Georgia Institute of Technology

Predicting Revitalization

A Descriptive Narrative and Predictive Analysis of Neighborhood Revitalization in Atlanta, Georgia

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Over the past two decades, revitalization has been transforming many of Atlanta's unique neighborhoods and attracting new residents, businesses, and investments to the city's urban core. This has resulted in positive and negative effects that are important to consider as redevelopment continues throughout Atlanta, especially in low-income or disadvantaged communities. In order to mitigate the consequences of redevelopment while highlighting opportunities for growth and innovation, it is important to investigate how and why some Atlanta neighborhoods undergo revitalization earlier or at a more rapid pace than others. This paper seeks to identify significant physical, sociodemographic, and policy-related factors that may catalyze or otherwise predict revitalization in certain communities, and then apply these indicators to Atlanta's remaining neighborhoods to classify those with a greater potential to revitalize in the coming years. To achieve this, a time-lagged probit model was developed to measure hypothesized revitalization indicators within each of Atlanta's Neighborhood Statistical Areas across multiple time periods. This model suggests that revitalization often occurs in Atlanta neighborhoods that overlap with designated historic districts, those that are within walking distance of transit stations and the Beltline, those that are adjacent to other revitalized neighborhoods, those with lower percentages of renter-occupied housing units, and those with greater proportions of jobs in creative, higher education, and professional and technical service industries. Using these results, the model identified other neighborhoods that contain a combination of factors which make them susceptible to revitalization.

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INTRODUCTION

Over the past several decades, cities across the nation have experienced unprecedented revitalization of commercial, residential, and industrial neighborhoods within the urban core. This inner-city revival marks a turn from decades of disinvestment, abandonment, and blight for many neighborhoods and offers hope that these communities may regain a vibrancy and vitality that will result in a greater quality of life. Beginning in the 1950s and lasting through the end of the 20th century, factors including increasing suburbanization, periods of economic instability, and the eclipse of manufacturing sector jobs by service sector jobs left many inner city districts vacant or obsolete. Cities such as Charlotte, Fort Worth, Nashville, and Orlando reported that over 20% of their total land area was vacant in 2000, with others including St. Louis, Philadelphia, Detroit, and Cincinnati experiencing significant declines in population between 1960 and 2000 (Bowman and Pagano 2015; Schilling and Logan 2008). Although some inner city districts continue to struggle with blight and disinvestment, others have managed to revitalize into mixed-use, walkable, sustainable neighborhoods attracting renters and homeowners, new commercial and entertainment venues, and increased investment from real estate developers and local governments. As cities across the nation attempt to incorporate revitalization strategies into planning agendas while non-profit and grassroots organizations rally behind struggling neighborhoods, it is important to understand the both the indicators and predictors of revitalization as well as the impacts of revitalization activities on existing communities. What measures indicate that a neighborhood is revitalized? What types of existing conditions position some neighborhoods for successful revitalization ahead of others? By understanding the foundations and catalysts for revitalization, one can attempt to identify blighted areas that are likely to redevelop with greater speed and greater success relative to other neighborhoods in the city. This knowledge can, in turn, be used to develop policies and practices for

thoughtful revitalization that aim to curb displacement and retain important aspects of the cultural and social fabric of these neighborhoods.

Review of Existing Research

In the article "What if Cities Used Data to Drive Inclusive Neighborhood Change," authors Solomon Greene and Kathryn L.S. Pettit voice the need for new neighborhood early warning systems that utilize continually-expanding data resources and increased public input to guide forecasted neighborhood changes (Greene and Pettit 2016). Traditionally, these early warning systems have been used to predict and manage housing abandonment and neighborhood decline which then enables local governments and nonprofit organizations to identify and stabilize at-risk neighborhoods (Hillier et al. 2003). The concept proposed by Greene and Pettit adapts the early warning system to also identify neighborhoods forecasted to revitalize. With this predictive knowledge, municipalities can develop policies aimed at protecting vulnerable neighborhoods and mitigating displacement while guiding appropriate reinvestment activity and facilitating community engagement. However, few of these existing early warning systems use advanced statistical analyses to predict which neighborhoods will be most vulnerable to change (Hillier et al. 2003).

Likewise, a number of studies discuss the causes and implications of gentrification in specific places. One such study already exists for the City of Atlanta, in which the author outlines a history of gentrification in Atlanta, identifies sociodemographic and locational factors that influence gentrification, and then utilizes logistic regressions and T-tests to compare the characteristics of Atlanta's gentrified neighborhoods to non-gentrified ones from 1990 to 2000. The results of this study indicate that the age of housing units and the location of neighborhoods adjacent to gentrified areas are significant factors in predicting gentrification. However, this study does not examine certain physical characteristics and policy

variables that may impact a neighborhood's likelihood of gentrification, and it is limited to an analysis period of 1990 to 2000. Another limitation in this study is the method of measuring change over time using a cross-sectional analysis. It is particularly challenging to analyze gentrification using conventional statistical methods because it is a process that occurs over varying lengths of time that are difficult to quantify (Law 2008).

Another study published by Governing in 2015 examines gentrification at the Census tract level for the nation's 50 largest cities, including Atlanta. The report first establishes a definition for gentrification based on median home values, the percentage of the population over 25 holding bachelor's degrees, and median household income. Then, it identifies which tracts gentrified from 1990 to 2000 and from 2000 to 2010 based on significant changes in those variables over time. While this study contributes a clear definition of gentrification to the literature and provides a methodology for determining which tracts have gentrified, it does not offer any predictive information on revitalization and limits its focus to only sociodemographic factors (Maciag 2015).

Revitalization Strategies

Much of the existing research on neighborhood revitalization focuses on individual case studies of revitalization strategies. These are often place-based approaches that leverage existing natural, historical, or cultural amenities, tax credit programs and incentives, grassroots missions, and other features to foster redevelopment. One could hypothesize that neighborhoods featuring similar existing conditions may revitalize using the same strategies presented in these case studies. However, because these strategies are place-based and contingent upon certain amenities or environments, such strategies cannot be applied indiscriminately to any given neighborhood with the expectation that revitalization will

be successful. Ultimately, these case studies of successful revitalization catalyst projects helped to generate a preliminary list of predictive indicators of revitalization that apply to Atlanta neighborhoods.

In some cases, local governments and nonprofit groups develop programs and policies that target distressed neighborhoods for stabilization and reinvestment, therefore resulting in incentive-based revitalization. Jennings analyzes revitalization through the United States federal administration's Choice Neighborhood and Promise Neighborhood programs which locate highly-distressed neighborhoods and identify their specific needs. Jennings develops a distress score based on education, employment, income, housing, and public safety variables which is used to generate a ranking of Census tracts in Boston. Within this ranking system, Census tracts with higher scores are those with greater concentrations of foreclosures, crime, poverty, female-headed households, foreign-born residents, and other factors related to neighborhood distress. This information is then used by grassroots organizations and public agencies to facilitate civic engagement and initiate place-based responses targeting neighborhood needs (Jennings 2012).

Similarly, many local governments leverage tax increment financing (TIF) and offer other tax credits to attract new investments to distressed neighborhoods. Initially developed to target blight and support urban renewal efforts, TIF has expanded to finance a variety of economic development projects in some municipalities. The most common TIF structure collects property tax revenues generated by increases in local property values due to new development and investment activities. Previous research has shown mixed impacts of TIF and other tax incentive programs. Early studies indicate that TIF successfully stimulates community-wide property value growth and yields a positive impact on local employment (Man and Rosentraub 1998; Man 1999). However, more recent literature suggests that TIF generates minimal new revenue while only increasing intergovernmental tensions; one study even found that municipalities that offer TIF experience slower growth than those that do not (Briffault 2010; Dye and

Merriman 2000). The nature of the impact of TIF depends on the implementing body, the structure of incentives, and the characteristics of local communities in which TIF is applied.

Other studies show that unique existing features such as natural amenities, historic structures, and established "third places" can serve as anchors for revitalization. Many cities have achieved successful redevelopment along water features – examples include the River District in Portland, Oregon, the Los Angeles River Revitalization project, and Boston Harbor (Hagerman 2007; Gumprecht 2001; Hoffman 1999). Natural features provide unique backdrops for recreational activities, entertainment venues, and environmentally-conscious redevelopments. As cities seek to enhance their sustainability and resiliency, the restoration and revitalization of natural features can contribute to environmental, equitable, and economical planning solutions.

Cities which lack unique natural features may instead leverage their historic building stock as a catalyst for redevelopment. This is a common strategy of Main Street America, which has endeavored to restore the vitality of downtowns and commercial districts for nearly 40 years ("The Main Street Approach" 2015). Historic rehabilitation projects not only physically restore the built environment of older cities – they can also provide employment opportunities for community members and increase neighborhood pride. Many neighborhoods apply for historic district designation through the National Register of Historic Places. Historic designation encourages restoration efforts by providing opportunities for neighborhoods to receive federal investment tax credits, preservation grants, and other redevelopment incentives. Likewise, the age of housing stock in urban areas may affect where revitalization occurs. While personal preference may attract some homeowners to historic homes in older inner-city neighborhoods, studies suggest that one predictor of gentrification is the amount of new housing stock in the urban core, although one could argue that new housing stock is a symptom of revitalization rather than a predictor (Brueckner and Rosenthal 2009).

Research shows that “cultural clusters” – concentrations of cultural resources such as resident artists and nonprofit arts organizations – can create a unique identity for a neighborhood which may, in turn, spur revitalization. Generally, residents who are engaged in neighborhood cultural activities are more likely to participate in other community activities, which, in turn, encourages neighborhood-level community building efforts. The resulting collective efficacy - in which community members band together to create grassroots movements for neighborhood improvement - is critical in improving quality of life and community health. Although it is difficult to measure collective efficacy and quantify its impacts on neighborhood revitalization, suggested relationships between cultural amenities, community engagement, and neighborhood economic development warrant further attention (Stern and Seifert 2010). Similar relationships can be observed between creative clusters and revitalization. Some studies promote the adoption of placemaking efforts, the provision of flexible arts investments and funding, and the development of inclusive creative spaces throughout the community as revitalization catalysts (Nowak 2007). Richard Florida’s popular “creative class” concept suggests that clusters of creative professionals - defined by Florida as those who “are primarily paid to use their minds - the full scope of their cognitive and social skills” - are key to bolstering local economic development (Florida 2014). Ultimately, these clusters of cultural and creative assets can serve as revitalization catalysts with recognition and support from private and public entities.

Others still identify the roles of strong civic leaders, development “pioneers”, and dedicated community organizations in catalyzing revitalization. An excellent example is Boston’s Dudley Street neighborhood, where community members transformed their blighted and crime-ridden surroundings into their vision of an “urban village” through grassroots projects and an unconventional, resident-led approach to eminent domain (Benfield 2012). Civic leaders encourage redevelopment through zoning reforms and incentive programs. Some cities form business improvement districts or implement tax increment financing in order to spur new development (Mitchell 2001). Some successful revitalization

efforts, such as Denver's Lower Downtown, or "LoDo" district, are the result of the dedicated efforts of key community members. LoDo's revitalization was championed in its early stages by John Hickenlooper, a LoDo business owner and later Mayor of Denver and Governor of Colorado, and Dana Crawford, who advocated for historic preservation, beginning with Denver's Larimer Square. LoDo's revitalization status was solidified with the construction of Coors Field in the early 1990s (Segal 2015). Active and emphatic buy-in from strong community leaders and development pioneers is important for forging partnerships between public offices and private organizations.

Few existing studies examine the collective effect that these factors have on predicting neighborhood revitalization. However, some research instead focuses on causes and effects of gentrification, including predictive socioeconomic and market-based factors of gentrification. In "Alternative Explanations for Inner-City Gentrification: A Canadian Assessment," David Ley presents four explanations for gentrification, which include changes in neighborhood demographics, price inflation of housing in suburban communities, preference shifts towards urban amenities and lifestyles, and the rise of downtown service industry economies, which attracts white-collar workers to housing in urban areas. Ley's research findings indicate that the strongest simple correlations with gentrification exist between amenity- and economy-related factors, with the highest correlation occurring as a measure of office space per capita. A shortcoming of this study as it relates to our research question is that many of these factors are symptoms of revitalization as opposed to predictors, often experiencing significant changes once revitalization has already been catalyzed (Ley 1986). Other research suggests that gentrification may be predicted by the income of neighboring tracts and inter-neighborhood spillover effects as well as proximity to the urban core (Kolko 2007). However, the number of studies examining the collective predictors of revitalization and gentrification is far exceeded by the number of studies assessing their impacts and consequences.

This study seeks to synthesize key findings from existing literature and case studies to measure the combined impact of different factors on neighborhood revitalization. Once significant predictive indicators are identified, a probit model can be used to calculate revitalization probability for each neighborhood. Then, public, private, and nonprofit groups can identify those neighborhoods which are more likely to revitalize and generate policies and plans to guide appropriate growth and redevelopment into the future. This early-warning system for revitalization can help to preserve key natural and cultural features that are unique to certain neighborhoods while mitigating displacement of existing residents and businesses and the loss of neighborhood character.

UNDERSTANDING THE REVITALIZATION PROCESS

Identifying the predictors of revitalization first requires a relative understanding of the revitalization process. One of several challenges when studying revitalization is that the revitalization process is fluid and continuous, and therefore difficult to assess through cross-sectional examination at a single time period. It is also challenging to establish a boundary between "revitalizing" and "revitalized," which leads to further inquiry on how to define revitalization.

A 2005 Brookings Institute publication outlines twelve general steps of the revitalization process. The first six steps outline planning for revitalization, while the remaining six steps focus on implementation. Although no two neighborhoods are alike, this list of twelve steps contains common themes that are applicable in many revitalization efforts. The framework provided here can be tailored to individual neighborhoods using local-area physical, socioeconomic, and policy variables.

In the first two steps, communities must capture a vision and then develop a strategic plan to support it, taking into account key characteristics such as housing, social values, employment, retail,

character, and community involvement. Stakeholders then come together to form *private/public partnerships*, which aim to encourage private development with some limited municipal involvement. Once formed, these partnerships can lead initiatives for zoning and building code reforms in order to attract private investment and guide appropriate redevelopment. Public entities should also establish business improvement districts and other non-profit organizations to advocate for appropriate redevelopment, cohesive architecture and urban design, affordability, and transit alternatives. Then, these partnerships and organizations must recruit developers who are willing to take risks in order to be pioneers in the revitalization process.

Once the revitalization vision and strategies are developed and all stakeholders are identified, strategies must be implemented in the community. Although this is seemingly intuitive, too often, plans created through much time, effort, and coordination are ultimately shelved while funding, logistics, and politics are sorted out. The Brookings publication recommends that implementation begin with the creation of a walkable urban entertainment district that will draw people back into the city. Following this, a rental housing market should be developed, targeting young students and professionals who are looking for a live-work-play atmosphere. It is critical to simultaneously develop an affordability strategy that aims to be inclusive for local residents and businesses. Once an initial rental market has been established, focus can shift to for-sale housing that will attract middle and upper-middle homeowners downtown, bringing an additional tax base and a greater demand for surrounding amenities. A strategy for new local-serving retail can then be developed in order to meet the needs of a strong and diverse residential sector. Finally, strong office markets can be re-created, filling in existing vacant office buildings that are the result of past cycles of over-building. Oftentimes, this final step isn't achieved until 15 to 20 years have passed since the initial stages of revitalization. While this twelve-step process certainly doesn't apply in all situations, it serves as a general guideline for cities seeking revitalization (Leinberger 2005).

DEFINING REVITALIZATION

As noted throughout the existing literature, one challenge in measuring and predicting revitalization is the lack of a clear, universally-accepted definition of revitalization. Previous research defines revitalization as "a process to influence and support individual and institutional choices within a regional context toward investment in a particular neighborhood or neighborhoods" or "changes that improve the existing residents' quality of life" (Schubert 2001; Bright 2003). A 2010 publication by Karen Chapple and Rick Jacobus stratifies revitalization into three different typologies: revitalization of low-income neighborhoods that remain low-income but have greater access to services, revitalization of low-income neighborhoods into mixed-income neighborhoods, where some affluent residents move into the neighborhood or the incomes of existing residents are increased through local improvements, and revitalization of low-income neighborhoods resulting in gentrification and displacement of existing residents (Chapple and Jacobus 2010).

Many researchers are quick to distinguish between revitalization and gentrification, and the terms are not considered synonymous for this study. Gentrification, generally defined as "simultaneously a physical, economic, social, and cultural phenomenon…the invasion by middle-class or higher-income groups of previously working-class neighborhoods or multi-occupied 'twilight areas' and the replacement or displacement of many of the original occupants," describes a process of revitalization that has ultimately resulted in resident displacement and a shift in neighborhood demographics (Hamnett 1984). This study relies on several previous studies of gentrification to contribute to the definition and measurement of revitalization, but ultimately classifies revitalization separate from gentrification. This begs the question, can neighborhoods achieve revitalization without causing gentrification? While not central to this study, the identification of revitalization strategies that truly "improve the *existing* residents' quality of life" is a crucial area of research that merits further exploration.

Based on the existing literature, neighborhood revitalization will be defined for this study as the process through which disinvested neighborhoods experience reinvestment as the result of certain physical, social, and programmatic factors. It is important to note that revitalization is a process and not a singular event – this concept becomes a challenge in measuring revitalization and is discussed later in this paper.

NEIGHBORHOOD REVITALIZATION IN ATLANTA'S URBAN CORE

Over the latter half of the 20th century, Atlanta's inner city neighborhoods experienced significant decline as residents moved to outlying suburban areas. By the turn of the century, Atlanta was rooted in a suburbanization crisis resulting in widespread sprawl across the 10-county metropolitan region. Although several Atlanta neighborhoods began revitalizing in the 1990s, population growth and development beyond the city limits has far outpaced any growth within the city. In fact, Atlanta is consistently named within the top ten sprawling cities in the U.S., earning the number one spot in 2010 according to one study, and the number two spot in 2014 according to another (Jaffe 2017; Stott 2014). Some researchers have even nicknamed Atlanta "the Poster Child of Sprawl" (Mulholland 2017).

Founded in 1847 as a railroad city, Atlanta stood for many years as the South's singular transportation and commercial hub. Much of the city's ensuing development was directed by issues of race and class. Throughout the 20th century, segregation was sustained through policies and practices which restricted the growth and movement of black communities while favoring new developments in white communities. Zoning ordinances were implemented in the 1930s, resulting in the separation of land uses and, in many cases, separation by race and income. By the mid-20th century, federal policies were reoriented to encourage metropolitan decentralization and major highway construction. Highway

construction bisected neighborhoods and dismantled communities, often at the expense of black and Latino communities, resulting in displacement and neighborhood collapse. Waves of suburbanization followed, as white middle- and upper-class families moved out of the inner city to greenfield developments along the newly constructed highways. Offices and retail quickly followed, leaving inner-city neighborhoods abandoned and blighted. This out-migration was further facilitated through the development of Atlanta's transit system, MARTA, in the early 1970s. Much like the highway system, MARTA stations and new rail lines cut through existing inner-city neighborhoods, exacerbating issues of abandonment and community dissolution (Brown and Thompson 2008). An office development boom in the 1980s brought new construction to inner city commercial areas, but many of these buildings struggled to attract businesses. Few investments were made to attract residents, retail, and entertainment to downtown areas, and remaining inner-city residential neighborhoods fell into further states of disrepair.

The late 1980s also ushered in some of the first revitalization efforts in Atlanta's blighted neighborhoods. An example is the Midtown neighborhood just north of Atlanta's central business district, where the largest rezoning in Atlanta's history and a strong push for the preservation of the Fox Theatre and other historic assets catalyzed major neighborhood revitalization ("The Story of Midtown" 2015). Since then, similar efforts have been made to revitalize Inman Park, Old Fourth Ward, Kirkwood, West End, and other Atlanta neighborhoods (Maciag 2015).

While Atlanta has continued to experience decentralization, interest towards in-town investments and infill development has grown significantly in recent years. The Atlanta Regional Commission's Livable Centers Initiative (LCI) program has become a key source of funding and support for revitalization efforts – while not explicitly created to redevelop inner-city neighborhoods, the LCI program aims to improve connectivity among business, retail, and residential uses in existing neighborhoods. Over 100 communities have been awarded LCI grants since 2000, with many utilizing funding towards

revitalization projects. Within Atlanta, several LCIs have been granted to support transit-oriented developments that aim to capitalize on the value of in-town living, while others have been granted to corridors or neighborhoods to improve walkability, attract investment, and increase quality of life (Dobbins 2005; Goodwin 2017).

Invest Atlanta, which serves as the city's economic development authority, also advocates for the redevelopment and expansion of in-town living opportunities. Comprised of the Downtown Development Authority, Urban Residential Finance Authority, and Atlanta Economic Renaissance Corporation, Invest Atlanta offers bond financing, housing financing, revolving loans, tax credits, and tax increment financing in order to facilitate public-private partnerships within the city and promote job creation, economic growth, innovation, entrepreneurship, and neighborhood reinvestment. Invest Atlanta also functions as the redevelopment agent for the city's tax allocation districts (TADs). A TAD is a tax increment financing tool that enables governments to provide financial assistance toward specific private or public capital projects. Ten TADs have been implemented in Atlanta, with the majority of these targeting reinvestment efforts in older in-town neighborhoods ("Tax Allocation Districts" 2016).

Some Atlanta neighborhoods with significant historic structures, sites, or objects have pursued historic designation from the National Register of Historic Places, which can result in additional funding for renovation and stricter design guidelines. Historic districts often serve as catalysts for reinvestment within inner cities, because they offer interesting building stock and a unique narrative that can support placemaking efforts. The City of Atlanta contains over 50 historic districts registered through the National Register of Historic Places, as well as a number of additional historic sites, buildings, and objects ("National Register of Historic Places Database and Research Page" 2015). Atlanta's Urban Design Commission is tasked with reviewing and approving all applications for changes to these buildings, sites, and districts. The city's office of planning has compiled a list of economic incentives and resources for historic

preservation that encourages the restoration and redevelopment of historic properties ("Urban Design Commission" 2017)

Transit access in Atlanta may also play a role in neighborhood revitalization. Although MARTA has been a facilitating factor in Atlanta's decentralization, new transit-oriented developments surrounding MARTA stations aim to draw residents and businesses into walkable, mixed-use, in-town neighborhoods. Ultimately, transit-oriented developments can increase transit ridership and public safety, reduce rates of vehicle miles traveled and energy consumption, provide transit alternatives, bolster household disposable incomes, and anchor economic development efforts (Lombard 2017). Shifting lifestyle preferences have also resulted in an increased desire to live in transit-accessible areas; this is particularly true of millennials, but also of baby boomers who wish to age in place (Thrun, Leider, and Chriqui 2016).

In recent years, the Atlanta Beltline, a rails-to-trails project encircling the core of the city, has generated significant redevelopment activity in bordering neighborhoods. Studies show that even the announcement of the Beltline and public discussion of its associated TIF had a positive impact on housing prices within nearby communities. This project has bolstered revitalization efforts in Old Fourth Ward and Inman Park, and it is expected to generate reinvestment in blighted south- and west-side neighborhoods. However, concerns over affordability and displacement have prevailed since the Beltline was announced, and many residents of low-income neighborhoods - especially along the Beltline's southern segments - have experienced the pressure of inflated rents or increased property taxes. The Beltline certainly plays a role in Atlanta's in-town revitalization, but it illustrates the need for programs and policies that mitigate the negative repercussions of revitalization (Immergluck 2009).

The initiatives and phenomena discussed here are hypothesized to have some measurable impact on neighborhood revitalization. Other important factors to consider are sociodemographic variables such

as median household income, racial composition, age structure, and education, the quality of nearby jobs and schools, and housing characteristics such as building age and tenancy status.

PREDICTING REVITALIZATION: MODEL OVERVIEW

Measuring and predicting revitalization is complicated by difficulties in defining revitalization and establishing its timeline. This prevents the use of conventional regression modeling techniques or a simple cross-sectional study which examines revitalization and its effects at a single moment in time. Another challenge is defining the geographic extent of revitalization, especially given the highly-localized nature of many revitalization catalysts. To reconcile these difficulties, this study employs a time-lagged regression model that analyzes the characteristics of Neighborhood Statistical Areas (NSAs) before and after revitalization has occurred. Neighborhood statistical areas are similar to Census tract groups, but attempt to reflect local neighborhood boundaries. In Atlanta, therefore, NSAs correlate directly with established neighborhoods such as English Avenue, Bankhead, Kirkwood, and Grant Park. In order to collect neighborhood characteristics at the NSA scale, all data were collected at the Census tract scale or smaller and then redistributed or aggregated to the NSA scale. Appendix figure 1A shows a map of all Atlanta NSAs, and appendix table 1A lists neighborhoods associated with each NSA.

The time periods used in this study attempt to capture the robust revitalization activity that has occurred in Atlanta over the past fifteen years. However, the financial and housing crises in the late 2000s negatively impacted many revitalization efforts and had adverse effects on property values, which could disproportionately weigh into the results of this study. Therefore, two analysis periods were selected that cover 2002 to 2006 and 2010 to 2014. Revitalization status in the final year of each period is predicted by characteristics of the NSA in the first year of the period.

This study utilizes a time-lagged probit regression to compare the predicted revitalized neighborhoods for each study period to the actual revitalized neighborhoods. Because there are 102 unique NSAs within the City of Atlanta and two separate time periods of study, the number of cases used in the regression totals to 204 cases. First, a collection of predictive indicators of revitalization was hypothesized according to existing literature. "Revitalized" Atlanta neighborhoods were then identified using a revitalization benchmark which considers various physical and social factors discussed in previous studies. Next, data points were gathered from 2002, 2006, 2010, and 2014 for each predictive indicator. Then, the significance of the causal relationships between "revitalized" neighborhoods and their predictive indicator data from the preceding period was determined using a probit regression. This regression also produces a probability of revitalization for all 204 cases, which can then be compared to the actual revitalization status for each NSA. The strength of the probit model is assessed using a receiver operating characteristics (ROC) curve.

DETERMINING PREDICTIVE INDICATORS

Predictive indicators for this study were identified by researching journal and newspaper articles, case studies, and publications on revitalization from national organizations such as Brookings Institution, the U.S. Department of Housing and Urban Development, and the Center for Community Progress. These indicators can be classified as physical factors related to the built environment, social factors that describe sociodemographic characteristics of the local community, and policy factors that pertain to government-sponsored incentive programs and redevelopment priority areas. The indicators selected for use in this study were limited by the scale and quality of available data. It was also necessary for indicators to be measurable across the time range selected for the lagged model. One challenge when identifying appropriate predictive indicators was to separate revitalization predictors from revitalization symptoms.

Factors such as changes in property values, shifting neighborhood sociodemographic characteristics, and housing occupancy statistics are likely symptomatic of a revitalization process that is ongoing. Instead, this study attempts to identify the physical, social, and policy-related factors that serve as revitalization catalysts within neighborhoods. A preliminary list of predictive indicators is provided in Appendix Table A2.

Predictive indicators are measured using percentage variables, raw value variables, and binary variables. Some indicators are measured in multiple ways; for example, tax allocation districts are measured as percentage variables and binary variables. This allows the model to determine whether the percentage of an NSA within a tax allocation district has a significant effect on revitalization, or if it is only important that a portion of the NSA is within the tax allocation district, which is reflected by a binary variable. Jobs are also measured in two ways: one variable accounts for the raw number of creative, higher education, and professional and technical jobs per NSA, while another variable measures the ratio of these target jobs to total jobs in the NSA.

CREATING A REVITALIZATION BENCHMARK

Existing literature fails to establish a process for determining whether or not a neighborhood has revitalized; therefore, a rough measure of revitalization had to be developed as part of this study. Within Atlanta, there is a general colloquial knowledge that dictates which neighborhoods are revitalized and which are not, as evidenced by city-based newspapers, blogs, and other outlets such as Curbed Atlanta and Creative Loafing. These publications highlight changes in property value, major shifts in sociodemographic characteristics, and concentrations of new developments as signals that a neighborhood has revitalized (recall that these factors were previously noted as symptoms of revitalization). The *Governing* article, which maps gentrification throughout Atlanta, primarily relies on

sociodemographic factors to define gentrification and largely overlooks physical neighborhood changes (Maciag 2015). Based on these previous discussions of revitalization, this study examines changes in property value over ten years, the number of commercial and residential conversions per neighborhood since 2008, and changes in educational attainment among neighborhood residents to identify which Atlanta neighborhoods have undergone revitalization during the past fifteen years. The resulting list of "revitalized" neighborhoods established through this measure is provided in Table 1 below:

These results were corroborated using local knowledge and a brief examination of neighborhood physical conditions through Google Street View. A quick visual analysis of neighborhood streets depicts a mixture of older building stock with interspersed new developments, improved streets and sidewalk infrastructure in some areas, and a focus on place-making and creating neighborhood identity.

The next step was to classify the "revitalized" NSAs under one of the two time periods used in the study. Due to the subprime mortgage crisis beginning in 2007 and the subsequent financial crisis whose consequences were particularly severe in Atlanta, most revitalization activity occurred during the 2002-2006 period and then again in the 2010-2014 period. This stratification on either side of the financial crisis simplified the process of determining which NSAs fell into which time periods. Ultimately, 28 NSAs were classified as revitalized sometime between 2002 and 2014; these NSAs are listed and mapped in Figure 1.

Figure 1: Revitalized Neighborhood Statistical Areas, 2002-2014

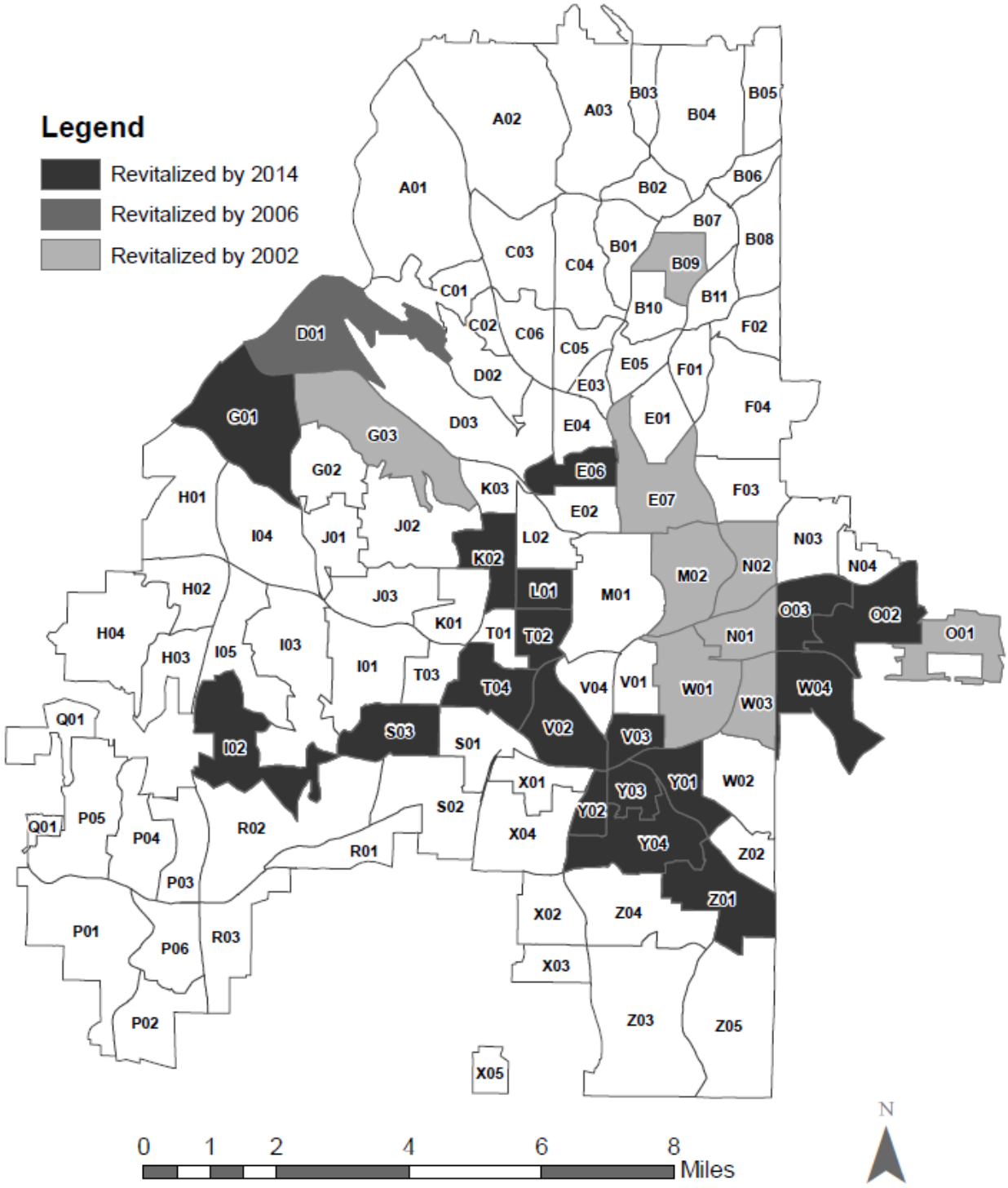


Table 1: Revitalized Neighborhood Statistical Areas, 2002-2014

NSA	Neighborhoods	Year*
B09	Garden Hills	Pre-2002
E07	Midtown	Pre-2002
G03	Carver Hills, Rockdale, Scotts Crossing, West Highlands	Pre-2002
M02	Old Fourth Ward, Sweet Auburn	Pre-2002
N01	Cabbagetown, Reynoldstown	Pre-2002
N02	Inman Park, Poncey-Highland	Pre-2002
O01	East Lake, The Villages at East Lake	Pre-2002
W01	Grant Park, Oakland	Pre-2002
W03	Ormewood Park	Pre-2002
D01	Bolton, Riverside, Whittier Mill Village	2002-2006
E06	Home Park	2010-2014
G01	Atlanta Industrial Park, Bolton Hills, Brookview Heights, Chattahoochee, English Park, Lincoln Homes, Monroe Heights	2010-2014
I02	Cascade Heights, East Ardley Road, Green Acres Valley, Green Forest Acres, Horseshoe Community, Magnum Manor, West Manor	2010-2014
K02	Bankhead, Washington Park	2010-2014
L01	Vine City	2010-2014
O02	Kirkwood	2010-2014
O03	Edgewood	2010-2014
S03	Cascade Avenue/Road	2010-2014
T02	Atlanta University Center, The Villages at Castleberry Hill	2010-2014
T04	West End	2010-2014
V02	Adair Park, Pittsburgh	2010-2014
V03	Peoplestown	2010-2014
W04	East Atlanta	2010-2014
Y01	Chosewood Park, Englewood Manor	2010-2014
Y02	Amal Heights, Betmar LaVilla, High Point, Joyland	2010-2014
Y03	South Atlanta, The Villages at Carver	2010-2014
Y04	Lakewood Heights	2010-2014
Z01	Lakewood, Leila Valley, Norwood Manor, Rebel Valley Forest	2010-2014

GATHERING LONGITUDINAL DATA

Data corresponding to each predictive indicator was gathered for the years of 2002, 2006, 2010, and 2014. For some indicators, such as tax allocation districts, MARTA stations, and livable center initiatives, the variable becomes zero for years in which the policy or feature was not active. For other indicators, such as the jobs variable, data values change throughout the various years of study. Appendix Table A2 includes a list of all variables considered in this study and hypothesized effects for each on neighborhood revitalization.

PREPARING THE TIME-LAGGED PROBIT MODEL

Once longitudinal data was gathered for each predictive indicator, all data was formatted for use in a time-lagged probit model. Each record in the model corresponds to a particular NSA during one of the two study periods and its predictive indicator data for the preceding period. The record's revitalization status is given as zero for years in which the NSA has not met the revitalization benchmark and one for the years in which it has surpassed the benchmark. A total of 204 records were input into the model and several iterations of the model were executed with different types and combinations of covariates. Receiver operating characteristic curves were used to calculate fit for each iteration, with higher ROC values corresponding to greater matching of predicted and actual revitalization status for each NSA. Iterations were developed by using multiple methods to select, combine, and transform different variables. The first method followed a "pick-and-choose" approach, in which variables were included and excluded from the model at random and changes in model results were recorded. Based on this observed cause-and-effect relationship, the model was continually refined to yield higher ROC values. Under a second approach, related variables were combined using principal components analysis and then included

in the model among other independent, single variables. This approach reduces multicollinearity by creating factors which explain potential relationships among small groups of variables. Ultimately, iterations developed under each of these approaches were compared to identify significant predictive indicators of revitalization and determine which NSAs have the highest likelihood for revitalization. The results of the various model executions are discussed in the next section.

STUDY FINDINGS

Three model iterations were selected for final analysis: Iteration A was produced using the "pick-and-choose" approach for binary variables, Iteration B was produced using principal components analysis of percent variables, and Iteration C was produced using principal components analysis of binary variables. While results vary slightly among these three iterations, many similarities can be identified pertaining to significant variables and the distribution of neighborhood revitalization probabilities.

SIGNIFICANT VARIABLES

Iteration A is comprised of the factors shown in table 2. The time-lagged probit model based on Iteration A indicates that proximity to MARTA stations and the Beltline, adjacency to revitalized NSAs, and co-location with historic districts are positively related to higher probabilities of revitalization, while greater percentages of renter-occupied housing are negatively related to likelihood of revitalization. Adjacency to other revitalized neighborhoods has the greatest impact on probability to revitalize, which corroborates the hypothesis that revitalization has significant spillover effects into nearby neighborhoods. Proximity to MARTA rail transportation also yields a strong impact on revitalization, whether due to

resident and business location choice or targeted investment efforts generated by transit-oriented development. Historic districts and proximity to the Beltline[1] also have positive effects on revitalization probability, whereas % renter-occupied homes has a negative effect.

Table 2: Iteration A Time-Lagged Probit Model Results

	Iteration A "Pick and Choose" Model, AUC = 0.904	
Variable	**Coefficients**	**Significance**
School proficiency index	-0.011	0.209
% population over 25 with a bachelor's degree	0.011	0.352
% population over 9 years old	0.013	0.696
Median household income	0.000	0.053
% renter-occupied homes	**-0.029**	**0.006**
Number of target jobs within NSA	0.009	0.131
Structure year	0.000	0.863
NSA within half-mile of MARTA station	**1.119**	**0.011**
NSA within half-mile of the Beltline	0.623	0.062
Adjacent to revitalized neighborhood	**1.181**	**0.000**
NSA within TAD	0.231	0.457
NSA within LCI	0.292	0.313
NSA within Historic District	**0.603**	**0.045**

Iteration B was generated by creating two factors from the following variables: school proficiency index, % population black, % population over 25 with a bachelor's degree, and median household income (sociodemographic/class factor); and % renter-occupied housing, % of an NSA with walking distance of a MARTA station, and % of an NSA within a TAD (TOD/transit infrastructure factor). These two factors were then combined with other independent variables, shown in table 3, and input into the time-lagged probit model. Results indicate that the sociodemographic/class factor has a significant, negative impact on revitalization probability. Conversely, proximity to the Beltline and existing revitalized neighborhoods and

[1] Proximity to the Beltline is significant at a 90 percent confidence interval.

co-location within a historic district or an LCI yield a positive effect on probability to revitalize. These results are summarized in table 3.

Table 3: Iteration B Time-Lagged Probit Model Results

		Iteration B Percent Factor Model, AUC = 0.866	
Factor	**Variable**	**Coefficients**	**Significance**
Sociodemographic/ class factor	**School proficiency index, %black, %bachelors degree, median household income, %renter occupied housing**	**-0.63**	**0.006**
The TOD/transit infrastructure effect	%NSA within 0.5 miles of MARTA station, %NSA within a TAD	0.041	0.739
	%under 9	-0.028	0.357
	%NSA within 0.5 miles of Beltline	**0.009**	**0.039**
	Adjacent to revitalized NSA	**1.287**	**0**
	%NSA within historic district	**0.013**	**0.006**
	Structure year	0.000	0.576
	%NSA within an LCI	**0.010**	**0.028**
	%target jobs within the NSA	0.009	0.102
	Existing neighborhood association	-0.186	0.509

Iteration C is structured similarly to Iteration B, although it utilizes binary variables instead of percent variables. Dimension reduction yields three factors from the following variables: school proficiency index, % population black, and % population over 25 with a bachelor's degree (race and education factor); number of target jobs within the NSA and whether an NSA falls within walking distance of a MARTA station (jobs access factor); and whether an NSA falls within a TAD or within walking distance of the Beltline (Beltline investments factor). Results of Iteration C indicate that the race and education factor has a significant, negative impact on revitalization probability, while the Beltline investments factor, adjacency to revitalized NSAs, and co-location within a historic district yield significant, positive impacts. These findings are shown in table 4.

Table 4: Iteration C Time-Lagged Probit Model Results

		Iteration C Binary Factor Model, AUC = 0.864	
Factor	**Variable**	**Coefficients**	**Significance**
Race and education factor	**School proficiency index, %black, %bachelors degree**	**-0.645**	**0.004**
Jobs access factor	Number of target jobs within NSA, NSA within 0.5 miles of MARTA station	0.094	0.385
Beltline/TAD overlap	**NSA within 0.5 miles of Beltline, NSA within TAD**	**0.294**	**0.009**
	%renter occupied housing	-0.011	0.171
	Adjacent to revitalized NSA	**1.212**	**0.000**
	NSA within LCI	0.357	0.19
	NSA within historic district	**0.817**	**0.007**
	Existing neighborhood association	-0.131	0.644
	Structure year	0.000	0.717
	%under 9	-0.032	0.301

The results of all three iterations indicate that the most common predictors of revitalization are adjacency to other revitalized NSAs, proximity to the Beltline, and location within a historic district, which were shown to be significant in each iteration. Race and education variables and renter-occupied housing were found to be significant in two out of three iterations. The effect of LCIs and proximity to MARTA stations were only significant in one out of the three iterations.

REVITALIZATION PROBABILITIES

The time-lagged probit model produces probabilities of revitalization for each NSA in 2006 and 2014 based on sociodemographic, physical, and policy-related variables. These probabilities, which range from 0 to 1, measure the likelihood that an NSA will revitalize given the values of independent variables during the preceding period of study. These results provide two key insights: when compared with actual

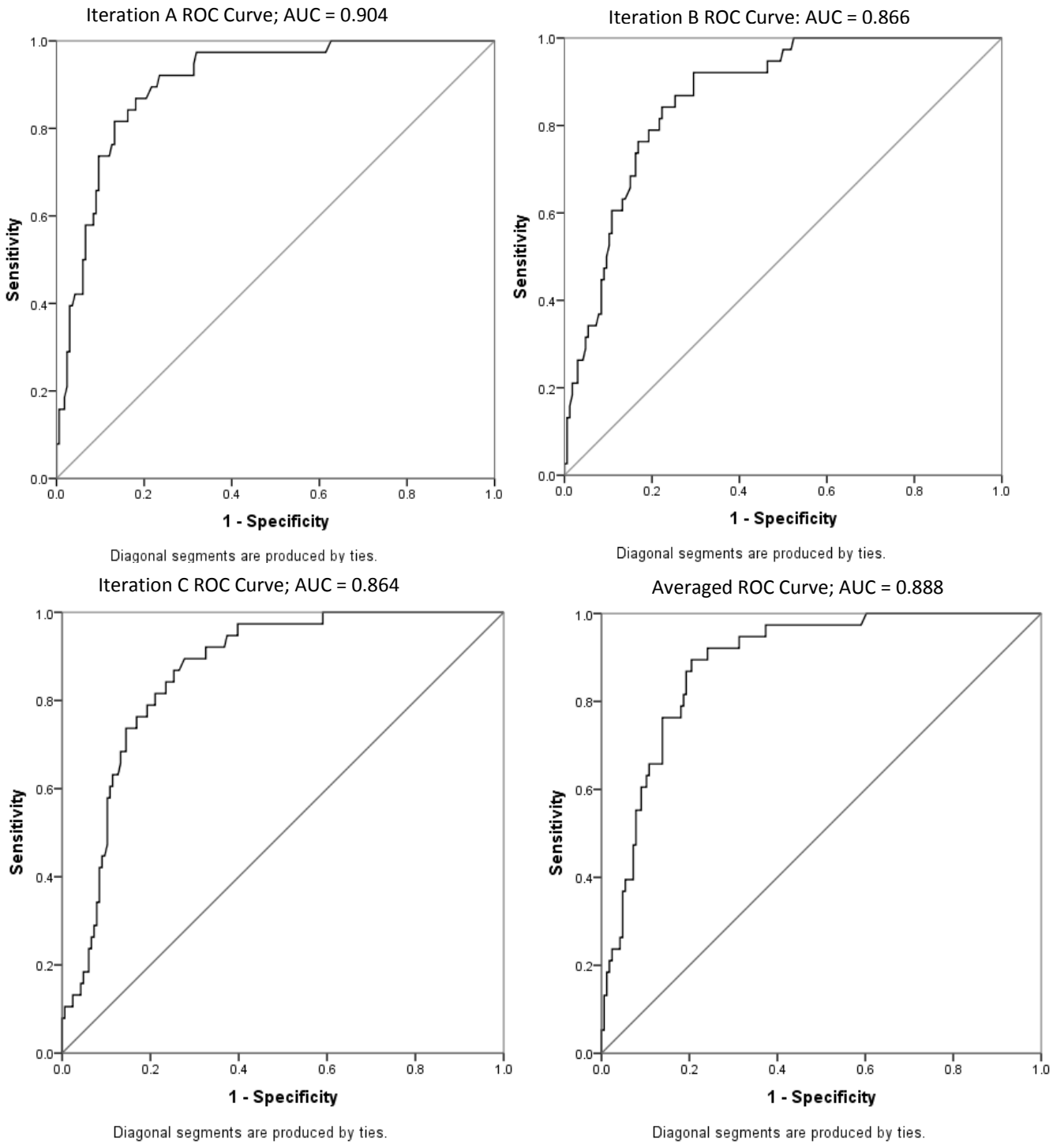
revitalization status, these probabilities can function as a validation tool, and when ranked for all non-revitalized neighborhoods, these probabilities can be used to estimate which NSAs are most likely to revitalize in the future. The following sections will examine the probability insights from each of the three model iterations.

VALIDATING REVITALIZATION

Within each period of study, NSAs which have already surpassed the revitalization benchmark (and are therefore considered "revitalized") are denoted with a response variable value of 1. By producing a receiver operating characteristic (ROC) curve for each iteration, the binary dependent revitalization variable can be compared with results of the probit model to test the model's predictive power. An ROC curves is often employed to measure the performance of classification models which contain binary dependent variables. This tool operates on the assumption that higher values of probability correlate with increasing belief that an NSA has already revitalized. Consequently, four predictive outcomes are possible: true-positive, in which a revitalized NSA is predicted to be revitalized based on its probability score; true-negative, where a non-revitalized NSA is predicted to be non-revitalized based on its probability score; false-positive, in which a non-revitalized NSA is falsely predicted to be revitalized; and false-negative, in which a revitalized neighborhood is falsely predicted to non-revitalized. The resulting curve plots sensitivity versus (1-specificity), where sensitivity is the proportion of true positive cases for all positive outcomes and specificity is the proportion of true negative cases for all negative outcomes. The area under the curve (AUC) value is a measure of the model's predictive power, where greater area corresponds with greater reliability in predicting revitalization. Of the three iterations presented in this study, Iteration A had the highest AUC value of 0.904, indicating strong predictive power. Iterations B and C had similar AUC values of 0.866 and 0.864, respectively, denoting lower, but still strong, predictive power. When

probabilities are averaged across all three iterations, the AUC value is 0.888. These results are reflected in figure 2 below.

Figure 2: Receiver Operating Characteristic Curves



The results of the probit model can be evaluated further to determine which NSAs were correctly predicted to be revitalized. For each iteration, true-positives for the 2002-2006 and 2010-2014 periods are listed in tables 5 through 8 and 9 through 12, respectively. Based on probability averages across all three iterations, true-positive results for 2002-2006 include Garden Hills, Grant Park, Oakland, Cabbagetown, and Reynoldstown. By 2014, true-positives include Ormewood Park, Peoplestown, West End, Midtown, Inman Park, Poncey-Highland, Kirkwood, Old Fourth Ward, Sweet Auburn, and East Atlanta.

Table 5: Iteration A True-Positive NSAs, 2002-2006 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration A	0.64	B09	Garden Hills
	0.64	W01	Grant Park, Oakland
	0.59	N02	Inman Park, Poncey-Highland
	0.52	E07	Midtown

Table 6: Iteration B True-Positive NSAs, 2002-2006 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration B	0.58	N01	Cabbagetown, Reynoldstown
	0.51	B09	Garden Hills

Table 7: Iteration C True-Positive NSAs, 2002-2006 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration C	0.53	N01	Cabbagetown, Reynoldstown
	0.50	G03	Carver Hills, Rockdale, Scotts Crossing, West Highlands

Table 8: Averaged True-Positive NSAs, 2002-2006 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Average	**0.52**	**N01**	**Cabbagetown, Reynoldstown**
	0.52	**W01**	**Grant Park, Oakland**
	0.51	**B09**	**Garden Hills**

Figure 3: True-Positive NSAs, 2002-2006 Period

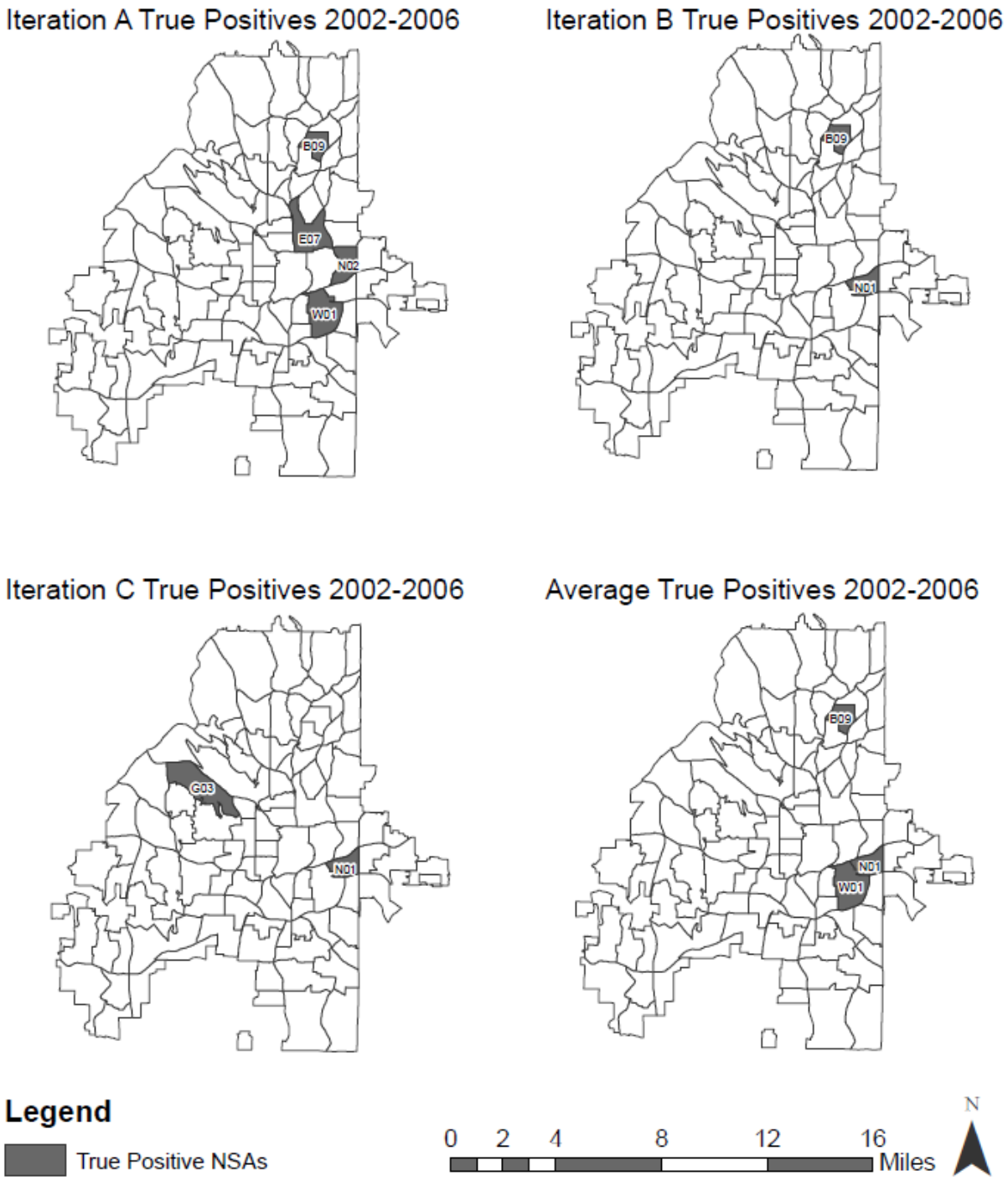


Table 9: Iteration A True-Positive NSAs, 2010-2014 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration A	0.90	W01	Grant Park, Oakland
	0.89	N01	Cabbagetown, Reynoldstown
	0.88	N02	Inman Park, Poncey-Highland
	0.79	M02	Old Fourth Ward, Sweet Auburn
	0.79	B09	Garden Hills
	0.70	W03	Ormewood Park
	0.67	E07	Midtown
	0.65	T04	West End
	0.61	K02	Bankhead, Washington Park
	0.59	O02	Kirkwood
	0.57	V03	Peoplestown
	0.55	W04	East Atlanta

Table 10: Iteration B True-Positive NSAs, 2010-2014 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration B	0.95	N01	Cabbagetown, Reynoldstown
	0.81	W01	Grant Park, Oakland
	0.71	M02	Old Fourth Ward, Sweet Auburn
	0.66	W03	Ormewood Park
	0.64	B09	Garden Hills
	0.62	N02	Inman Park, Poncey-Highland
	0.58	V03	Peoplestown
	0.55	T02	Atlanta University Center, The Villages at Castleberry Hill
	0.54	O03	Edgewood
	0.53	O02	Kirkwood
	0.52	T04	West End

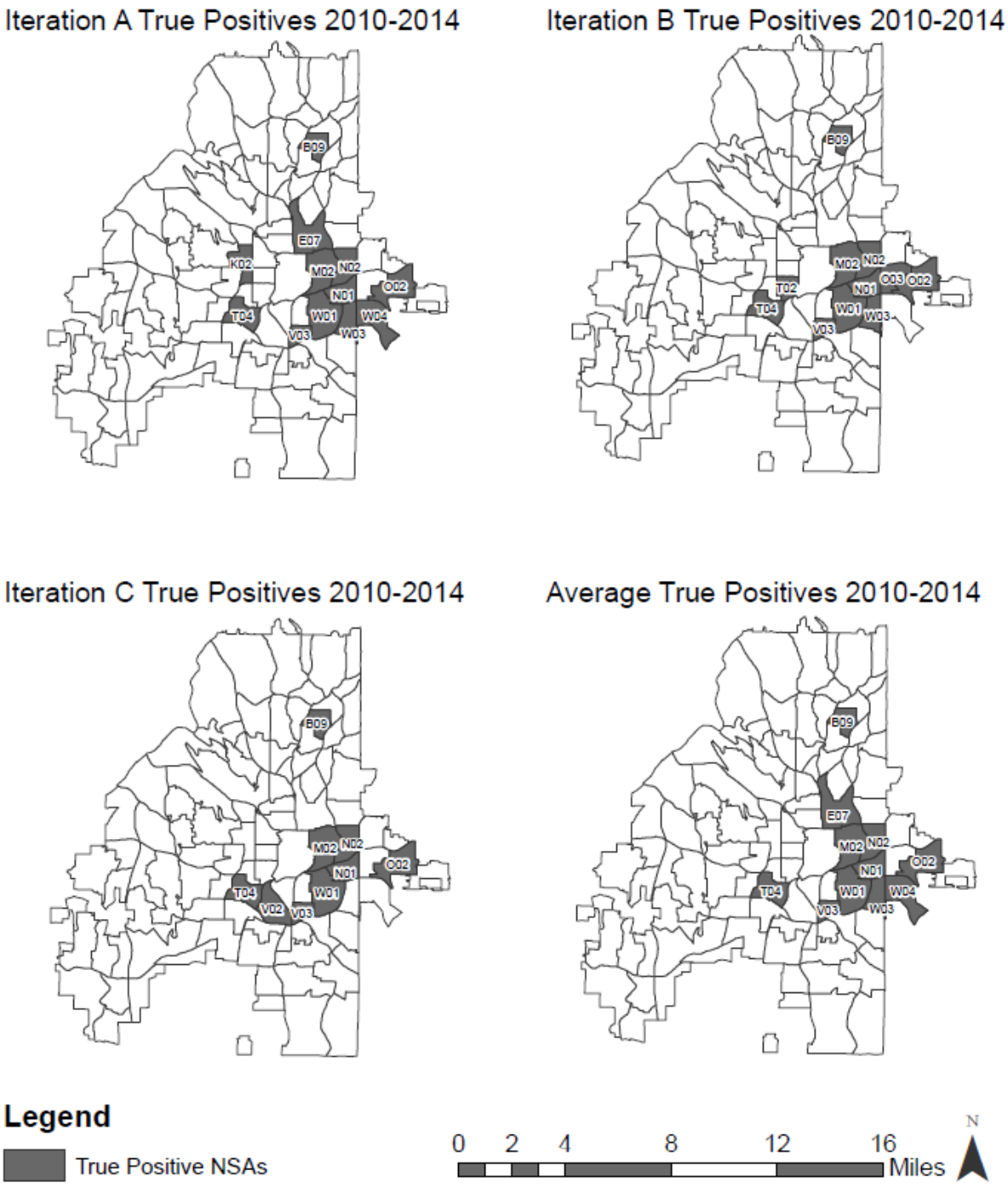
Table 11: Iteration C True-Positive NSAs, 2010-2014 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Iteration C	0.92	N01	Cabbagetown, Reynoldstown
	0.88	W01	Grant Park, Oakland
	0.87	M02	Old Fourth Ward, Sweet Auburn
	0.73	N02	Inman Park, Poncey-Highland
	0.66	B09	Garden Hills
	0.60	T04	West End
	0.54	O02	Kirkwood
	0.52	V03	Peoplestown
	0.51	V02	Adair Park, Pittsburgh

Table 12: Averaged True-Positive NSAs, 2010-2014 Period

Model	Probability	True-Positive NSAs	True-Positive Neighborhoods
Average	**0.92**	**N01**	**Cabbagetown, Reynoldstown**
	0.86	**W01**	**Grant Park, Oakland**
	0.79	**M02**	**Old Fourth Ward, Sweet Auburn**
	0.74	**N02**	**Inman Park, Poncey-Highland**
	0.70	**B09**	**Garden Hills**
	0.61	**W03**	**Ormewood Park**
	0.59	**T04**	**West End**
	0.56	**V03**	**Peoplestown**
	0.55	**O02**	**Kirkwood**
	0.50	**W04**	**East Atlanta**
	0.50	**E07**	**Midtown**

Figure 4: True-Positive NSAs, 2010-2014 Period



PREDICTING REVITALIZATION

False-positive cases indicate which NSAs may be poised for revitalization, given particular neighborhood characteristics. For the 2010-2014 period, Iteration A false-positive results are shown in table 13. Iteration A produced high probabilities of revitalization for many neighborhoods located near the center of the city and adjacent to one or more revitalized NSAs. Downtown, Castleberry Hill, Hunter Hills, Mozley Park, Knight Park, and Howell Station have the greatest probabilities of revitalization, which is reflected by redevelopment efforts that are already occurring in some of these neighborhoods.

Table 13: Iteration A False-Positive NSAs, 2010-2014 Period

Model	Probability	False-Positive NSAs	False-Positive Neighborhoods
Iteration A	0.82	K03	Knight Park/Howell Station
	0.69	K01	Hunter Hills, Mozley Park
	0.68	M01	Castleberry Hill, Downtown
	0.65	D03	Berkeley Park, Blandtown, Hills Park
	0.61	X01	Capitol View, Capitol View Manor
	0.51	S01	Bush Mountain, Oakland City

Iteration B produces slightly different results than Iteration A, as shown in table 14. The model generated a high revitalization probability for the NSAs containing the Georgia Tech, Marietta Street Artery, and Grove Park neighborhoods, while Berkeley Park, Blandtown, Hunter Hills, Mozley Park, Bush Mountain, Oakland City, and Capitol View have probabilities below 50 percent. The Georgia Tech neighborhood, which largely consists of institutional facilities owned and operated by the Georgia Institute of Technology, has experienced some revitalization in the form of new building construction and increased property values (although “revitalization” within the predominantly institutional neighborhood occurs under different circumstances than within other residential/commercial neighborhoods.) The Marietta Street Artery has also been the site of several new adaptive reuse loft and office projects in the Means Street Historic District and new residential developments and restaurants along Marietta Street.

In fact, the Means Street Historic District was even recently upgraded to Landmark District status, which further protects significant period buildings in the neighborhood (Kahn 2017).

Table 14: Iteration B False-Positive NSAs, 2010-2014 Period

Model	Probability	False-Positive NSAs	False-Positive Neighborhoods
Iteration B	0.90	K03	Knight Park/Howell Station
	0.62	V01	Capitol Gateway, Summerhill
	0.58	E02	Georgia Tech, Marietta Street Artery
	0.55	M01	Castleberry Hill, Downtown
	0.53	S01	Bush Mountain, Oakland City
	0.53	J02	Grove Park

Iteration C adds Brookwood Hills, Buckhead Village, and Peachtree Park to the list of false-positives but omits Hunter Hills and Mozley Park. Brookwood Hills is a predominantly residential neighborhood that has commercial uses on the western border - in recent years, several new commercial developments and residential renovations have signaled neighborhood reinvestment. Buckhead Village and Peachtree Park have also experienced recent redevelopment activity. Although Buckhead Village still contains several vacant or declining properties, the restoration and reopening of The Buckhead Theatre in 2010 has created a community landmark that can anchor new developments (“Theatre History” 2017). Peachtree Park is home to a mix of older single family residences and new-builds.

Table 15: Iteration C False-Positive NSAs, 2010-2014 Period

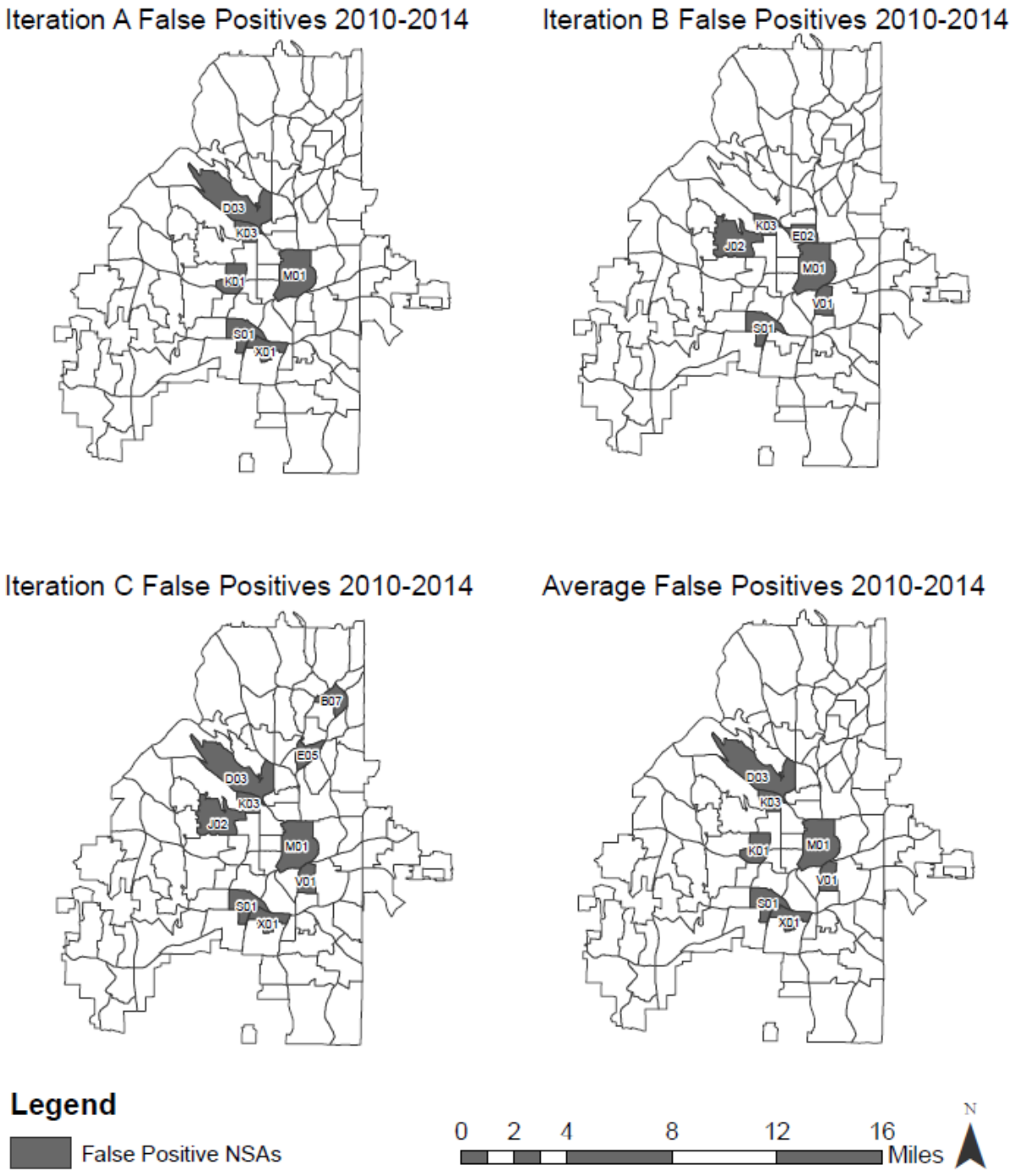
Model	Probability	False-Positive NSAs	False-Positive Neighborhoods
Iteration C	0.80	K03	Knight Park/Howell Station
	0.73	M01	Castleberry Hill, Downtown
	0.68	X01	Capitol View, Capitol View Manor
	0.64	V01	Capitol Gateway, Summerhill
	0.62	S01	Bush Mountain, Oakland City
	0.62	E05	Brookwood Hills
	0.53	D03	Berkeley Park, Blandtown, Hills Park
	0.51	J02	Grove Park
	0.50	B07	Buckhead Village, Peachtree Park

Averaging probabilities of revitalization across all three iterations generates the following false-positive results: the Knight Park and Howell Station neighborhoods reflect the highest revitalization probability, followed by Downtown and Castleberry Hill, Capitol Gateway and Summerhill, Bush Mountain and Oakland City, Capitol View and Capitol View Manor, Hunter Hills and Mozley Park, and, finally, Berkeley Park, Blandtown, and Hills Park. In some of these neighborhoods, symptoms of revitalization are already present. Castleberry Hill, for example, has experienced redevelopment in recent years, as evidenced by plans for a new Hard Rock Hotel and mixed use development at the north end of the neighborhood and a number of adaptive reuse projects throughout the community. In Blandtown, the Ellsworth Office Park development has repurposed an old industrial complex into new creative office spaces (Sams 2014). Popular Westside fixtures Bacchanalia and Star Provisions also plan to relocate to Blandtown near the Ellsworth complex (Wenk 2017).

Table 16: Averaged False-Positive NSAs, 2010-2014 Period

Model	Probability	False-Positive NSAs	False-Positive Neighborhoods
Average	**0.84**	**K03**	**Knight Park/Howell Station**
	0.65	**M01**	**Castleberry Hill, Downtown**
	0.58	**V01**	**Capitol Gateway, Summerhill**
	0.55	**S01**	**Bush Mountain, Oakland City**
	0.54	**X01**	**Capitol View, Capitol View Manor**
	0.54	**K01**	**Hunter Hills, Mozley Park**
	0.52	**D03**	**Berkeley Park, Blandtown, Hills Park**

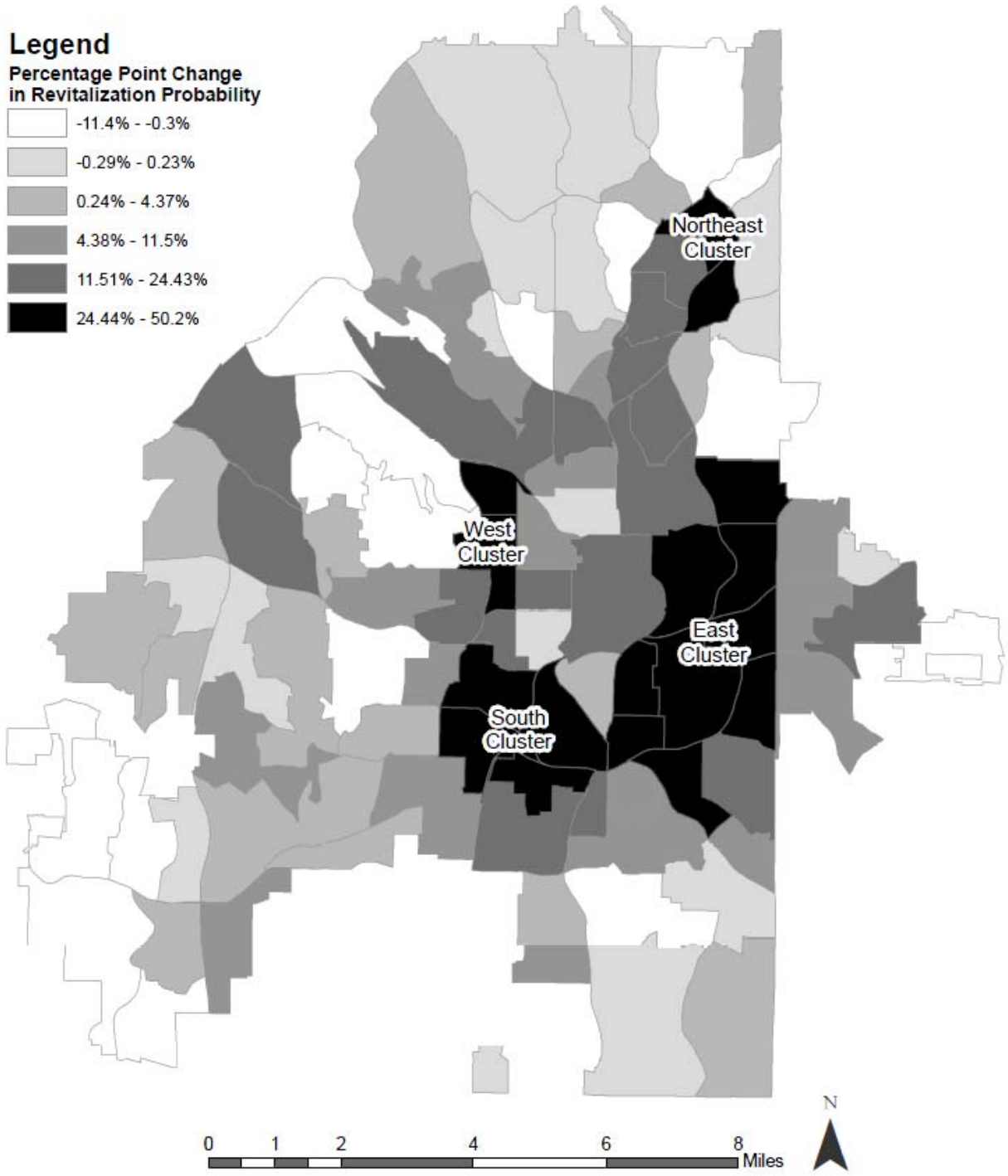
Figure 5: False-Positive NSAs, 2010-2014 Period



Overall, ongoing revitalization activity is predicted to occur in three key clusters surrounding Atlanta's central business district, as shown in figure 6. The west cluster, which includes Bankhead,

Washington Park, Knight Park, and Howell Station, leverages its proximity to Beltline improvements and new investments through the Upper Westside and Bankhead LCIs to catalyze or continue neighborhood revitalization. The south cluster, comprised of Adair Park, Pittsburgh, Capitol View, Capitol View Manor, Bush Mountain, and Oakland City, is poised to benefit from new investments related to LCIs, TADs, historic districts, and Beltline improvements. This cluster contains portions of the Oakland City/Fort McPherson LCI, the Turner Field LCI, and the West End LCI. It is also intersected by the Beltline TAD as well as the Oakland City Historic District, the Capitol View Manor Historic District, the Pittsburgh Historic District, and the Adair Park Historic District. The east cluster, containing the neighborhoods Grant Park, Oakland, Capitol Gateway, Summerhill, Ormewood Park, Old Fourth Ward, Sweet Auburn, Cabbagetown, Reynoldstown, Inman Park, and Poncey-Highland, benefits from its proximity to the Beltline Eastside Trail as well as from several LCIs and TADs. This cluster is overlapped by the Beltline Subarea 3 LCI, the Turner Field LCI, the Memorial Drive LCI, the Moreland and South Moreland LCIs, the Ponce de Leon LCI, and the Downtown LCI. It also includes portions of the Stadium TAD, the Beltline TAD, and the Eastside TAD. While many neighborhoods in this cluster have already revitalized, this revitalization activity can be expected to continue by strengthening revitalized communities and catalyzing reinvestment in non-revitalized ones. It is also important to note the northeast cluster – which includes Buckhead Village, Peachtree Park, Lindbergh, and Morosgo – which has experienced a significant increase in revitalization probability from 2002 to 2014. Although the likelihood of revitalization for these neighborhoods still ranges from 35 to 50 percent by 2014, the percentage increase in these probabilities between the periods of study merits further investigation into this area. This cluster is overlapped by the Buckhead LCI and is accessible to the Lindbergh MARTA station. The Beltline TAD and the Peachtree Highlands-Peachtree Park Historic District, established in 2005 and 2008, respectively, also overlap portions of this cluster and increase revitalization probability. Recent developments within this cluster include several multifamily residences, some commercial buildings, and a new grocery store.

Figure 6: Revitalization Clusters: Change in Probability of Revitalization from 2006 to 2014



CONCLUSIONS

The results of this study indicate that, within the City of Atlanta, certain factors can be used to make predictions about neighborhood revitalization. Based on three different time-lagged probit models, place-based physical and policy factors such as proximity to the Beltline, transit stations, or other revitalized neighborhoods, as well as location within a historic district, LCI, or TAD can positively impact a neighborhood's propensity to revitalize. Sociodemographic factors have a more complex effect on revitalization: while % population over 25 with a bachelor's degree and % population under 9 are positively correlated with neighborhood revitalization, % renter-occupied housing units, % population black, and school proficiency have a negative impact on neighborhood revitalization. The varying effects of these predictive indicators illustrate the complex nature of revitalization and highlight the need for a greater understanding of individual revitalization catalysts.

Although a number of Atlanta's in-town neighborhoods have already experienced revitalization, this study predicts that Knight Park and Howell Station will be the next two neighborhoods to undergo significant revitalization activity, followed by Castleberry Hill and Downtown Atlanta, Capitol Gateway and Summerhill, Bush Mountain and Oakland City, Capitol View and Capitol View Manor, Hunter Hills and Mozley Park, and finally, Berkeley Park, Blandtown, and Hills Park. This revitalization activity will likely be bolstered by the improving public opinion of in-town living and increasing desires across several demographics - especially among young professionals but growing among families and older generations as well - to live in walkable, accessible, mixed-use communities near urban amenities. Public and nonprofit groups in Atlanta can use this predictive information to guide appropriate growth and direct economic development, transit, and service-provision decisions. Neighborhood planning units or other community groups can also leverage this information to advocate for their neighborhood visions and interests. These results may also influence speculation among private property owners and developer interests. The

information provided by this study should ultimately be used to facilitate discussion about revitalization and encourage robust public engagement processes that seek to incorporate community goals into long-term planning and development activities.

FURTHER RESEARCH

It is ultimately difficult to measure all variables that may impact a neighborhood's propensity for revitalization. This study does not claim to exhaustively assess all potential predictive indicators of revitalization. Instead, the indicators utilized here are a reflection of previous literature and data availability from 2002 to 2014. The impacts of the housing and financial crises on revitalization activities in this period could merit a separate study altogether. As research into revitalization and gentrification continues, new factors influencing neighborhood change may come to light and should be integrated into future predictive studies. In addition, new types of data - especially big data - may add a different dimension to the list of predictive indicators. The ability to continuously gather data and maintain updated predictive indicator values will also enable predicting revitalization to be a dynamic, ongoing process.

Revitalization manifests itself in different ways depending on neighborhood characteristics, nearby amenities, local development and zoning policies, and the conditions of the built environment. Therefore, there is no singular methodology to induce revitalization that ensures positive results. Instead, revitalization activities should arise out of joint efforts among community members, developers, and local government agencies so that new developments garner economic growth and boost the quality of life for existing neighborhood residents and businesses without displacing them. Further research must be conducted into methods of revitalization that positively impact existing members of communities and mitigate the consequences of property value increases, rent growth, and other development pressures.

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APPENDIX

Table A1: Atlanta Neighborhood Statistical Areas

NSA	Neighborhoods
A01	Margaret Mitchell, Paces, Pleasant Hill
A02	Kingswood, Mt. Paran/Northside, Mt. Paran Parkway, Randall Mill, West Paces Ferry/Northside, Whitewater Creek
A03	Chastain Park, Tuxedo Park
B01	Peachtree Heights West
B02	Buckhead Forest, South Tuxedo Park
B03	East Chastain Park
B04	North Buckhead
B05	Brookhaven
B06	Buckhead Heights, Lenox, Ridgedale Park
B07	Buckhead Village, Peachtree Park
B08	Pine Hills
B09	Garden Hills
B10	Peachtree Heights East, Peachtree Hills
B11	Lindbergh/Morosgo
C01	Fernleaf, Hanover West, Ridgewood Heights, Wesley Battle, Westover Plantation
C02	Cross Creek
C03	Brandon, Castlewood, Westminster/Milmar, Woodfield
C04	Arden/Habersham, Argonne Forest, Peachtree Battle Alliance, Wyngate
C05	Collier Hills, Collier Hills North, Colonial Homes
C06	Channing Valley, Memorial Park, Springlake, Wildwood (NPU-C)
D01	Bolton, Riverside, Whittier Mill Village
D02	Underwood Hills
D03	Berkeley Park, Blandtown, Hills Park
E01	Ansley Park, Sherwood Forest
E02	Georgia Tech, Marietta Street Artery
E03	Ardmore, Brookwood
E04	Atlantic Station, Loring Heights
E05	Brookwood Hills
E06	Home Park
E07	Midtown
F01	Piedmont Heights
F02	Lindridge/Martin Manor
F03	Atkins Park, Virginia Highland
F04	Morningside/Lenox Park
G01	Atlanta Industrial Park, Bolton Hills, Brookview Heights, Chattahoochee, English Park, Lincoln Homes, Monroe Heights
G02	Almond Park, Carey Park
G03	Carver Hills, Rockdale, Scotts Crossing, West Highlands

H01	Bankhead Courts, Bankhead/Bolton, Carroll Heights, Fairburn Heights, Old Gordon
H02	Adamsville, Oakcliff
H03	Fairburn Mays, Mays
H04	Baker Hills, Bakers Ferry, Boulder Park, Fairburn Road/Wisteria Lane, Ridgecrest Forest, Wildwood (NPU-H), Wilson Mill Meadows, Wisteria Gardens
I01	Beecher Hills, Florida Heights, Westwood Terrace
I02	Cascade Heights, East Ardley Road, Green Acres Valley, Green Forest Acres, Horseshoe Community, Magnum Manor, West Manor
I03	Audobon Forest, Audobon Forest West, Chalet Woods, Harland Terrace, Peyton Forest, Westhaven
I04	Collier Heights
I05	Ivan Hill
J01	Center Hill, Harvel Homes Community
J02	Grove Park
J03	Dixie Hills, Penelope Neighbors, West Lake
K01	Hunter Hills, Mozley Park
K02	Bankhead, Washington Park
K03	Knight Park/Howell Station
L01	Vine City
L02	English Avenue
M01	Castleberry Hill, Downtown
M02	Old Fourth Ward, Sweet Auburn
N01	Cabbagetown, Reynoldstown
N02	Inman Park, Poncey-Highland
N03	Candler Park, Druid Hills
N04	Lake Claire
O01	East Lake, The Villages at East Lake
O02	Kirkwood
O03	Edgewood
P01	Arlington Estates, Ben Hill, Butner/Tell, Elmco Estates, Fairburn, Fairburn Tell, Fairway Acres, Huntington, Lake Estates, Wildwood Forest
P02	Princeton Lakes
P03	Ben Hill Acres, Briar Glen, Cascade Green, Heritage Valley, Meadowbrook Forest, Mt. Gilead Woods
P04	Ben Hill Terrace, Kings Forest, Old Fairburn Village
P05	Ashley Courts, Greenbriar Village, Niskey Cove, Niskey Lake, Sandlewood Estates
P06	Ben Hill Forest, Ben Hill Pines, Brentwood, Deerwood, Mellwood, Rue Royal, Tampa Park
Q01	Midwest Cascade, Regency Trace
R01	Campbellton Road, Fort Valley, Pomona Park
R02	Adams Park, Laurens Valley, Southwest
R03	Greenbriar
S01	Bush Mountain, Oakland City
S02	Fort McPherson, Venetian Hills
S03	Cascade Avenue/Road

T01	Ashview Heights, Harris Chiles, Just Us
T02	Atlanta University Center, The Villages at Castleberry Hill
T03	Westview
T04	West End
V01	Capitol Gateway, Summerhill
V02	Adair Park, Pittsburgh
V03	Peoplestown
V04	Mechanicsville
W01	Grant Park, Oakland
W02	Benteen Park, Boulevard Heights, Custer/McDonough/Guice, State Facility, Woodland Hills
W03	Ormewood Park
W04	East Atlanta
X01	Capitol View, Capitol View Manor
X02	Perkerson
X03	Hammond Park
X04	Sylvan Hills
X05	Airport
Y01	Chosewood Park, Englewood Manor
Y02	Amal Heights, Betmar LaVilla, High Point, Joyland
Y03	South Atlanta, The Villages at Carver
Y04	Lakewood Heights
Z01	Lakewood, Leila Valley, Norwood Manor, Rebel Valley Forest
Z02	Thomasville Heights
Z03	Blair Villa/Poole Creek, Glenrose Heights, Orchard Knob, Rosedale Heights
Z04	Browns Mill Park, Polar Rock, Swallow Circle/Baywood
Z05	South River Gardens

Figure A1: Atlanta Neighborhood Statistical Areas

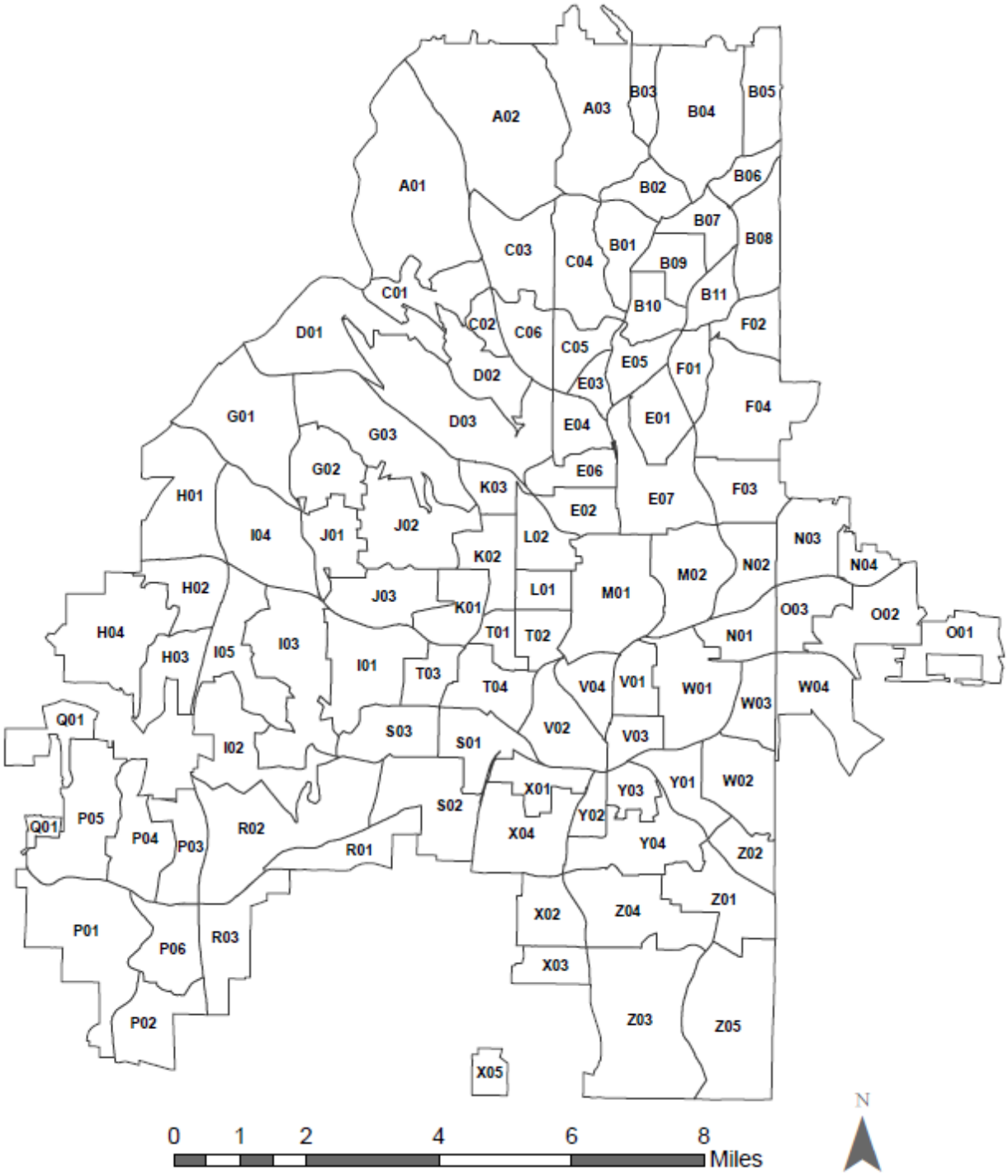

Table A2: Predictive Indicators

Variable	Description	Anticipated Impact Based on the Literature	Source
SPI	School proficiency index values aggregated to the NSA level	Neighborhoods with higher-quality schools will have higher revitalization probabilities (+)	Atlanta Regional Commission; Department of Housing and Urban Development
PCT_BLACK_PP	Percent of an NSA's population that is black	Neighborhoods with higher percentages of African-American populations will have lower revitalization probabilities* (-)	Block-Level Census Data
PCT_25_B_PP	Percent of an NSA's population over the age of 25 with a bachelor's degree	Neighborhoods with higher percentages of formally-educated populations will have higher revitalization probabilities* (+)	Block-Level Census Data
PCT_U9_PP	Percent of an NSA's population under the age of nine	Neighborhoods with higher percentages of families with young children will have higher revitalization probabilities* (+)	Block-Level Census Data
MHHI_PP	Median household income aggregated to the NSA level	Neighborhoods with higher median household incomes will have higher revitalization probabilities* (+)	Block-Level Census Data
PCT_RENT_OCC_PP	Percent of an NSA's housing that is renter-occupied	Transiency related to high renter occupancy will produce lower revitalization probabilities (-)	American Community Survey 5-Year Housing Data
TAD_PCT_PP; TAD_B_PP	Percent of the NSA within a TAD; whether a TAD overlaps $\geq$ 25% of an NSA	Neighborhoods within a TAD will have higher revitalization probabilities due to targeted funding mechanisms (+)	Atlanta Regional Commission TAD shapefile
HIST_PCT_PP; HIST_B_PP	Percent of the NSA within an Historic District; whether a historic district overlaps $\geq$ 25% of an NSA	Neighborhoods within an Historic District will have higher revitalization probabilities due to building stock/aesthetics/ funding opportunities (+)	National Register of Historic Places
JOBS_R_PP; JOBS_PCT_PP	Number of creative, higher ed, and professional/tech services within an NSA; percent creative, higher ed, and professional/tech service jobs of total jobs in an NSA	Neighborhoods with higher numbers of creative, higher ed, and PTS businesses will have higher revitalization probabilities due to the "Creative Cluster" effect (+)	Block Group-Level Longitudinal Employer-Household Dynamics Data
STRUCT_YR	Average structure year for buildings within an NSA	Neighborhoods with older homes will have higher revitalization probabilities given the opportunity for restorations and demolitions (-)	Combination of Fulton County Tax Assessor shapefile (2010) and City of Atlanta SCI file
NBHD_A	Whether or not an NSA has an active neighborhood association	Neighborhoods with active neighborhood associations will have higher revitalization probabilities due to community-led efforts and involvement (+)	Web search for individual neighborhood associations
STAT_PCT_PP; STAT_B_PP	Percent of the NSA within a half-mile (network-based) catchment area of MARTA stations; whether a station catchment area overlaps $\geq$ 25% of an NSA	Neighborhoods within a walkable distance of MARTA stations will have higher revitalization probabilities because they are transit-accessible (+)	Atlanta Regional Commission MARTA Rail Stations shapefile

STOP_PCT_PP; STOP_B_PP	Percent of the NSA within a half-mile (network-based) catchment area of MARTA bus stops; whether the cumulative stop catchment area overlaps ≥ 25% of an NSA	Neighborhoods within a walkable distance of MARTA bus stops will have higher revitalization probabilities because they are transit-accessible (+)	Atlanta Regional Commission MARTA Stops shapefile
BL_PCT_PP; BL_B_PP	Percent of the NSA within a half-mile (straight-line) catchment area of the Beltline Trail; whether the Beltline catchment area overlaps ≥ 25% of an NSA	Neighborhoods within a walkable distance of the Beltline will have higher revitalization probabilities because the Beltline has been effective in generating economic development activity (+)	Digitized Beltline with half-mile buffer area
LCI_PCT_PP; LCI_B_PP	Percent of the NSA within an LCI planning area; whether an LCI overlaps ≥ 25% of an NSA	Neighborhoods within an LCI planning area will have higher revitalization probabilities because an LCI signifies community-led efforts, potential funding, and initiative (+)	Atlanta Regional Commission Livable Centers Initiative shapefile
ADJ_PP	Whether or not an NSA is adjacent to a "revitalized" neighborhood	Neighborhoods adjacent to other revitalized areas will experience spill-over effects and will have higher revitalization probabilities (+)	Based on revitalization benchmark results

*These variables were included based on the results of previous predictive studies of revitalization. However, this study recognizes that these neighborhood characteristics are likely symptoms of ongoing revitalization processes rather than true predictors.