). It was hypothesized that the TMDI and Black Neighborhood measures would have a positive relationship with the dependent mean and minimum national and regional supermarket distance variable and a negative relationship with the mean and minimum liquor store accessibility variables. Population density was expected to have a negative relationship with all the distance accessibility measures. That is, higher density regions tend to have shorter distances between amenities than low-density suburban and rural areas due to built-environment characteristics. Last, the intercept should have a statistically significant positive relationship. It would indicate the mean distance to national and regional supermarkets when all other variables were accounted for in the model. In the end, it was hypothesized that neighborhood racial composition was the most salient force in explaining differentials in accessibility levels.

Post regression diagnostics of the initial OLS results indicated the presence of heteroscedasticity in all the models. While the presence of heteroscedasticity does not impact the estimation of β, the model becomes inefficient. That is, the variance is either deflated or inflated which can bias the standard errors and the F- and t-values. Since the regression diagnostics identified the population density measure as the most likely culprit inducing the heteroscedasticity, it was used to implement a weighted least squares (WLS) regression framework. This weighted least squares regression model utilized a weight derived from the population density measure to adjust the variance: $w_i = 1/\sigma_i^2$.

Table 5-9 shows the results for the weighted least squares census tract models for the mean distance to the 5 nearest national and regional supermarket stores (5-NS). The census tract deprivation variable had a statistically significant ($\alpha = .05$) positive relationship with the mean neighborhood distance to national and regional supermarkets in every decade except 1990. Higher levels of census tract deprivation translated into increased mean distances to national and

Table 5-9: Mean Distance to the Nearest 5 National and Regional Supermarkets Weighted Least Squares Regressions (Census Tracts)

National and Regional Supermarket Nearest 5 Stores Mean Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	3098.14 (89.64)	***	3903.05 (85.69)	***	4040.76 (108.88)	***	4348.53 (75.83)	***	4678.7 (107.20)	***
TMDI	-10.77 (16.57)	*	68.49 (15.36)	***	16.44 (15.96)		121.01 (16.40)	***	158.9 (19.20)	***
Black Neighborhood (0 = N, 1 = Y)	-41 (50.58)	**	478.95 (97.23)	***	260.37 (88.86)	**	469.33 (107.12)	***	646.9 (112.40)	***
PopDen (sq. m.)	-111267.59 (14650.43)	***	-123650.90 (23311.87)	***	-14123.27 (30243.07)		-12986.13 (21413.13)		-301565.6 (49118.30)	***
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.542		1.323		1.435		1.355		1.338	
Multiple R-squared	0.348		0.064		0.022		0.183		0.201	
Adjusted R-squared	0.346		0.061		0.018		0.180		0.198	
F-statistic	160.8	***	20.77	***	6.79	***	69.59	***	77.63	***
df	(3,902)		(3,914)		(3,921)		(3,934)		(3,927)	

Table 5-10: Minimum Distance to the Nearest National and Regional Supermarket Weighted Least Squares Regression (Census Tracts)

National and Regional Supermarket Minimum Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	2.16E+03	***	2286.22	***	2503.00	***	2655.79	***	2831.10	***
	(66.63)		(78.64)		(98.36)		(79.15)		(100.78)	
TMDI	3.17E+01	***	47.2	**	3.00		48.74	**	72.67	***
	(6.78)		(14.72)		(16.41)		(16.95)		(18.59)	
Black Neighborhood (0 = N, 1 = Y)	1.40E+02	.	326.24	***	613.10	***	596.73	***	288.40	**
	(80.99)		(93.61)		(107.50)		(117.77)		(110.19)	
PopDen (sq. m.)	-1.59E+05	***	-102596.79	***	-166100.00	***	-159322.99	***	-232547.65	***
	(10590.00)		(21240.47)		(33050.00)		(27188.65)		(44831.13)	
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.54		1.305		1.329		1.304		1.297	
Multiple R-squared	0.393		0.034		0.058		0.082		0.059	
Adjusted R-squared	0.391		0.031		0.054		0.079		0.056	
F-statistic	194.4	***	10.76	***	18.74	***	27.91	***	19.5	***
df	(3,902)		(3,914)		(3,921)		(3,934)		(3,927)	

regional supermarkets. A statistically significant negative relationship between the African American dummy variable and the dependent variable existed in 1970. This indicated that African American census tracts had shorter mean distances to national and regional supermarkets than non-African American census tracts. However, the sign flipped and remained statistically significant for the remaining decades. Here, African American census tracts had greater mean distances to national and regional supermarkets than non-African American census tracts. Last, the population density measure had a statistically significant relationship with the dependent variable in 1970, 1980 and 2010. Residents in higher density census tracts travelled shorter mean distances to national and regional supermarkets than residents living in low-density census tracts.

Table 5-10 displays the findings for the minimum distance to national and regional supermarkets WLS census tract models. The census tract deprivation variable had a statistically significant ($\alpha = .05$) positive relationship with the minimum distance dependent variable in each decade except for 1990. This denoted that minimum distances to national and regional supermarkets increased as economic deprivation levels increased. There also existed a statistically significant positive relationship between the African American dichotomous variable and the dependent variable in each decade except for 1970. Living in an African American census tract increased one's minimum distance to national and regional supermarkets. The population density variable had a statistically significant negative relationship with the minimum distance variable. Here, increasing census tract density translated into shorter minimum distances to national and regional supermarkets.

Table 5-11 and 5-12 show the mean and minimum WLS regression results for the reconfigured neighborhoods respectively. In Table 5-11, the neighborhood deprivation measure

Table 5-11: Mean Distance to the Nearest 5 National and Regional Supermarkets Weighted Least Squares Regressions (Reconfigured Neighborhoods)

National and Regional Supermarket Nearest 5 Stores Mean Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	3436.01 (138.03)	***	4008.53 (139.55)	***	4144.90 (115.14)	***	4417.13 (102.91)	***	4732.18 (174.04)	***
TMDI	-11.89 (32.94)		72.68 (25.89)	**	11.31 (21.95)		115.17 (24.37)	***	149.42 (28.81)	***
Black Neighborhood (0 = N, 1 = Y)	82.48 (234.31)		226.31 (156.74)		484.61 (167.09)	**	295.00 (172.95)	.	466.25 (185.08)	*
PopDen (sq. m.)	-138290.52 (30715.17)	***	-112410.87 (40886.88)	***	-93890.53 (39638.54)	*	-39768.87 (37361.51)		-292983.23 (83069.07)	***
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.424		1.324		1.345		1.315		1.364	
Multiple R-squared	0.217		0.036		0.041		0.141		0.134	
Adjusted R-squared	0.212		0.029		0.033		0.134		0.127	
F-statistic	38.75	***	5.255	***	5.244	**	22.04	***	19.8	***
df	(3,419)		(3,422)		(3,371)		(3,404)		(3,385)	

Table 5-12: Minimum Distance to the Nearest National and Regional Supermarket Weighted Least Squares Regression (Reconfigured Neighborhoods)

National and Regional Supermarket Minimum Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	1.81E+03	***	2542.95	***	2372.29	***	2424.88	***	2961.94	***
	(104.13)		(129.86)		(115.99)		(98.52)		(162.36)	
TMDI	-4.53E+01	*	47.44	*	26.32		48.46	.	89.44	***
	(21.91)		(23.75)		(25.07)		(25.07)		(28.75)	
Black Neighborhood (0 = N, 1 = Y)	1.64E+02		83.09		333.68	.	547.55	**	114.88	
	(188.74)		(155.24)		(190.70)		(187.18)		(192.05)	
PopDen (sq. m.)	-2.92E+04		-162516.25	***	-136100.51	**	-106761.70	**	-263894.98	***
	(21621.23)		(40516.92)		(46168.00)		(40215.10)		(78567.60)	
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.526		1.301		1.353		1.297		1.339	
Multiple R-squared	0.101		0.373		0.036		0.071		0.049	
Adjusted R-squared	0.094		0.030		0.028		0.064		0.042	
F-statistic	15.66	***	5.451	**	4.58	**	10.34	***	6.613	***
df	(3,419)		(3,422)		(3,371)		(3,404)		(3,385)	

had a statistically significant positive relationship ($\alpha = .05$) in 1980, 2000 and 2010. As in the previous census tract models, increasing neighborhood deprivations levels led to increased mean distances to national and regional supermarkets. The African American neighborhood dummy variable had a statistically positive relationship in 1990 and 2010. Like neighborhood deprivation, residing in an African American neighborhood increased a resident's mean distance to a national and regional supermarket. The population density measure had a statistically significant negative relationship in every decade except for 2000. As census tract density increased, the mean distance to national and regional supermarkets decreased.

The results from the minimum distance WLS regression models in Table 5-12 showed similar trends. The African American neighborhood variable had a statistically significant positive relationship with the dependent variable in 2000. The population density variable had a statistically significant negative relationship in every decade except for 1970. Initially, the neighborhood deprivation variable had a statistically negative relationship in 1970; however, the sign of the coefficient flipped in 1980 and 2010. In 1970, minimum distances to national and regional supermarkets decreased as census tract deprivation levels increased, but in 1980 and 2010, the distances increased.

Last, the WLS regression results for the mean distance to the nearest 5 liquor stores and minimum distance to a liquor store dependent variables regressed against the independent variables at the census tract level are presented in Table 5-13 and Table 5-14 respectively. The results in Table 5-13 reveal that census tract deprivation levels had a statistically negative relationship with the dependent variable (mean distance to the nearest 5 liquor stores) in each decade. The mean distance to the 5 nearest liquor stores decreased as census tract deprivation levels increased. In 1970 and 2010, the African American neighborhood dichotomous variable

Table 5-13: Mean Distance to the Nearest 5 Liquor Stores Weighted Least Squares Regressions (Census Tracts)

Liquor Store Nearest 5 Stores Mean Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	1.74E+03	***	2.09E+03	***	2.01E+03	***	2.08E+03	***	2.17E+03	***
	(51.19)		(51.64)		(51.89)		(40.65)		(75.43)	
TMDI	-4.73E+01	***	-5.43E+00		-4.16E+01	***	-7.23E+01	***	-5.15E+01	***
	(9.64)		(8.55)		(8.14)		(7.95)		(10.65)	
Black Neighborhood (0 = N, 1 = Y)	1.23E+02	**	-3.57E+02		-3.97E+02	***	-4.78E+02	***	1.48E+02	*
	(46.12)		(60.59)		(55.65)		(61.87)		(70.59)	
PopDen (sq. m.)	-6.20E+04	***	-1.45E+05	***	-1.15E+05	***	-5.04E+04	***	-1.26E+05	***
	(8160.62)		(11940.00)		(15488.12)		(4331.49)		(16077.22)	
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.509		1.447		1.371		1.325		1.675	
Multiple R-squared	0.362		0.548		0.407		0.545		0.199	
Adjusted R-squared	0.360		0.546		0.405		0.544		0.197	
F-statistic	170.9	***	368.7	***	210.4	***	372.9	***	76.86	***
df	(3,902)		(3,914)		(3,921)		(3,934)		(3,927)	

Table 5-14: Minimum Distance to the Nearest Liquor Store Weighted Least Squares Regressions (Census Tracts)

Liquor Store Minimum Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	7.87E+02	***	1.20E+03	***	1.21E+03	***	1.18E+03	***	1.61E+03	***
	(49.36)		(62.00)		(62.48)		(33.95)		(52.88)	
TMDI	-1.86E+02	***	-3.97E+01	***	-7.25E-01		-4.01E+01	***	-2.53E+01	***
	(5.10)		(6.04)		(9.71)		(5.56)		(6.53)	
Black Neighborhood (0 = N, 1 = Y)	4.07E+02	***	-1.10E+02	**	-1.07E+03	***	-1.31E+02	***	-9.67E+01	*
	(62.14)		(33.86)		(28.47)		(24.03)		(38.57)	
PopDen (sq. m.)	3.03E+04	***	-6.76E+04	***	5.19E+04	***	-4.49E+04	***	-1.94E+05	***
	(7843.14)		(12525.93)		(14440.35)		(4834.55)		(11110.00)	
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.905		1.905		2.513		1.417		1.386	
Multiple R-squared	0.696		0.330		0.874		0.286		0.470	
Adjusted R-squared	0.695		0.328		0.874		0.283		0.468	
F-statistic	688.4	***	150.1	***	2130	***	124.4	***	273.5	***
df	(3,902)		(3,914)		(3,921)		(3,934)		(3,927)	

had a statistically significant positive relationship. In these decades, living in an African American neighborhood increased one's mean distance to the nearest liquor stores. However, the statistical relationship was flipped in 1990 and 2000. During these years, living in an African American neighborhood decreased one's mean distance to a liquor stores. Last, population density had a statistically significant negative relationship in each decade. Increasing census tract density decreased the mean distance to a liquor store.

The findings in Table 5-14 closely mirrored the previous results. The census deprivation measure had a statistically significant negative relationship with the dependent variable (minimum distance to a liquor store) in every decade except 1990. The minimum distance to a liquor store decreased as census tract deprivation levels increased. The African American dummy variable had a positive relationship in 1970, but the sign on the coefficient flipped in the remaining decades. From 1980 onward, living in an African American census tract decreased one's minimum distance to a liquor store. Population density had a statistically significant positive relationship in 1970 and 1990 but a statistically significant negative relationship in the remaining decades.

Similar results appear in the final set of weighted least square regressions for the liquor store accessibility measures in the reconfigured neighborhoods. Table 5-15 shows that neighborhood deprivation and population density had a statistically significant ($\alpha = .05$) negative relationship with the mean distance to the 5 nearest liquor stores in each decade. Both increasing deprivation levels and density decreased the mean distances one had to travel to reach a liquor store. The African American dummy variable also had a statistically significant negative relationship with the dependent variable in 1980, 1990 and 2000. Here, living in an African American neighborhood decreased the mean distance one had to travel to access a liquor store.

Table 5-15: Mean Distance to the Nearest 5 Liquor Stores Weighted Least Squares Regressions (Reconfigured Neighborhoods)

Liquor Store Nearest 5 Stores Mean Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	2097.16 (93.04)	***	2289.06 (89.02)	***	1972.03 (63.16)	***	2105.63 (64.93)	***	2465.10 (103.90)	***
TMDI	-44.98 (21.92)	*	-30.76 (14.94)	*	-50.24 (11.84)	***	-51.89 (12.19)	***	-131.40 (15.82)	***
Black Neighborhood (0 = N, 1 = Y)	256.78 (156.33)		-409.54 (90.12)	***	-514.38 (94.49)	***	-600.37 (100.73)	***	-66.10 (101.95)	
PopDen (sq. m.)	-117343.46 (21536.24)	***	-170122.32 (22202.82)	***	-65844.27 (19796.19)	***	-37183.18 (15415.95)	*	-94915.07 (31756.42)	**
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.431		1.476		1.298		1.345		1.485	
Multiple R-squared	0.289		0.489		0.463		0.386		0.263	
Adjusted R-squared	0.284		0.486		0.459		0.382		0.257	
F-statistic	56.75	***	134.9	***	106.8	***	84.8	***	45.74	***
df	(3,419)		(3,422)		(3,371)		(3,404)		(3,385)	

Table 5-16: Minimum Distance to the Nearest Liquor Store Weighted Least Squares Regressions (Reconfigured Neighborhoods)

Liquor Store Minimum Distance	1970 Estimate (S.E.)		1980 Estimate (S.E.)		1990 Estimate (S.E.)		2000 Estimate (S.E.)		2010 Estimate (S.E.)	
(Intercept)	1035.78	***	1667.85	***	1179.23	***	1342.87	***	1622.00	***
	(72.45)		(132.81)		(49.87)		(53.64)		(69.61)	
TMDI	-54.59	**	125.87	***	-34.44	***	-8.32		-66.48	***
	(17.29)		(8.75)		(8.82)		(5.56)		(5.73)	
Black Neighborhood (0 = N, 1 = Y)	56.71		-293.91	***	-330.39	***	-428.11	***	-119.00	*
	(126.25)		(51.43)		(68.48)		(70.47)		(57.91)	
PopDen (sq. m.)	5913.51		-190043.10	***	-33110.11	**	-76886.72	***	-148000.00	***
	(15478.76)		(25152.53)		(11865.71)		(8554.33)		(12030.00)	
Signif. codes: *** 0.001 ** 0.01 * 0.05 . 0.1										
Residual standard error	1.568		2.377		1.354		1.414		1.275	
Multiple R-squared	0.082		0.372		0.361		0.382		0.435	
Adjusted R-squared	0.076		0.367		0.356		0.377		0.431	
F-statistic	12.56	***	83.23	***	69.83	***	83.18	***	98.9	***
df	(3,419)		(3,422)		(3,371)		(3,404)		(3,385)	

Table 5-16 shows the final minimum distance to a liquor store WLS results for the reconfigured neighborhoods. The African American neighborhood and population density measures had a statistically significant negative relationship with the dependent variable in every decade except 1970. Increasing density levels and living in an African American neighborhood reduced the minimum distance to a liquor store. The neighborhood deprivation measure had a statistically significant negative relationship in 1970, 1990 and 2010 and a positive relationship in 1980. Subsequently, in 1980, increasing deprivation levels resulted in increased minimum distances but in the remaining decades, it resulted in decreased accessibility levels.

Discussion

The census tract ANOVAs paint a complicated picture about inequities in the food environment with regards to neighborhood store composition. During the 1970s, there were few differences between the neighborhood typologies with respect to the amount of national and regional supermarkets, green grocers and liquor stores located within them. Neighborhood disparities that existed occurred along racial lines as African American census tracts regardless of their economic status had more corner grocery stores than White census tracts. In many ways these initial trends reflected the early stages of the retail and residential suburbanization and the economic restructuring processes that would fundamentally alter the food environment. For the most part at the beginning of the decade, there were still large numbers of national and regional supermarkets as well as Whites located throughout the city of Detroit.

By 1980, racial disparities began to emerge with regards to national and regional supermarkets. Impoverished White census tracts had more supermarkets than comparable African American census tracts. Along with the emerging racial gradient was a strong polarization on racial and economic lines in which impoverished African American tracts had

fewer national and regional supermarkets and a greater number of corner grocery and liquor stores than affluent White tracts. In 1980, clear class distinctions also began to occur within African American and White census tracts. Impoverished census tracts regardless of their racial composition had more corner grocery stores than wealthier census tracts.

These disparities emerged after a decade of racially restrictive population sorting which saw over 400,000 Whites abandon the city for the surrounding suburbs. Moreover, the previous decade bared witness to a major restructuring within the supermarket industry that reduced over a hundred stores from the city of Detroit. Consequently, more affluent African American census tracts predominately in the city of Detroit lost access to national and regional supermarkets in their own backyards. Furthermore, impoverished African American census tracts began to find themselves with an overabundance of corner grocery and liquor stores and a shortage of national and regional supermarkets. These racial and economic disparities continued through the 1990s. Consequently, poor Whites living predominately in the city saw their accessibility and neighborhood store composition levels deteriorate. It also is at this time that poor Whites start to see improved access to green grocers. In contrast, to the corner stores this reflects suburban poor Whites living in the suburbs closer to the fruit and vegetable markets often offered by farmers.

Overall, the strongest disparities with regard to national and regional supermarkets and liquor stores were between low-income African American census tracts and wealthy and middle class White census tracts. However, impoverished White tracts also began to have more corner grocery stores than wealthier African American tracts. These changes occurred at a time that saw wealthier African American relocating into the older industrial suburbs of Oakland County and wealthier Whites moving deeper into Macomb County as well as into the exurbs of Oakland and Wayne County. Suburbanizing wealthier African Americans were able to gain better access

to more national and regional supermarkets and leave behind the concentration of corner grocery and liquor stores in the city. Moreover, the city of Detroit saw its national and regional supermarket base reduced to 10 stores.

Despite the initial weakening, racial disparities in the food environment remerged by 2010. Nonpoverty area African American census tracts had the least number of national and regional supermarkets than their White counterparts. Moreover, the gap between affluent White and low-income African American census tracts was at its greatest with regards to neighborhood national and regional supermarket composition levels. On the other end of the spectrum, low-income White tracts found themselves with more corner grocery stores than their African American counterparts. However, this was a reflection of the retail disinvestment within the African American community. While not openly redlined, impoverished African American census tracts found fewer and fewer stores within them and black owned businesses found it harder to raise the necessary capital to open up new stores in wake of the disinvestment (Bates, 1997). These conditions were further exacerbated by the collapse of the tri-County economy in 2007.

The relative strengthening of disparities along racial dimensions is also supported by the logistic regression results. Prior to the massive transformation of the 1970s, census tract economic deprivation was a major causal factor in explaining census tract composition disparities with regards to national and regional supermarkets. Yet by 1990, the role of economic deprivation had given way to census tract racial composition as a major force in explaining disparities. African American census tracts had a less likelihood of having a national and regional supermarket locate within them than White tracts. The persistence of race in explaining the likelihood of a census tract containing a national and regional supermarket

continued through the remaining decades. Moreover, these results are supported by the population density measure. Initially, higher density neighborhoods such as in the city of Detroit had more national and regional supermarkets. However, by 1980 lower density suburban locations had a higher likelihood of having a national and regional supermarket present. These low density suburban neighborhoods were the very ones desired by fleeing Whites from the city.

With regards to the new neighborhood configuration ANOVAs, some of the findings described above were muted, however, strong inequities in the food environment persisted. In particular, low-income African American neighborhoods have fewer neighborhood national and regional supermarkets and a greater number of liquor stores in comparison to affluent White neighborhoods in every decade since 1980. Again, this trend emerged after the major restructuring of the 1970s. These neighborhoods also have a greater amount of corner grocery stores in every decade except for 1990. What is more, distinct racial disparities do not completely fade away. Nonpoverty African American neighborhoods have fewer national and regional supermarkets than comparable White neighborhoods in 1980. The biggest disparity between the new neighborhood and census tract configurations occurred within the logistic regression framework.

In the new configuration, the logistic models fell apart. While this could indicate that the role of racial process in explaining disparities in neighborhood supermarket composition levels is an artifact of the census tract configuration, it is more likely an artifact of the new neighborhood clusters. The creation of larger neighborhoods removed the variability from the dependent variable as there were less "neighborhoods" containing a national and regional supermarket stores. Interestingly, typical scaling effects among spatial data should strengthen results as the underlying variance of the entire dataset is reduced. Moreover, it would have been expected at

the very least that the neighborhood economic composition or population density measures would remain or become increasingly more important. Given that the new neighborhoods are generated from the population it would have been expected from traditional locational theory that national and regional supermarkets would seek out wealthier regions or areas with high population densities. However, the neighborhood economic composition measure was not statistically significant and the population density measure had a statistically significant negative relationship indicating that the lesser dense regions had more national and regional supermarkets.

The initial empirical narrative arising from the neighborhood compositions results gains credence from the cumulative accessibility results. Low-income African American census tracts have the lowest cumulative opportunities to national and regional supermarkets than wealthy White tracts in every decade from 1980 onwards. Moreover, they have more cumulative opportunities to corner grocery and liquor stores than the wealthy White census tracts in every decade.

With respect to the national and regional supermarkets, a familiar pattern emerges. Prior to the massive White suburbanization and prior to the retail decentralization and economic restructuring of the supermarket industry, African Americans enjoyed equal or in some cases better opportunities than Whites. However, these conditions were short lived due to the restructuring of the food environment and the massive White flight experienced in the region. Consequently, disparities in cumulative opportunities crystalized along racial and socioeconomic gradients. Furthermore, these trends do not simply fade away when the neighborhood boundaries are reconfigured. Low-income African American neighborhoods still face massive disparities in cumulative opportunities to national and regional supermarkets than wealthy White neighborhoods and they have an overabundance of opportunities to corner grocery and liquor

stores. If this was not enough, the coverage accessibility measures also highlight the levels of disparities in the region and how they relate to history of retail and residential suburbanization in the region.

Wealthy White census tracts had the greatest mean and minimum distances to national and regional supermarkets in 1970. These are the initial White communities that left the city of Detroit during the 1960s to settle in the low density suburban locations. In these locations, the built-environment promotes greater distances to existing amenities than would be found in the city and industrial suburbs. Moreover, while national and regional supermarkets were already in the suburbs, the massive decentralization of the supermarket industry had not yet occurred.

Interestingly, disparities in neighborhood accessibility to national and regional supermarkets along class and racial lines were not present during the 1980s and 1990s. Yet, early disparities in neighborhood accessibility to liquor stores were strongly differentiated along racial dimensions. African American low-income census tracts had shorter mean and minimum distances to liquor stores than equivalent White census tracts in 1970. This racial disparity was intensified in 1980 and 1990 with regard to the mean distances. Here, African American neighborhoods had shorter mean distances than White neighborhoods regardless of neighborhood deprivation levels. This corresponded with an era that saw an infill of liquor stores replace the decentralizing national and regional supermarkets.

At the turn of the new millennium, a clear racial gradient with regard to mean distances to the five nearest national and regional supermarkets emerged. African American census tracts had to travel greater distances than equivalent White tracts in 2000 and 2010. A clear class distinction also emerged in 2000 within the African American community, in which more affluent African American census tracts had to travel shorter distances than their low-income

counterparts to national and regional supermarkets. These patterns also were present with regards to neighborhood accessibility to liquor stores during these later decades. Middle and upper income African American census tracts had shorter mean and minimum distances to liquor stores than comparable White tracts. Likewise the low-income census tracts also saw the shortest mean and minimum distances than wealthier tracts in both communities. But the clearest message in the latter decades was the extreme disparities between low-income African American census tracts in comparison to wealthy White census tracts.

These developments are further confirmed by the census tract coverage accessibility regression results. Living in an African American census tract increases residents' mean and minimum distances to national and regional supermarkets in every decade after 1970. Moreover, living in such tracts equates to shorter mean and minimum distances to liquor stores in every decade from 1980 with the exception of mean distances in 2010. Here, living in an African American census tract increase one's mean distance to a liquor store. At first glance this might appear contrary, yet, given that living in an African American tract decreases one's minimum distance to a liquor store, this finding could be thought of as a lower concentration of liquor stores occurring in African American tracts. In essence, a liquor store is always nearby but selection of stores is declining because of the broader retail disinvestment in the city.

While the regression results highlight the importance of neighborhood racial composition they also validate the role of neighborhood socioeconomic conditions in explaining disparities. Increasing levels of census tract deprivation often increase minimum and mean distances to the nearest 5 supermarkets while reducing distances to unhealthful stores such as liquor stores. Taken together it would appear that both racial and economic stratification impact neighborhood accessibility levels.

The new neighborhood configurations do little to change these trends. White affluent neighborhoods still had the greatest mean and minimum distances to national and regional supermarkets in 1970. Similarly, the strongest disparities in the latter decades existed between low-income African American and wealthy White neighborhoods. Within the new neighborhood configuration, African American neighborhoods had to travel greater mean and minimum distances to national and regional supermarkets. Moreover, with regard to liquor stores low-income African American neighborhoods had shorter mean and minimum distances to liquor stores than wealthy White neighborhoods in every decade. In addition, African American nonpoverty areas travelled shorter mean and minimum distances to liquor stores than their equivalent White neighborhoods in every decade except 1990. Likewise, the class distinctions within the African American and White neighborhoods also persisted in 2000 and 2010 respectively.

These trends also are reflected in the regression results from the reconfigured neighborhoods. In the early decades of the study, living in an African American neighborhood did not impact accessibility levels to national and regional supermarkets. However, in 1990 and 2010 one's mean distances to the nearest 5 supermarkets was negatively impacted by living in an African American neighborhood. Likewise, increasing levels of neighborhood deprivation increase mean distances. With regards to neighborhood accessibility to national and regional supermarkets the biggest difference between the neighborhoods derived from census tracts and the reconfigured neighborhoods occurs with respect to minimum distances.

In the census tract configuration, neighborhood racial and economic composition played important roles in explaining disparities between neighborhoods. However, in the reconfigured neighborhood regression, the duality of the conditions is often reduced. As a result,

neighborhood racial composition only plays a role in explaining disparities with regards to minimum distances in one decade (2000) while neighborhood deprivation accounts for 3 decades. In contrast, there is little difference between the role that neighborhood racial and economic composition play in explaining disparities in neighborhood access to liquor stores.

Overall, these results clearly document disparities in the urban food environment of tri-County Detroit. Like past "food desert" research, this chapter documents clear socioeconomic and racial differentials in neighborhood food accessibility and composition levels. The persistence of disparities along racial dimensions challenges scholars who argue that the role of race in explaining neighborhood inequalities had not only declined overtime but had been replaced by economic processes. The on the ground reality is that both racially and economically driven processes have create an uneven food environment in which predominately low-income and minority neighborhoods bear the burden. The importance of these changing dynamics has been highlighted in this chapter. Consequently, studies that focus on one point in time are potentially overlooking how certain processes come to forefront to alter the food environment before receding to the background. Last, these disparities appear not to be an artifact of how the neighborhood boundaries are delineated.

There are several limitations to the analyses in this chapter that might impact the results and conclusions. First, the analysis is only as strong as the data recorded. As mentioned in chapter 4, there is a particular level of uncertainty in the data sources used to reconstruct the urban food environment which underlies the accessibility measures. Second, as discussed in this chapter the calculation of network distances are prone to error. Despite these errors and the assumptions made in the construction of the variables, it is believed that the analysis captures important dimensions of the changing food environment and its relationship to levels of

neighborhood accessibility and composition. The last potential source of area is the exogenous factors not addressed in the statistical models.

Accessibility is partly driven by built-environment characteristics such as density, land use mix and connectivity (Handy and Niemeier, 1997). While built-environment factors play an important role in promoting or discouraging how individuals move through space, other variables also shape how people experience and navigate the built-environment. Socio-spatial relationships, environmental conditions and personal values and lifestyles all influence accessibility levels (Rapoport, 1987; Vojnovic et al., 2013; forthcoming). These complicated socio-spatial boundaries in the context of the tri-County Detroit region are further exacerbated by the strident racial legacy of the region. The historical subjugation of the African American community in the region has shaped everything from the spatial mismatch of jobs to the codification of racial discrimination in the built-environment (Darden, 2009; Vojnovic, 2009).

At a different level, economic factors associated with site location of retail stores play a role in how certain opportunities are distributed across the built-environment. Store location models rely on estimates of consumer demand and potential sales volume, which are in part tied to potential purchasing power and income when making decisions about site selection (Ghosh and McLafferty, 1987). In addition, land prices, insurance premiums and other forms of business subsidies also influence how certain economic opportunities are distributed across the built-environment, which in turn would impact neighborhood accessibility and composition levels (Alwitt and Donley, 1997). While some of these dimensions are captured by the population density measure, additional measures could be constructed. In the end, the incorporation of locational factors would most likely strengthen the findings presented.

Last, while this chapter has attempted to validate the use of census tracts as an appropriate approximation of a neighborhood by comparing it against an alternative neighborhood configuration, it should be noted that there is a greater need for more research testing such conceptualizations. There is no definitive solution to the MAUP. More sensitivity analyses are needed to validate the continued use of census geographies in food environment studies and to minimize any potential errors associated with the scaling and zoning effects inherent in the use of spatial data to approximate neighborhoods. Although, the findings in this chapter lend support to utilizing census tracts in the tri-County Detroit region, less polarized regions might find different results. The reconfigured neighborhoods reproduced similar albeit slightly muted trends in the differentiation of the food environment.

Conclusion

This chapter has documented spatial and socioeconomic disparities in the tri-County Detroit food environment that were brought about by the disinvestment of retail from the city of Detroit and compounded by the racially selective residential suburbanization patterns and the broader restructuring of the supermarket industry. Disparities in the neighborhood store composition and accessibility levels to affordable nutritious food sources, such as national and regional supermarkets occur along both racial and economic dimensions. Despite the presence of both processes, the results in this chapter counter past arguments that have attempted to downplay the role of race in explaining neighborhood disparities. African American neighborhoods are devoid of national and regional supermarkets in comparison to their White counterparts due to the retail disinvestment in their neighborhoods, especially in the city of Detroit, and the spatial restriction placed on their residential suburbanization patterns. Consequently, as national and regional supermarkets moved into the suburbs, African American

populations were not able to follow due to widespread racial discrimination in the housing market.

Methodologically, this chapter has scrutinized how the conceptualization and operationalization of a neighborhood impacts food accessibility research. Past work has relied on census tracts to approximate neighborhood conditions. The findings in this chapter show that the reliance on census tract geographies to delineate neighborhoods might alter one's findings. In the context of the tri-County Detroit region, reconfigured neighborhoods weakened initial findings derived from the census tract analysis. Despite the reduction in the fidelity of the initial results, racial and socioeconomic disparities in the food environment persisted. Given that the reconfigured neighborhoods did not produce drastically different conclusion especially in regards to the causality of racial and economic stratification in the differentiation of the food environment, the findings in this chapter lend some validity to the use of census tracts to capture neighborhood dynamics. However, such results might not be replicated in regions experiencing lower levels of economic and racial polarization.

Theoretical and methodological considerations aside these results clearly outline the plight of low-income African American neighborhoods in the region. These disparities are magnified because these same communities have low-vehicle ownership rates, poor public transportation options and higher rates of walking. Consequently, the food environment within these neighborhoods places higher temporal and financial costs on residents seeking to obtain affordable nutritious food. These residents not only have to travel greater distances but they also must navigate an urban built-environment that has been heavily disinvested to the point that travel through it becomes more analogous to movement through low density, disconnected

suburban environments, even though physically, they maintain relatively high densities with highly connected street systems.

CHAPTER 6 CONCLUSION

Over the past 10 years, there have been increasingly divergent results emerging within the "food desert" literature in the United States. Newer findings have challenged long held associations and assumptions embedded within the literature. In particular, research, while noting the numerous difficult challenges posed by the decline and disinvestment of urban centers, has challenged the findings that socially and economically marginalized urban communities have limited access to and availability of affordable, nutritious and culturally appropriate food sources such as national and regional supermarkets. Such research also has called into question the associations and relationships between the neighborhood food environment and public health outcomes within marginalized urban communities. These mixed findings within the "food desert" paradigm echo a much larger debate on whether or not neighborhood effects contribute to individual and collective disparities in access to resources, opportunities, services and life outcomes.

While part of the diverging results reflects differences in methodological standards and socio-spatial relationships across cities and regions, they also arise out of the failure to examine several crucial assumptions within the 'food desert" literature as well as several of the core processes thought to differentiate the retail food landscape. First, neighborhood food environments have been considered influential in shaping the public health outcomes of socially and economically disadvantaged residents primarily due to the assumption that food consumption and purchasing overwhelming occurs within stores located in or near one's residence.

Implicit within such assumptions is the notion that marginalized residents are economically or physically confined to their immediate local food environment. Consequently,

the lynchpin between the food environment and public health outcomes has been the postulation that individuals are confined to shop and consume in their immediate food environment. Such conventions are in direct contrast with findings from the disadvantage consumer literature. Research since the 1960s has shown that low-income residents often shop at large-scale national and regional supermarket chains outside their local food environment in an effort to maximize their food dollars.

Second, past "food desert" research has struggled to define and operationalize the concept of neighborhood. Many studies simply equate a neighborhood to an arbitrary administrative boundary such as a census tract or ward. It is assumed that these boundaries accurately capture and represent the phenomena and processes under inquiry. Yet, social and economic processes, along with people's perceptions do not neatly align with such administrative boundaries. The reliance on administrative boundaries not only has caused researchers to overlook the heterogeneity in size and sociodemographics within such boundaries but it also has made past findings susceptible to the modifiable areal unit problem. Consequently, there are valid concerns that past findings and the processes attributed to them may be an artifact of how one defines a neighborhood.

Last, despite long held assertions that the creation of uneven food environments and the spatial inequities that arise from them are a byproduct of residential and retail suburbanization, economic restructuring within the supermarket industry and economic and racial stratification processes, little is known about how such processes play out in major metropolitan regions in the United States. To date, there have been few empirical studies that have attempted to examine how these processes have transformed and morphed an existing food environment. Moreover, given that most "food desert" studies occur at one point in time, there has been little knowledge

about how disparities in the food environment have evolved as well as the long term saliency of certain racial and economic stratification processes thought to be crucial in the differentiation of the food landscape.

This dissertation has utilized a social ecological framework, GIS, historical records and survey data to examine the historical transformation of the tri-County Detroit, Michigan food environment since 1970. In so doing, it has postulated several research questions and hypotheses to scrutinize the overlooked assumptions within the literature in order to broaden and deepen the urban geography discourse on urban food desert. First, in order to examine the untested assumption that socially and marginalized residents living in a limited urban food environment are restricted to shop and consume within it, this dissertation has asked, do people who live in neighborhoods with poor accessibility to national and regional supermarkets shop in their immediate food environment? It was hypothesized that residents, no matter their economic and physical constraints, predominately shop outside their neighborhood food environment rather than at nearer neighborhood convenience, liquor and corner grocery stores.

Along similar lines, this dissertation also raised the question; does living in a limited food environment adversely affect public health outcomes as measured by dietary-intake levels? It also was hypothesized that the ability of marginalized residents to shop at full-service supermarkets outside their immediate food environment would soften the negative neighborhood effects on the dietary-intake of individuals living in a limited food environment. Subsequently, it was offered that sociodemographics would play a greater role in explaining dietary-intake levels than neighborhood conditions due to the higher temporal and fiscal travel costs imposed on marginalized residents.

The findings from the household survey data analysis in chapter 3 have shown that residents—regardless of economical and physical mobility constraints—overwhelmingly shop for their groceries outside their immediate food environment. Instead of shopping at the disproportionate number of convenience, party and discount dollar stores located in their food environment, residents on the lower eastside of Detroit visit the national, independent and discount supermarkets located in the city and suburbs. These findings challenge past assumptions that socially and economically disadvantaged residents are restricted to visit stores nearest to them. These results confirm the initial hypothesis and question past research that has attributed direct associations between one's food environment, dietary-intake and diet-related health outcomes but fail to track where residents purchase and consume their foods.

Consequently, additional findings from chapter 3 have shown that the role of the immediate food environment in explaining disparities in dietary-intake among lower eastside Detroit residents was attenuated by their ability to reach full-service supermarkets. The amount of national, independent and regional supermarkets along with the number of convenience, liquor and corner grocery stores within 1-mile of a residents' home did not influence the consumption of soda, fruit juices, salty snacks, sweets, vegetables and fruits. The only direct role that the immediate retail food environment played on shaping dietary-intake levels was related to alcohol consumption. Residents with a large amount of corner grocery, party and liquor stores near their home drank more alcohol than residents with fewer stores near them. Moreover, the role of fast food establishments in explaining differences in dietary-intake levels was only significant with regards to vegetable intake. Here, residents with a large number of fast food establishments near their home ate fewer servings of vegetables than residents with only a handful of establishment near them.

The limited role of the immediate food environment was dwarfed by the role that sociodemographics played in explaining differentials in dietary-intake. Consumption of healthful foods, such as fruits and vegetables, disproportionately occurred among households with higher income levels. Moreover, levels of education, physical activity, gender and age all played important roles in explaining differences in dietary-intake levels. Given that the majority of residents visit stores such as independent, national and discount supermarkets that have long been thought to have a positive impact on diet, the results highlight the need to not overlook the conditions impacting the bottom financial lines of residents. Despite making trips outside their immediate food environment, lower-income residents rely on walking and public transit which imposes greater relative financial and temporal costs while the wealthy almost exclusively travel by car at lower relative costs.

The findings in chapter 3 also highlight how past conceptualizations of neighborhood are problematic when trying to capture how people navigate through the built-environment. Past research has assumed that an administrative boundary, often census geography, represents/delineates a neighborhood. As shown by the complicated travel patterns of residents in chapter 3, people's perceptions of neighborhood do not neatly align with administrative boundaries. The reliance on such boundaries fails to accurately capture how people interact and navigate the built-environment. It also highlights the need not to become too fixated on the local food environment in order to understand how built-environments shape health outcomes. Past studies reliance on the use of census tracts to delineate neighborhood boundaries have limited analysis to a predetermined spatial proximity that does not correspond with people's behaviors and ignores other components of the food environment.

In seeking to better understand how the uneven food environment of tri-County Detroit has come into existence and how it has evolved overtime, this dissertation has examined how the decentralization of retail supermarkets led to the creation of spatial inequalities in the food environment of tri-County Detroit, Michigan. It also has inquired whether spatial inequities are predominately differentiated by neighborhood racial composition or neighborhood economic conditions. Moreover, it has asked if existing spatial inequities are an artifact of how a neighborhood is delineated rather than the racial and economic segregation, racially restrictive residential suburbanization, retail deconcentration and massive restructuring within the supermarket industry long thought to have differentiated the food environment.

This dissertation has postulated that the historical formation of the tri-County Detroit food environment was tied crucially to how the suburbanization of retail supermarkets, as well as the economic restructuring of the supermarket industry occurred over a racially polarized landscape, which resulted in the creation of an uneven food environment between the predominately African American city of Detroit and the predominately-White suburbs. Subsequently, it was hypothesized that spatial inequalities in the food environment have been distributed unevenly across the region and vary predominately by levels of neighborhood racial composition rather than levels of neighborhood economic deprivation.

It was expected that African American sections of tri-County Detroit, including the more affluent African American census tracts, would have the greatest spatial inequities in access to national and regional supermarkets in comparison to low-income, middle class and affluent White census tracts. These same African American census tracts also were expected to be overburdened by an abundant access to unhealthful stores such as corner grocery, dollar and liquor stores. Accordingly, it was expected that the African American community would have

fewer national and regional supermarkets and a greater amount of corner grocery and liquor stores located in their neighborhoods when compared to White neighborhoods. These disparities were thought to be the product of divisive racial stratification processes embedded in region rather than an artifact of census geography.

Utilizing historical city and telephone directories along with historical archives to reconstruct the tri-County Detroit food environment (national and regional supermarkets, corner grocery, green grocers and liquor stores) since 1970, it has been shown that initially there were very few differences with regards to store composition levels between census tracts across the tri-County Detroit region in 1970. Low-income and wealthy African American census tracts had similar numbers of national and regional supermarkets as equivalent White census tracts. Moreover, levels of census tract deprivation played a greater role in determining the likelihood that a national and regional supermarket would be located within an area. Subsequently, disparities in census tract accessibility levels also were at a minimum in 1970.

In 1970, the only disparity within the tri-County food environment was between affluent White census tracts and African American census tracts. Individuals living in less deprived White census tracts had to travel greater distances to national and regional supermarkets than individuals living in an African American census tract. Consequently, these White census tracts also had the least cumulative opportunities to national and regional supermarkets even when compared to African American census tracts. In addition, the census tract racial and economic deprivation levels thought to be responsible for differentiating the food environment actually reduced the distances required to travel to national and regional supermarkets in 1970.

As documented in chapter 4, these initial disparities in the tri-County Detroit food environment reflected a time in which there were many national and regional supermarkets and

Whites located throughout the city of Detroit. While there was widespread White residential suburbanization into the inner suburbs occurring, it did not translate into widespread spatial inequalities within the food environment due to the relatively high concentration of national and regional supermarkets within the city of Detroit. With respect to affluent Whites, they were relocating to exurban communities that were located beyond the existing suburban ring of national and regional supermarkets. As a result, they experienced the greatest travel distances to national and regional supermarkets. Despite these distances, these communities also had the financial means to overcome such obstacles.

The relative stability of the tri-County food environment was fundamentally transformed during the 1970s. Over 400,000 Whites fled the city for the surrounding suburban communities. Once in the suburbs, they constructed formal and informal barriers that prevented African Americans from settling in the suburbs, as recognized by other Detroit researchers (Darden et al., 1987; Thomas, 1997; Farley et al., 2000; Sugrue, 2005; Vojnovic, 2009; Galster, 2012; Darden and Thomas, 2013). While the racially restrictive population sorting was occurring within the region, major transformations were occurring within the national and regional supermarket industry. During the 1970s, several of the leading national and regional supermarkets in the tri-County Detroit region, such as Allied Supermarkets and A&P fell into financial difficulties. These companies were forced to drastically reduce their foot print within the region. The ensuing store closings were concentrated in the city of Detroit which resulted in a fundamentally rearranged food environment by 1980.

In wake of these massive transformations, racial disparities began to emerge with regard to the number and availability of national and regional supermarkets across the region. Low-income White census tracts began to have more national and regional supermarkets than

comparable low-income African American tracts. Moreover, census tract racial composition became the major force in explaining the presence of a national and regional supermarket across tri-County Detroit by 1990. The emergence of race also reflected a polarized landscape in which impoverished African American census tracts had fewer national and regional supermarkets and a greater number of corner grocery and liquor stores than affluent White census tracts. These disparities and the salience of race in explaining them would continue to persist throughout the remaining decades of the study.

After the transformation of the tri-County Detroit food environment, racial disparities also began to emerge in the cumulative opportunities to national and regional supermarkets across the region. Middle and wealthy African American census tracts began to confront greater distances and have fewer opportunities to national and regional supermarkets than equivalent White census tracts. In addition, low-income African American census tracts began to have fewer cumulative opportunities to national and regional supermarkets and greater cumulative opportunities to corner grocery and liquor stores than the wealthy White census tracts. There also were disparities in census tract accessibility levels to liquor stores that occurred along racial lines. The African American community had to travel shorter distances to liquor stores than their White counterparts. Moreover, low-income African American census tracts had the greatest access to liquor stores.

Despite the differentiation in store composition levels, cumulative opportunities to national and regional supermarkets, corner grocery and liquor stores and accessibility levels to liquor stores along census tract racial composition, disparities in accessibility levels to national and regional supermarkets did not immediately emerge after the major restructuring of the tri-County Detroit food environment. The clear racial gradient with regard to the mean distances to

the five nearest national and regional supermarkets and the minimum distances to the nearest stores emerged in the latter decades of the study. African Americans, regardless of their socioeconomic status, had to travel greater distances to national and regional supermarkets than Whites in 2000 and 2010. This imbalance reflected the continued restructuring of the region's supermarket industry as well as a racialized landscape which prevented African Americans from relocating into the suburbs.

During the 1980s and 1990s, several of the national and regional supermarkets in the region were bought out by competitors, which one could reasonably argue, have had less commitment to the city of Detroit. These companies quickly closed many of the existing stores in the city of Detroit and constructed new stores in the suburban communities, which by 1990 were still predominately-White. By 2000, there was only one major national and regional supermarket chain with stores in the city of Detroit, Farmer Jack. Eventually, when Farmer Jack's parent company, A&P, faced increasing economic pressures in its core market, it withdrew from the region. This left the city devoid of opportunities. This process was exacerbated by the construction of larger, newer stores in the exurban communities and by continued spatial sorting of the population along racial dimensions. African Americans were heavily concentrated in the city and some of the older industrial suburbs. Consequently, African American communities experienced a massive disinvestment of retail from their communities.

While the food environment was becoming differentiated along racial lines, it also was becoming differentiated along class lines within the African American and White communities. After the major restructuring of the 1970s, low-income White census tracts had fewer national and regional supermarkets and a greater number of corner grocery stores than their affluent counterparts. Similarly, low-income African American census tracts had more corner grocery

stores than less deprived African American census tracts. However, unlike the racial disparities, class disparities were more pronounced in certain decades. When present, it was the low-income census tracts that had fewer opportunities and greater distances to national and regional supermarkets while having unrestricted opportunities and shorter distances to corner grocery and liquor stores than wealthier census tracts.

Overtime, the formation of inequalities across the tri-County Detroit food environment created an extreme disparity between low-income African American and wealthy White census tracts. Low-income African American census tracts not only had to travel greater distances to national and regional supermarkets but also had fewer cumulative opportunities and fewer national and regional supermarkets than affluent White census tracts. Subsequently, they also had greater cumulative opportunities and a larger number of corner grocery and liquor stores than wealthy White census tracts. Consequently, the greatest travel burdens to stores with affordable nutritious food staples fell upon the most marginalized members of the region.

The vociferous and enduring role of race in explaining the differentiation of the landscape was also validated in chapter 5. When examining the factors driving these disparities in the food environment, it was found that living in an African American census tract increased residents' mean and minimum distances to national and regional supermarkets in every decade after 1970. Moreover, living in such a neighborhoods equated to shorter mean and minimum distances to liquor stores in every decade from 1980 with the exception of mean distances in 2010. Last but not least, African American census tracts were less likely to have a national and regional supermarket located within them in every decade from 1980.

While these results support the initial hypothesis about the importance of racial composition, they also validate the role that socioeconomic conditions play in explaining

disparities in the food environment. Increasing levels of census tract deprivation often increased residents' distances to national and regional supermarkets while reducing their distance to unhealthful stores such as liquor stores. Despite, the importance of economic conditions, the message is clear: race remains a driving force in the differentiation of the tri-County Detroit food environment. Past accounts that have downplayed the role of race in relation to economic factors have overlooked and marginalized the constraints faced by the African American community in the tri-County Detroit region.

The findings of this dissertation build upon and extend past research that has examined the tri-County Detroit food environment. Past research has only documented accessibility differences between impoverished African American and impoverished White census tracts in 2000. While this past research excluded discount supermarkets from its analysis and covered a smaller study area, these results have been confirmed by the findings in chapter 5. Impoverished African American census tracts have to travel greater distances than impoverished White census tracts in 2000. Moreover, this dissertation shows that such disparities are not only limited to one decade.

In congruence with past research that has found that African American census tracts lack equivalent access to resources, ranging from clean environments to safe schools than White census tracts in metropolitan Detroit, this research has confirmed similar disparities with regards to the food environment. Most notably are the relative disparities with regards to national and regional supermarkets and amount of liquor stores between the African American and White communities.

Unlike past research, this dissertation is the first to examine the validity of these disparities in tri-County Detroit in relation to how one delineates a neighborhood. There has

been a growing concern that the unreflective use of arbitrary borders to capture human processes could lead to biases and results that are more tied to the boundary used rather than the underlying process. Utilizing spatial clustering algorithms to generate new neighborhood configurations across the study area, this dissertation has shown that the spatial inequities in the tri-County Detroit food environment and the racial and economic stratification driving them are not an artifact of census geography.

Past research has questioned whether or not the use of census geographies and other administrative boundaries biases trends and results related to neighborhood effects studies. Yet, economic and racial disparities in the food environment persisted even when the census tract as an appropriate unit of analysis was scrutinized. Disparities in the amount of national and regional supermarkets, corner grocery, green grocers and liquor stores located in White and African American reconfigured neighborhoods existed. Inequalities in the cumulative opportunities to such establishments as well as in the physical accessibility levels to national and regional supermarkets and liquor stores were also found between predominately-White and African American reconfigured neighborhoods. Moreover, low-income African American reconfigured neighborhoods had shorter distances to unhealthful food sources, such as liquor stores, in every decade when compared to affluent White neighborhoods. Such disparities expanded overtime, resulting in these same African American communities having to travel greater distances to national and regional supermarkets when compared to affluent White neighborhoods, starting in 2000. In addition, African American neighborhoods disproportionately had more cumulative opportunities to liquor stores than equivalent White neighborhoods, irrespective of neighborhood economic conditions in every decade from 1980.

Overall, the reconfiguration of the neighborhoods reduced the pure class and racial disparities especially in terms of national and regional supermarket access. Despite this muting, the polarization between low-income African Americans and affluent Whites continued after the reconfiguration of the neighborhood boundaries. The complex role that race and class play in explaining these disparities also persisted. The reconfigured neighborhood analysis confirmed the ebb and flow of racial composition and economic deprivation in explaining the observed inequities. Last, the reconfigured neighborhood analysis raises the need to scrutinize the boundaries used in food studies. While the new neighborhoods did not change the overall trends in the tri-County Detroit region, they did reduce the pure racial and economic impacts of the initial results. Consequently, studies in less polarized regions might be more adversely affected by how one delineates a neighborhood.

In seeking to better understand how the uneven food environment of tri-County Detroit has come into existence, this dissertation has added important contributions to the literature by filling the missing gap in the history and evolution of the food environment. This study has been the first to not only document how the tri-County Detroit food environment has evolved but also the first to examine how levels of spatial inequities in the food environment fluctuate overtime. Like past research in the tri-County Detroit region, it has shown that disparities in the food environment also occur along racial dimensions. In so doing, this dissertation has shown that the salience or race in differentiating the food environment is alive and well. Moreover, it has shown how race and economic conditions work in tandem to create unequal food environments. Last, this research has challenged one of the fundamental assumptions in the "food desert" literature in an attempt to better understand how evolving disparities in the food environment impact individuals and their health outcomes. In the end, this research has provided a rich

historical record of changing food accessibility and the processes that influence the creation of uneven food environments.

Speramus Meliora; Resurget Cineribus

On Monday, May 14, 2012, CEO Walter Robb, Detroit mayor Dave Bing and United States Senator Debbie Stabenow stood before a sea of politicians, community leaders and city residents on the corner of Mack Avenue and John R in Midtown Detroit, one of the wealthiest Detroit neighborhoods, to celebrate the ground breaking of a new 21,000 sq. foot Whole Foods.

Figure 6-1: Meijer Groundbreaking in Detroit (©Detroit Free Press)

On the Thursday of the same week, Hank Meijer, Dave Bing and Michigan Governor Rick Snyder broke ground at the corner of 8 Mile and Woodward Avenue in front of an enthusiastic crowd to celebrate the ground breaking of a 195,000 square foot Meijer (Figure 6-1). The new Meijer will anchor the first major shopping center, Gateway Marketplace, built on city land in over 50 years. While both the new Whole Foods and Meijer are funded largely through tax subsidies and incentives, the ground breakings marked a potential watershed for the city of Detroit.

Since the collapse of Farmer Jack in 2007, the only national and regional supermarket chains to locate in the city have been discounters Aldi and Supervalue (Save-A Lot). While largely heralded by politicians, developers and pundits as a sign of the new urban development that could return economic prosperity to the city, to many struggling residents and organizations working on increasing food security, the announcements raise anxiety and concerns that the neighborhood benefits from these new establishments will largely go to wealthy Detroit residents and suburban shoppers who work in Detroit. Will the opening of Whole Foods and Meijer usher in a new wave of retail development that will help alleviate some of the city's food insecurity or will the companies experience the same fate as Farmer Jack? How will the openings, one in an affluent neighborhood and the other on the city border with Ferndale, impact the spatial accessibility of the remaining Detroit neighborhoods? Should residents expect a panacea of health benefits? Were the countless hundreds of thousands of dollars spent subsidizing two large national and regional supermarket chains sound policy? If history offers any insights, then it should be one of trepidation.

This dissertation has shown that the lower eastside of Detroit residents already visit national, regional and discount supermarkets in the city and its suburbs. Consequently, they

already have access to stores that offer an array of nutritious food staples. Such retail activity raises questions about policy prescriptions that continue to solely focus on the composition of the food environment. There is no doubt that lower eastside of Detroit residents might visit newer stores in their communities, but evidence from this dissertation makes clear that shopping habits and patterns of low-income communities is complex and varied, and that socioeconomic conditions play an important role in this process. Even with newer stores near them they will continue to shop at more distant stores based on a milieu of sociocultural conditions. Policy makers must not lose sight that many residents are unable to afford healthful foods, lack nutritional knowledge and lack the time needed to prepare such foods.

The local food environment indirectly contributes to these burdens by increasing the temporal and fiscal travel costs of residents. It is well understood that while many of the lower-income Detroit residents travel to these distant store locations by walking or public transit, they wealthy suburbanites almost exclusively travel by car. However, the social benefits achieved by policies that give away millions of dollars in subsidies to relocate or open up new stores are unclear. That is, the savings achieved by closer stores will not necessarily be enough to improve dietary-intake levels, especially given that the entire study area lags behind recommended nutritional guidelines. Moreover, only focusing on the composition of the food environment opens the door for its potential upscaling. Prior to the bankruptcy of the city of Detroit, business owners and the city leaders were attempting to lure the gourmet Papa Joe's supermarket to the downtown. While good news to wealthy doctors and business professionals working in Midtown it would do little to alleviate the health disparities and food insecurity rampant throughout the city.

As an alternative proposition, instead of luring a handful of new stores to the city through huge subsidies, policy efforts could focus on increasing monthly food supports of programs such as SNAP and WIC, and expanding programs that match dollar for dollar money spent on certain food groups. Programs could also focus on expanding and strengthening the existing network of independent supermarkets scattered throughout the city. In conjunction with these programs could be active policy efforts that alleviate the burdens of poverty. Such programs will not only increase money available to purchase nutritious staples, while reducing the stresses of poverty, but they also will have the added benefit of keeping money within the local economy. The failure to tackle the economic and racial stratification process that are rampantly remaking the built-environment will only allow for the continued bifurcation of the city into the haves and have nots.

Future Research

The findings in this dissertation light the path for several avenues of future research. At one level, the findings highlight the need to link explicitly the travel patterns of socially and economically marginalized residents with their food purchasing and consumption habits. Only then can a clearer picture between the role of the food environment and public health outcomes be formulated. Future work will continue to link respondents travel patterns with their local food environment as well as the food environments associated with their work and school. In addition, future work will explore the role that independent supermarkets play in meeting the needs of marginalized communities. Not all independent supermarkets are created equal. There are a series of socio-spatial relationships that need to be addressed in order to understand better the role that such supermarkets play in the tri-County Detroit region. In particular, work needs to explore why there is only one African American owned independent supermarket in a

predominately African American city and how the historical tensions between the Chaldeans, the primary owners of the independent supermarkets, and the African American community might affect the food choices of residents.

At a similar level, the findings in this dissertation also open the door for a greater methodological examination of "neighborhoods" in food environment research. In particular, more sensitivity analyses are needed on the results of food accessibility studies that rely on administrative boundaries to construct neighborhoods. Future research will continue to examine how the delineation of a neighborhood can influence conclusions and policy outcomes associated with food environment studies. Moreover, there is a crucial need to link how individuals experience the built-environment and contextualize their own "neighborhood" environments in relation to their neighbors. There is a strong indication from this dissertation that individual's conceptualizations of their food environment will vary greatly due to life experiences and socio-spatial processes. Consequently, it is only through the layering of these accounts that accurate policy interventions can begin to be defined that will truly address the food insecurity and public health outcomes associated with the food environment.

At a broader level, the time has come to envision radically how the restructuring of the urban food environment can transform the socioeconomic foundations of Detroit and traditional hegemonic representations of space and place. The juxtaposition and dichotomization of place and space have served to create a series of embedded socio-spatial relationships that manifest themselves spatially as an impoverished and segregated landscape within a broader capitalist accumulation regime. Moreover, alternative conceptions of space have become marginalized and led to a resurgence of the culture of poverty. In essence, the fixation on the neighborhood food environment has served to reinforce conservative interpretations of inequality. Given that

the increasing trend in the literature is one in which low-income and minority communities have better accessibility, attention has become focused on internal neighborhood characteristics, actions and cultural behaviors rather than existing power geometries that have marginalized the community.

So how can one envision a new development or at least an unmaking of the uneven capitalist development that has legitimized a set of economic, political and cultural doctrines that have benefited a few at the expense of many. If one is to hope for better things arising out of the ashes, then one must begin to reexamine the linkages with the broader structural conditions occurring within our current era of capital accumulation. The fate of the city, the region and the residents hinges not on business as usual or local efforts but a widespread revision of Michigan's southeast region.

Within this vein, future research will begin to illuminate how the tri-County Detroit food environment is an articulation of particular moment within capitalist accumulation and development. The massive transformation of the tri-County Detroit region has led to a systematic disinvestment in the city that has constructed a particular built-environment that now burdens the low-income and minority residents of the region while obfuscating the broader structural conditions that continue to marginalize and dissolve the foundations of their communities. The transformation of the food environment is a crucial piece of this broader process. Work will begin to explore how the socio-spatial and socio-political relationships embedded in the urban food environment have been used to legitimize the persistence of hunger and poverty in the region. Moreover, it will investigate how exploitation of the African American community and the construction of the urban food environment contribute to the social production of the body of the countless thousands of tri-County Detroit residents.

Appendix A: City and Telephone Directories

Birmingham Polk City Directory 1960
Birmingham Polk City Directory 1970
Birmingham Polk City Directory 1980
Birmingham Polk City Directory 1989
Birmingham Polk City Directory 2000
Dearborn Polk City Directory 1960
Dearborn Polk City Directory 1970
Dearborn Polk City Directory 1980
Dearborn Polk City Directory 1990
Dearborn Polk City Directory 2000
Detroit Yellow Pages 1960
Detroit Yellow Pages 1970
Detroit Yellow/White Pages 1980-1981
Detroit Yellow/White Pages 1990-1991
Detroit Yellow Pages 2000
Detroit East Side Polk City Directory 1957
Detroit West Side Polk City Directory 1958
Detroit East Side Polk City Directory 1970
Detroit West Side Polk City Directory 1970
Detroit Down River Polk City Directory 1970
Detroit Down River Polk City Directory 1980
Detroit Down River Polk City Directory 1989
Detroit Down River Yellow Pages 1960
Detroit Down River Yellow Pages 1970
Detroit Down River Yellow/White Pages 1979-1980
Detroit Down River Area White/Yellow Pages 1990-1991
Detroit East Yellow Pages 1960
Detroit East Yellow Pages 1970
Detroit East Yellow/White Pages 1980-1981
Detroit East Yellow Pages 1990
Detroit East Yellow Pages 2000
Detroit North Area Yellow Pages 1960
Detroit North Oakland White/Yellow Pages 1990-1991
Detroit North Woodward Yellow Pages 1970
Detroit North Woodward Yellow/White Pages 1980-1981
Detroit North Woodward Yellow Pages 1990-1991
Detroit North Woodward Yellow Pages 2000
Detroit Northwest Yellow Pages 1960
Detroit Northwest Yellow Pages 1970
Detroit Northwest Yellow Pages 1980
Detroit Northwest Yellow Pages 1990
Detroit Suburban Northwest Yellow Pages 2000
Detroit West South Yellow Pages 1960
Detroit West & Downriver Area Yellow Pages 1960

Detroit West-Northwest Area Yellow/White Pages, 1980-1981
Detroit West-Northwest Area Yellow/White Pages 1990-1991
Detroit West Yellow Pages 1960
Detroit West Yellow Pages 1970
Farmington City Directory 1970
Lincoln Park, Allen Park and Melvindale Polk City Directory 1960
Lincoln Park, Allen Park and Melvindale Polk City Directory 1970
Lincoln Park, Allen Park and Melvindale Polk City Directory 1980
Macomb County Polk City Directory 2003
Novi and Northville Polk City Directory 2000
Oakland Country Polk City Directory 2003
Plymouth and Northville Polk City Directory 1961
Plymouth and Northville Polk City Directory 1970
Pontiac Polk City Directory 1960
Rochester Polk City Directory 1960
Rochester Polk City Directory 1970
Rochester Polk City Directory 1980
Royal Oak Polk City Directory 1960
Wayne, Garden City and Inkster Polk City Directory 1960
Wayne County Polk City Directory 2003

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