

ABSTRACT

Title of Dissertation: THE ENDURANCE OF GENTRIFICATION:
THREE ESSAYS ON MEANING,
MEASUREMENT, AND CONSEQUENCES

Nicholas James Finio, Doctor of Philosophy,
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Dissertation directed by: Professor Gerrit-Jan Knaap
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Abstract:

Gentrification is the process through which an influx of new investment and new residents with higher incomes and educational attainment flow into a neighborhood over time. This dissertation expands scholarly understanding of gentrification's meaning, measurement, and consequences through three essays. The first essay reviews, inventories, and critiques the numerous methods scholars have used to identify gentrification. The second essay critiques the normative foundations of the smart growth movement and improves empirical understanding of how that urban policy agenda and gentrification are linked. The final essay identifies gentrification in Maryland's Purple Line Corridor and with quantitative methods illustrates how gentrification impacts the local business economy. The findings of this dissertation show that gentrification is often not properly identified, smart growth and gentrification can be linked, and that businesses in gentrifying neighborhoods are more likely to close.

THE ENDURANCE OF GENTRIFICATION:
THREE ESSAYS ON MEANING, MEASUREMENT, AND CONSEQUENCES

by

Nicholas James Finio

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Advisory Committee:

Professor Gerrit-Jan Knaap, Chair
Professor Casey Dawkins
Professor Willow Lung-Amam
Professor Ariel Bierbaum
Professor Kris Marsh, Dean's Representative

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Preface

This dissertation takes the three-essay form allowed for the Urban and Regional Planning and Design (URPD) degree, as approved by the committee at the time of the proposal. As stated in the URPD handbook and as approved by the committee, one of the essays can be a literature review. The first essay of this dissertation is a literature review, which was published in the *Journal of Planning Literature* in 2021 with the title “Measurement and Definition of Gentrification in Urban Studies and Planning.” This article has two main parts. The first part is a literature review of the history and definition of gentrification, theoretical discussion of how and why it occurs, and a summary of its effects. The second part of the article is a descriptive analysis that inventories hundreds of journal articles about gentrification to categorize methodologies for identifying gentrification with respect to time, geography, data source, variables, and statistical techniques. The second essay of this dissertation is a heavily modified version of a forthcoming book chapter, “Smart Growth without Gentrification?” in *The Handbook on Smart Growth* (Elgar), which I co-authored with Eli Knaap, PhD. As specified in the letter at the end of the document, I completed the majority of the writing and analysis for this second chapter, with dataset composition assistance from Eli. The third essay is my own, yet unpublished, work.

Dedication

For my son Sam and his generation, so they may inhabit more equitable and just urban space.

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I acknowledge the research support provided by all scholars and staff National Center for Smart Growth at UMD, where I have felt at home as a scholar for nearly nine years. I especially thank my advisor Dr. Gerrit Knaap for years of productive collaboration and guidance on this dissertation and a range of other topics. I also thank the members of my committee for their feedback on my dissertation, and my other professors at UMD for their instruction in various courses and willingness to dive deep into issues beyond the coursework. I thank the staff at the Maryland Department of Labor for their maintenance and provision of dataset used in my third article. I thank my friend and colleague Eli Knaap for his assistance with the dataset for the second article, which we are co-authoring, as described in the Preface on the next page and the letter to the Dean of the Graduate School in the appendix. I thank my parents and my brother for their support over the years. Last, I thank my partner Margaret Scott for her patience, support, and feedback. Any errors or omissions in this work are my own.

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Introduction

Gentrification is an urban phenomenon of neighborhood change that has significant impact on people and shifts the built form and character of the towns, cities, and suburbs where it takes place. It can be succinctly defined as the influx of new investment and new residents with higher incomes and educational attainment into a neighborhood (Chapple and Loukaitou-Sideris, 2019). Ruth Glass first identified this process nearly sixty years ago in London, and it was found in the United States by the early 1970s (Lees et al. 2008). It has persisted since that time despite tectonic shifts in urban policymaking since the tail end of the Great Society era, and even larger shifts in global macroeconomics. Gentrification has become embedded in neighborhoods across the country and empirical evidence has shown it is appearing at an accelerating rate in more cities (Hwang and Lin, 2016).

This acceleration has been both a blessing and a curse to cities and their residents. While less academic attention has been paid to the positive benefits of gentrification, it is a simple argument that population growth, home price increases, and in-movement of higher income individuals to disadvantaged neighborhoods can boost local economies and supplement government tax revenue (Atkinson, 2004). Residents, however, may not equitably share these benefits, and each benefit has corollary negatives. Significant attention has been paid to these negative consequences of gentrification, and one specific consequence dominates the literature: displacement, or the forced or involuntary removal of incumbent residents in gentrifying neighborhoods due to increased housing costs, or blocked relocation of residents with low incomes into gentrified neighborhoods (Slater, 2009). In response to increased societal attention to the subject, a growing number of scholars have expanded examinations of the consequences of gentrification to focus on its impacts on public health, crime, and employment in the last several decades.

In the 2010s, as national attention shifted toward economic inequality in the aftermath of the 2008 financial crisis and ensuing recession, gentrification became a highly visible part of the contest between the haves and have nots in American society. As cities dealt with foreclosure crises, shortages of affordable housing, and enduring poverty, certain neighborhoods saw influxes of the highly educated, glittering new construction, and displacement of incumbent, non-white culture and businesses. Come the 2020s, these issues were magnified as the COVID-

19 pandemic drove a further wedge into an already deeply unequal society. Given this background, the tenor of the scholarly conversation about gentrification has continued to escalate, and an ongoing debate over the scale and consequences of displacement persists (Brown-Saracino, 2017). As the literature on gentrification expands and attempts to provide policymakers with responses to the phenomenon, crucial gaps in understanding have been identified. First, some have argued that rigorous research on the consequences and causes of gentrification remains rare (Ellen and Ding, 2016). Second, others have argued that accurate identification of gentrification is essential for policymaking, and that there is little current agreement on how to do so despite the growth in volume of literature (Easton et al. 2020; Preis et al. 2020).

In this dissertation I respond to these research gaps through three essays that deepen the understanding of what gentrification is, how to measure it, and its form and effect at a macro and micro scale. The first essay is a literature review that inventories how scholars of gentrification have quantified and measured the concept in order to assess its consequences. The essay provides background on the history of gentrification and its scholarship, theoretical grounds for why gentrification occurs, and a review of its consequences. I provide a critique of gaps in quantitative measurement methodologies based on links to the theoretical foundations of gentrification.

The second essay is a critical examination of the links between gentrification and the growth movement, which is a policy agenda designed to more efficiently distribute growth for normative environmental and economic reasons. While the political moment for smart growth in planning policy is long past, the principles of smart growth are successfully embedded in urban policy in many regions. Most importantly, the principle of smart growth that directs planning agencies to strengthen and direct development toward existing communities has spawned a range of policy ideas that all attempt to drive infill growth and redevelopment in disinvested areas. This principle does not speak to the displacement this may cause, or other equity concerns like increased housing costs. To broaden understanding of this issue, I first identify relationships between gentrification and possible links to smart growth by using a nationwide dataset of gentrifying neighborhoods and then propose policy responses.

In the final essay, I identify gentrification in Maryland's Purple Line light rail corridor, and with quantitative methods link patterns of gentrification to changes in employment, wages,

and patterns of business closure. Gentrification in the suburbs remains understudied, but strong empirical links between public investment and gentrification have been identified. Further, other scholars have identified a major research gap, as there is a lack of knowledge about the impacts of gentrification and transit investment on small businesses. This essay explores these issues through two quantitative exercises. The first identifies gentrification in this area in advance of the line's opening. The second assesses patterns of employment, firm size, wages and firm closure with a unique dataset. I place these issues in context with local policymaking through this quantitative case study.

I find in the first essay that while the theory that forms the foundation of the gentrification discourse provides clarity on how to measure gentrification, there is little unity in scholarly approach to methodological choices. Of most consequence, scholars have not always jointly addressed both the supply (land market) and demand (demographic) sides of gentrification. In methodologies used to define gentrification, scholars have largely ignored the question of time periods for measurement, used relatively large spatial units of measurement, rarely used mixed methods, and leave race of both incumbent residents and newcomers out of the discussion more often than not. I utilize findings from this essay to inform my measurement choices in the second and third essays, including utilizing longer time periods, matching geographic reference areas to study issues, and measuring both the supply and demand sides of gentrification.

In the second essay, I find that the underlying components of gentrification – changes to socioeconomic status and real estate prices – have undergone accelerated change in the 21st century, as compared to the late 20th. This acceleration can be quantitatively linked to increased housing construction in gentrifying neighborhoods, calling into question the normative defensibility of the smart growth movement's principles. The third essay finds strong evidence of gentrification in advance of the Purple Line light rail's opening date in a range of diverse neighborhoods in the Maryland suburbs of Washington, DC. This gentrification is linked to growth in the local economy but increased risk of business closure. Both this essay and the second essay clearly illustrates that gentrification of neighborhoods outside urban core areas has been ongoing for some time, adding weight to the body of work that considers the spatial boundaries of gentrification to have expanded outside the traditionally urban context.

The methodological conundrums detailed in the first essay with respect to defining gentrification expose weaknesses in identifying causes and consequences of gentrification that all scholars face. In the second and third essay, I make choices with regard to measurement that are examples of such compromises, which continue to cloud firm conclusions about the causes and consequences of the phenomenon. As detailed in the first essay, these choices include geographical reference areas, measurement time periods, variables to identify gentrification, and proxy choices for consequence identification that can only partly illuminate how gentrification impacts people, economies, and the built environment. More work that builds on this dissertation will be necessary to answer the growing set of questions about the causes and consequences of gentrification.

This dissertation is organized as follows after this first, introductory section. The second section is the first essay, which provides a literature review by discussing the history of gentrification, how it is defined, and its effects, before moving to the inventory of quantitative methods. The third section is the essay about smart growth and gentrification, and the fourth section is the essay about gentrification in the Purple Line Corridor. The fifth and final section reviews and summarizes the contribution of this work to the literature and offers a discussion of policy ramifications.

Essay One: Measurement and Definition of Gentrification in Urban Studies and Planning

I. Introduction

During the first two decades of the 21st century, gentrification appeared ascendant in American cities. The phenomenon, described as “in-migration of middle-and upper-income households into existing lower income urban neighborhoods,” became a focus of attention in policy and scholarly debate (Griffith 1995, p. 241). Despite the global recession from 2007-2009, gentrification persisted and arguably accelerated in the last decade. Hwang and Lin found that in US cities “since the 1970s and especially since 2000, downtown gentrification has strengthened and a growing number of neighborhoods have gentrified” (2016, p. 12). In response to this escalation, conversations about the issue amongst the press, politicians, and the public increased in tenor. Scholars reacted and have attempted to assess the impact of gentrification on cities and their residents in the current era through qualitative and quantitative studies (Brown-Saracino 2017).

Gentrification is a critical issue for city planners because it shifts new residents and financial capital into disinvested lower-income areas, which are typically home to incumbent low income and racial minority populations. Thus gentrification is a directly observable contest between the haves and have nots in urban space, a conflict spotlighted by scholarly and public attention to economic and racial structural inequality particularly as it plays out in the housing market. Further, the social problem of displacement, potentially caused by gentrification, is also concerning to planners and policymakers (Marcuse, 2015). Displacement is the forced removal or blocked relocation of residents out of or into certain areas that have experienced rent or home price increases, and further includes the phenomenon of indirect displacement via social and cultural shifts (Slater, 2009). Debate about displacement is inseparable from social and economic inequality in cities today, especially as it intersects with race and culture (Hyra, 2017).

Some scholars argue that despite “becoming more prevalent in US cities... rigorous research on the extent, causes, and consequences of gentrification remains rare” (Ellen and Ding, 2016). Ellen and Ding’s qualifiers *rare* and *rigorous* notwithstanding, this review will show that the literature on gentrification and its consequences has expanded greatly. This literature can be roughly separated into two groups, qualitative and quantitative, with the former generally relying

on analysis of several or individual neighborhoods selected through *a priori* knowledge of gentrification, and the latter typically relying on census or other data to conduct panel or cross-sectional analysis of gentrification in multiple areas (Brown-Saracino, 2017).

Scholars who choose not to define gentrified areas through *a priori* or purely qualitative means must first determine if neighborhoods are eligible to gentrify through some quantitative metric, and then specify criteria by which neighborhoods did in fact gentrify over some time period (Galster and Peacock, 1986). Van Criekingen and Decroly (2003) noted that across the literature there was no unanimously approved empirical delimitation of the concept of gentrification forty years after Ruth Glass coined the term. Barton (2016) agreed and further noted that “the strategy used to identify gentrified neighbourhoods potentially had important implications for whether gentrification was associated with other neighborhood outcomes” (2016, p. 2).

Rachel Drew completed a review of differing strategies and noted that “differences in the data and variables used to separate gentrified from non-gentrified neighborhoods... can lead to very different conclusions about where gentrification occurs, as well as the outcomes with which it is associated” (2018, p. 1). Easton et al. (2020) further elaborated upon this point by noting that accurate identification of gentrifying neighborhoods is critical in research measuring displacement, because neighborhoods not marked as gentrifying are used as baselines for comparison. Despite this point, Easton et al. note that “operationalisation of these dimensions [of gentrification] in terms of measurable variables is far more equivocal [than agreement on gentrification’s broad meaning]” (2020, p. 288). Both Preis et al. (2020) and Mujahid et al. (2019) compared different gentrification measurement methods and reached similar conclusions, with Preis et al. concluding that “cities that adopt one of the various different mapping methods will come to very different conclusions about the location and severity of gentrification based on the method they choose” (Preis et al. 2020, p. 16).

These papers, however, have been limited in scope. Drew summarizes six quantitative methods and discusses several more; Preis et al. compares four; Mujahid et al. compare three; and Barton compares two. In aggregate these reviews have not assessed more than a hundred extant additional quantitative methods used to define gentrification and measure its consequences. In this paper I expand the scope of such reviews by connecting the choices on methods scholars have made, using a novel **descriptive** analysis technique to conduct

categorization of a much broader set of papers, to theory on the causes of gentrification. The aim of this review is to provide both a comparison of methods used to quantify gentrification, grounded in theory, and also provide suggestions on methods which future scholars seeking to measure gentrification can use to inform their studies.

The review finds that across a set of nearly 200 papers that utilize quantitative methods, there are tendencies towards measurement of the same time periods using limited time intervals. Further, measurement is more commonly limited to a single city, rather than multiple cities or regions. Quantitative definitions of gentrification tend to be simple and authors more often utilize basic metrics rather than complex analysis tools to identify it, and further still, these metrics are more often than not vaguely defined. Robust analysis which combines census data with field surveys remains rare despite evidence that such approaches add nuance (Hammel and Wily, 1996).

The structure of this review is as follows. First, I review definitions of gentrification and theories about how and why it is caused. I next review the effects of gentrification. Following that, I review the general methods with which scholars have identified gentrification. I then review my approach for identifying the variety of methods that have been used to empirically delimit gentrification in quantitative urban studies research. The next section offers a description of the results of the classification process. In the penultimate section I discuss the results of the analysis and relate those results to trends in gentrification research. In the final section I offer conclusions and suggestions for improvement of further quantitative research on gentrification and its consequences.

II. Defining gentrification, understanding its history, and reviewing its causes

Definitions and History

“Gentrification” was introduced as a term by Ruth Glass, a British sociologist, in the early 1960s when an urban gentry was beginning to re-inhabit and rehabilitate the housing stock in working class neighborhoods in London. In her analysis, Glass described how these affluent newcomers transformed neighborhoods from renter occupied to owner occupied, increased property prices, and displaced working class residents. Glass described gentrification as “an inevitable development, in view of the demographic, economic, and political pressures to which

London, especially Central London, has been subjected,” arguing that gentrification is a neighborhood process that cannot be attributed to one factor, but is instead the result of a set of metropolitan interactions (Glass, 1964, xviii).

Glass’s terminology began to enter the lexicon in the United States in the early 1970s. Perhaps best encapsulated by the *brownstoning* movement in the Park Slope neighborhood (purchase and rehabilitation of older, large townhomes) in Brooklyn, New York, the press and the general public became aware of the process of gentrification, alternatively termed the ‘back to the city movement,’ or ‘central city revival’ at the time. Across the country, in large cities like Washington D.C., Philadelphia, and Chicago, professionals and bohemians alike were defying the conventional habit of seeking more land and larger homes in the suburbs. They instead sought to rehabilitate and inhabit what they deemed as valuable pre-war housing stock in neighborhoods close to downtowns (Lipton, 1977).

Though early research generally focused on gentrification as an isolated process in residential housing markets in certain cities, it became clear during the 1980s and even more so after that this process was widespread, and part of a broader cycle of economic and class change in cities across the world. Initial research that speculated the process was transient was proven wrong over time through identification of the process in additional cities into the 1990s. Recent macro-scale studies have found that the pace of gentrification has since accelerated (Hwang and Lin, 2016).

Scholars in the current era, and I in this paper, generally agree that gentrification is defined by an influx of new investment and new residents with higher incomes and educational attainment into a neighborhood (Chapple and Loukaitou-Sideris, 2019). In the United States, gentrification is often associated with the process of racial demographic change in inner cities. In the prototypical and widely observed case, mostly white higher social class individuals move in to formerly disinvested areas that are largely Black or Latinx. Despite that association, scholars have argued that gentrifiers can be of any race as social class is not hegemonic within or across racial groups, and indeed some have found limited evidence of Black and Latinx gentrification (Moore, 2009; Hyra, 2006). Because of this nuance, race is not typically used as a binary or deciding factor in defining gentrification.

Critical scholarship on the left has identified and emphasized how the traditional description of gentrification as in-movement of higher income residents leaves out a story of

power imbalances, marginalization, and alienation drawn along racial lines, especially in the United States (Betancur, 2002). Communities with little access to capital or political power, particularly urban Black and Latinx communities, have little ability to influence the planning process or organize to block private investment that may cause displacement or other unwanted impacts. Stated directly, some argue that structural racism, which excludes low-income minority groups from planning and economic power, has left open the ability for the combined forces of mostly white private investment and political power to gentrify inner cities via in-movement by white residents (Smith, 1996). Recent empirical research has added nuance to the story, finding that gentrification in some cities is more likely in diverse and immigrant neighborhoods and less likely in deeply segregated areas (Hwang, 2015). Debate over the scale and impacts of displacement is ongoing and contentious (Brown-Saracino, 2017).

Gentrification has attracted the attention of city residents, decrying housing cost increases and displacement; popular culture, following the trend and tastes of millennials moving into central cities; the press, noting the ‘rebirth’ of central cities in the aftermath of the greatest housing crisis in generations and the plight of residents subject to higher rents; and the political class, responding to these provocations. Increasing societal attention paid to income inequality and structural racism have pushed the issue even deeper into the national consciousness. In order to evaluate the consequences of the phenomenon to inform policy, scholars have built on work that began in the 1960s that identified where, why, and how the process occurred.

Why and how does gentrification occur?

As evidence of gentrification accumulated in the 1960s and 1970s across major cities in North America, scholars began to attempt to understand the root causes of the process. Publications on the causes of gentrification in the first decades of gentrification research can be simply classified into two groups: the demand side, which sought to understand the demographic and social forces that influenced the desire for gentrified housing and in-movement to disinvested areas; and the supply side, which sought to understand the economic conditions which created neighborhoods with housing stock that could be gentrified (Lees et al. 2008, Griffith 1995). In more recent decades, scholars have moved beyond the supply and demand

debate and shifted their focus from attempting to answer questions of causality toward examination of consequences (Lees et al. 2008).

Before recounting the supply-demand debate, it is worth noting that gentrification sits nested within work which seeks to understand neighborhood change. Gentrification is a specifically defined upward transition in social class in a neighborhood, but many have studied the variegated forms of neighborhood social and economic change, which include stasis, upgrading, and decline. Prominent theories of neighborhood change include the filtering model, the bid/rent model, the tipping model, and the border model (Temkin and Rohe, 1996). The filtering model, first advanced by Hoyt (1933) describes how newly built housing eventually degrades in quality due to decreased investment, thus allowing lower-income residents to replace more affluent residents as those residents seek newer, higher quality housing. Gentrification may represent part of a filtering process, but instead of new housing being constructed at the suburban fringe, rehabilitated or new housing is constructed in denser, urban areas. Such a process may be reflected in the bid/rent model, commonly referenced in urban economics, and advanced by Muth (1969). The bid/rent model describes the tradeoffs between leisure time, housing cost and commuting cost; as desire for lower commuting cost increases due to an increasing value of time, some higher income consumers may choose older housing near jobs in the city rather than larger housing in the suburbs, thus gentrifying inner areas (Laska and Spain, 1979). Border and tipping models examine the impacts of social class and race on in-and-out movement from neighborhoods within the framework of the invasion-succession model, assessing how trends in racial change may cause neighborhoods to “tip” (Schwirian, 1983). All of these models frame debate over gentrification, which is one specific type of neighborhood change. Early debate on gentrification, however, was to some degree separate from this context and instead focused on competing supply and demand side explanations.

Work on the supply side owes its foundations to Neil Smith, a geographer and student of noted urban theorist David Harvey. In his seminal article “Toward a Theory of Gentrification: a back to the city movement of capital, not people,” Smith laid out his argument, founded in Marxist economic theory, that over time land parcels in central cities saw reduction in their ‘capitalized ground rent’ relative to their ‘potential ground rent’ (Smith, 1979). As structures aged and became less valuable, the capitalized ground rent of the land would fall, and landlords would receive less income. While this occurs, the potential ground rent, or the rent that could be

achieved through utilizing the parcel at its highest and best use, may increase over time for certain parcels as the city's economy grows. Enterprising capitalists would eventually identify the rent gap between the capitalized and potential ground rents, and purchase and rehabilitate structures to be used in some updated manner to thus earn the full potential rent (Smith, 1979).

Smith's initial work was in response to early research on gentrification in the 1970s that had sought to explain the process of gentrification from the perspective of the gentrifiers, or the demand side. Scholars sought to understand who gentrifiers were, why they chose gentrifying neighborhoods, and the larger structural factors that influenced their decisions. David Ley and Chris Hamnett (1986, 1980) were both influential researchers in this area, as they sought to identify the characteristics of the demand that sustained the production of the supply side. Their and other work linked the decline of the industrial economy and rise of the service sector to gentrification, observing that as professional employment increased in central cities, the residential neighborhoods nearby became more desirable, especially as undesirable industrial uses vacated (London et al., 1986).

The forces of supply and demand which have interacted to drive decades of gentrification did not do so in a free-market vacuum. In many cases, government – at the local, state, and federal level – has been directly or indirectly involved in the process of urban regeneration or gentrification. As Griffith (1995, p. 246) noted, “local governments throughout the United States have been among the most active participants in the gentrification process.” The public sector can catalyze or accelerate gentrification through changes to zoning and form-based codes, investment in physical infrastructure like transit, and the provision of services (Zuk et al. 2018). Governments can also provide financial incentives to businesses and developers to locate in certain gentrifying neighborhoods, or even provide financial incentives to gentrifiers themselves through instruments like property tax abatements. Others have linked federal housing policy to gentrification efforts, particularly the HOPE VI program which sought to demolish and redevelop subsidized housing, and thereby deconcentrate poverty and create mixed-income neighborhoods as a replacement (Goetz, 2011). Critical research has focused on the impact of increased legal restrictions on homelessness, and beautification and intense regulation of public spaces, all of which can make cities more amenable to the preferences of gentrifiers (Mitchell, 2003).

This combined set of forces – political, supply, demand – acts across the market economy for land in the city and region. Some scholars have sought to separate these forces and identify causal factors that catalyze or influence gentrification in specific neighborhoods or parts of neighborhoods within cities or regions, and they have found that supply, demand, and political factors are related to the process of gentrification. In a review, Brown-Saracino (2017) found that at the neighborhood level these factors include locational attributes, increasing gentrification's likeliness in neighborhoods near cultural amenities, a downtown center, public transportation, and other gentrifying places; there are also more hyper-local factors like the quality of the housing stock, presence of single family homes, and the age of buildings. Hwang and Sampson (2014) found that racial demographics matter, as certain neighborhoods that are majority Black are less likely to gentrify than more diverse places, a finding replicated by Timberlake and Johns-Wolfe (2017). Others have emphasized the spatial dependence of gentrification – the fact that places adjacent to wealthy or already gentrified areas are often the next to gentrify or experience redevelopment (Meligrana and Skaburskis 2005).

Research has shown that the process of gentrification occurs due to a complex, interacting set of forces that apply at different scales. At the regional scale gentrification is the result of a complex set of demand side and supply side factors influenced by a legacy of political and economic exclusion and public sector decisions. At the neighborhood scale, the process results from a complex set of geographic and socio-economic factors relating to the built environment, city amenities, and the residents who live in those places. The consequences of gentrification, however, are a subject of great debate. There is a divide between the macro-scale, quantitative body of work that finds gentrification to be of muted impact, and a micro-scale qualitative body of work that finds it to be of high consequence to neighborhood residents. Brown-Saracino (2017) identifies core a source of this issue: methodological differences in measurement of gentrification, which consist of limits of data across time and space and disagreement over how to qualify gentrification itself with various variables or techniques. This paper offers a full inventory those measurement issues, a task as yet incomplete and of importance as the empirical literature on consequences continues to expand. Before reviewing that inventory, the next section reviews research on the consequences of gentrification, and the recent responses of planners and the public sector to those consequences.

III. The effects of gentrification

Gentrification occupies a unique position in the urban policy debate. Unlike clear social ills like concentrated poverty or environmental injustice, gentrification has boosters and is often an indirect policy goal of local government. Few elected officials or planners in communities in the United States categorically oppose in-movement of capital or higher-income residents into lower-income areas that they represent. In fact, many elected officials have touted gentrification, as they stood to benefit through expansion of the tax base and therefore potential mitigation of urban problems (Beauregard, 1985). Planners and elected officials seek economic improvement in the lives of their constituents and understand that in-movement of capital and new residents could bring that about. These individuals with planning power must hold that desire while responding to residents' concern about gentrification, especially in regard to displacement and escalating housing costs. This contradiction and conflict is deeply rooted in the intra- and inter-metropolitan competition for growth, jobs, and prestige. In planning departments, this conflict is especially sour. Planners attempting to advance the tenets of smart growth, designed to advance economic and environmental sustainability, must "strengthen and direct development towards existing communities" (Smart Growth Network, n.d.). Some argue that in doing so, "urbanists have prescribed compact development without evaluating the very real consequences of new, dense construction in terms of raising land prices beyond the means of current residents" (Chapple and Loukaitou-Sideris, 2019, p. 3). This debate is a direct manifestation of the conflict between the 'just city' and the 'growing city' in Campbell's (2007) planning triangle.

Brown-Saracino's (2018, p. 517) review of scholarship on gentrification noted it is increasingly viewed in qualitative and micro-level studies as a social issue that is "deeply problematic and consequential for longtime residents." That is only half the debate. In the same review, Brown-Saracino (2018, p. 520) notes that macro-level quantitative analyses offer a viewpoint that gentrification is not as widespread as commonly thought, and further and more importantly argues that "displacement is far from endemic." These quotes reflect a deeply embedded debate on gentrification and displacement in urban studies, regarding whether or not the two are inseparable. Chapple and Loukaitou-Sideris (2019, p. 40) argue that "displacement

occurs when forces outside people's control force them to move from their residence. Because these forces may stem from either disinvestment or investment, displacement is not necessarily directly induced by gentrification." Slater (2009) argues that gentrification was always linked to inequality and class struggle, and was thus inseparable from social justice and displacement.

A significant fraction of the empirical work on the consequences of gentrification is focused on the question of displacement, or the forced or involuntary removal of incumbent residents in gentrifying neighborhoods due to increased housing costs, or blocked relocation of low-income residents into gentrified neighborhoods (Slater, 2009). The incumbent residents studied in this work, who are to be replaced or joined by gentrifiers, are typically of lower social status and earn lower incomes, and are often racial minorities.. A growing body of macro scale evidence indicates that low-income residents of gentrifying neighborhoods do not face higher displacement rates than other residents in high-income neighborhoods or low income neighborhoods that are not or cannot be gentrifying, even after controlling for numerous factors (Delmelle and Nilsson, 2020; Ding, et al 2016; Ellen and O'Regan, 2011; Freeman, 2005). Some more nuanced evidence on that question has shown that displaced residents are more likely to relocate to lower-income areas, and that homeowners are less likely to be displaced than renters (Martin and Beck, 2018; Ding et al. 2016, Newman and Wyly 2006). Qualitative evidence has shown that at the local level, long-term residents are displaced and often negatively psychologically impacted during gentrification processes (Pattillo, 2007; Betancur, 2011; Hyra, 2017).

The consequences of gentrification stem far beyond displacement, and can be both positive and negative. Atkinson (2004) lists and reviews positive and negative consequences of gentrification. The positives include stabilization of declining areas, increased property values, decreased vacancy rates, increased government revenue, encouragement of further development, reduction of sprawl, and increased social and income mix. Negatives include displacement, community conflict, loss of affordable housing, increased homelessness, industrial and commercial displacement, loss of social diversity, and cultural displacement (Hyra, 2017). Freeman (2006) via in-depth qualitative work found highly nuanced perspectives, both positive and negative, from incumbent residents on gentrification in their gentrifying neighborhoods in New York City. Some residents may appreciate greater access to services and stores and benefit from increased home prices if they are property owners; others resent feeling unwelcome or are

unable to afford new amenities designed for the newcomers. Incumbent residents may clash with newcomers over differences in cultural and social expectations. Atkinson (2004) also notes that research on the benefits of gentrification is much rarer than research on the negative impacts, but this is a point that requires further explanation. Scholars who have sought to explain or inventory the benefits of gentrification have often used other words – urban renaissance, revitalization, or regeneration. These scholars may avoid use of the word gentrification, which is a universally recognized label for urban inequality (Slater, 2006).

Lang (1986) found limited evidence in Philadelphia that gentrification produced increased revenue streams for local government, and further this effect was greater than the cost of providing additional amenities for these residents. Other older research was inconclusive on positive impacts of gentrification, and instead emphasized that attention paid to real or potential positive impacts was magnified by the context of urban decline prior to the 1990s (Beauregard, 1986).

The positive and negative impacts of gentrification may impact the life course of residents who remain or are displaced, through increased or decreased access to education and jobs, shifts in public health, exposure to crime, or other means. A burgeoning body of research has attempted to assess the financial and health impacts of gentrification on residents who remain or are displaced from gentrifying neighborhoods. This research was partly spurred by Mindy Fullilove's thesis that residential displacement, caused by urban renewal or other factors, causes traumatic psychological stress (Fullilove, 2016). In a review of studies that relate gentrification to health impacts, Schnake et al. (2020) find mixed results, which vary by outcomes assessed, measurement methodology, and local context. Several studies have investigated the link between falling crime and gentrification, finding that less crime in central city neighborhoods makes them more attractive to potential gentrifiers (Ellen et al. 2019). Other empirical studies have assessed the impact of gentrification on crime in gentrifying neighborhoods, generally finding a negative relationship after an initial increase due to destabilization of social control (Kirk and Laub, 2010). Kreager et al. (2011) find a curvilinear relationship between gentrification and crime, suggesting early stage gentrification is associated with small increases, but later stage gentrification associated with crime declines. That relationship is true only for property crime, not violent crime, which is unassociated with gentrification. Papachristos et al. (2011) find that gentrification's effect on crime is contingent on race, with white gentrifying neighborhoods

seeing declining homicide rates, and black neighborhoods seeing increasing robberies. Barton (2016) found in New York City that sub-boroughs gentrifying at a faster clip experienced much larger declines in serious crimes than other sub-boroughs.

A small body of work has identified a process of industrial change and labor market transition which impacts local residents and workers in gentrified areas. Curran (2004) and Lester and Hartley (2014) identify a shift from blue collar industrial employment to service sector employment in gentrifying neighborhoods, with the latter authors finding evidence of more rapid employment growth. Meltzer and Ghorbani (2017) build on these results and find that incumbent residents experience job losses in local gentrifying areas, but those losses are balanced by increases in employment in surrounding areas. Limited evidence shows that wages are higher for residents who remain in gentrifying neighborhoods (Ellen and O'Regan 2011). Hwang and Ding (2016) find positive relationships between gentrification and credit scores for those who stay versus those who exit gentrifying areas.

A review of the methodological breadth of scholarly work that identifies the consequences of gentrification is outside of the scope of this paper, and it is of note that no such review yet exists. This is partially due to the explained cross-disciplinary nature of the gentrification literature, in which scholars from planning, criminology, sociology, economics, public health and additional disciplines have attempted to test the impact of gentrification on a wide variety of social metrics. Typically these studies will identify gentrifying neighborhoods – with methods explained in detail in the next section – and test, with qualitative or quantitative methods, whether those neighborhoods see different social outcomes than neighborhoods that do not gentrify. Authors generally hypothesize that gentrification itself will lead to measurably different social dynamics in gentrifying neighborhoods. The classic example of this is the measurement of residential displacement: do low income households move out, or get evicted at, higher rates in gentrifying neighborhoods than comparable households in non-gentrifying neighborhoods? Such questions may be answered with macro-level data in the aggregate, with average rates derived from census or other data, or in qualitative work, through interviews. Others may rely on individual-level panel data to track the behavior or characteristics of individuals over time as they enter or exit gentrifying neighborhoods. Many papers identify change by testing it over time, meaning they compare change in a base year against a final year for the studied metric in both gentrifying and non-gentrifying areas. Econometric methods

utilizing regressions with varying levels of complexity have become commonplace as a method to test hypotheses. If one replaces the example of displacement with typically studied metrics in other disciplines, like crime rates, travel behavior, spending patterns, social capital or network structure, etc., then one can infer the scope of papers that have been produced. All of these papers rely upon identification of gentrification at some geographic level, contingent on available data for the consequence being measured, to test such hypotheses. In the next section, I review the methods that authors have used to identify gentrifying places.

IV. Measurement of Gentrification

For decades scholars have used qualitative and quantitative metrics to identify gentrification, track it over time, and measure the consequences of the process in gentrifying areas. A few key parts of the identification and measurement process can be identified by referencing the origins of the term. Ruth Glass noted that gentrification occurred in disinvested, central areas of London that were largely working class. These areas over time experienced both an influx of financial capital – discussed in her work as investment in existing housing stock – and an influx of new residents of a higher social class. Empirical studies of gentrification there and elsewhere have followed this framework by first identifying gentrifiable areas, which meet some criteria for disinvestment and/or lower social class occupation, and then by specifying which of those neighborhoods gentrify over some time period (Galster and Peacock, 1986). Those undertaking this measurement process must therefore account for time, a unit of spatial analysis, a set of criteria for eligibility, and a set of criteria that qualifies as gentrification. The most common approach is to follow that framework and use of quantitative census data at some small level of geographic reference that approximates the neighborhood – e.g., the census tract or block group – and assess socioeconomic and demographic conditions at separate census intervals (Barton, 2016).

Time

Within the standard approach, scholars typically assess conditions at decadal census intervals, though 5-year intervals and multi-decadal intervals of 20 and even 40 or 50 years have been utilized where and when possible. Such intervals are most often used because they are the time periods at which socio-economic and demographic data for small geographic units are made available through Census results. This includes two major drawbacks: many years are missing direct observation and the decadal observation points do not align with the macroeconomic business cycle. Despite this, scholars have found some justification in the lengthy interval due to the fact that neighborhoods change slowly in their social and economic composition due to the relatively static nature of the housing stock (Zwiers, 2018). Others have argued for the importance of studying gentrification over multiple decades (Meltzer, 2016). Since 2009, researchers have gained access to the U.S. Census Bureau's American Community Survey data, which provides 5-year data averages for small levels of geography, released annually. Such data enables, for example, scholars to compare the year 2000 to the 2005-2009 period, or any other subsequent 5 year period after those years (though temporally overlapping time periods should not be compared).

Spatial unit and analysis area

Within both the qualitative and quantitative branches, scholars in most cases focus on a particular area of study, or a particular unit of analysis, for a broader investigation of multiple places. Those relying on census data are in the United States and elsewhere confined to using units of statistical aggregation offered to them, which are generally census tracts. In the US, tracts are considered an imperfect proxy for neighborhoods but have long been used in studies of neighborhood change and gentrification (Timberlake and Johns-Wolfe, 2017). Beyond tracts, most researchers tend to use government-defined definitions when studying neighborhood change, primarily for reasons of convenience related to data availability (Kirk and Laub, 2010). A census tract is a small subdivision of a county, home to an average of 4,000 residents, and it is made up of smaller block group units. These subdivisions of counties are created to be homogeneous relative to demographics and socioeconomics, which may potentially bias

estimates of neighborhood change as their boundaries are not random with respect to socioeconomic conditions (US Bureau of the Census, 1994). Census tract boundaries can and do change over time, so researchers frequently make use of spatially harmonized tract boundary datasets from private or academic sources to ensure consistency.

With the geographic unit of analysis selected, researchers must also select a reference area in which to conduct their analysis. Some papers consider entire or even multiple, metropolitan areas; some individual cities or sets of cities; while some consider certain neighborhoods within cities or even single neighborhoods. Still others consider rural areas specifically (Nelson et al. 2010). Many have limited their eligible areas to “central cities,” often defined with political boundaries, or with quantitative metrics like proximity to a central business district, population isochrones, or areas with older housing stock (Freeman, 2005; Hwang and Lin, 2016). Researchers here are trying hold to the original conception of gentrification as an inner-city or inner-area phenomenon affecting older neighborhoods. This is not a universal trend, however, as many have included suburbs (Ley 1986).

Variables and criteria for analysis

With time, a spatial unit, an analysis area, and variables chosen, researchers must mark areas as eligible to gentrify, and assess whether they did or did not. It is worth noting that in some work scholars opt not to limit the set of tracts and all tracts are considered eligible to gentrify. Researchers often use a threshold to mark tracts as eligible, holding tracts below or above some level of a quantitative metric, like median income, as eligible. For example, Freeman (2005) marked tracts as eligible if they had a level of housing construction below a 20-year metropolitan median and a median income below the metropolitan average.

With a set of tracts or block groups defined as eligible, researchers must then determine whether tracts gentrified or not. Within this part of the measurement process, there is a much wider range of methods. For example, Yonto and Thill (2020) measured change in a social status index composed of three variables (occupation, education, and median household income). Tracts with above mean increases in the index were categorized as having experienced gentrification. Others have taken a simpler route, and like with the eligibility threshold, created a gentrification threshold. For example, Freeman (2005) utilized a five-step process to identify gentrification: to qualify as eligible, tracts must be located in the central city, have a median

income less than the metropolitan 40th percentile, have a smaller proportion of housing built in the last 20 years than the metropolitan 40th percentile; and to gentrify, tracts must see a greater increase in tract educational attainment than the median metropolitan area increase and see an increase in real housing prices over the measurement period.

Other studies branch out from census data to assess whether or not tracts gentrified or mark them as eligible for gentrification. Mixed methods studies have utilized field surveys of buildings over time to assess physical upgrading, coupling that information with census data to assess change over time (Wyly and Hammel 1998; Hammel and Wyly, 1996). In a unique stream of work, Smith et al. (1989) and Smith (1999), utilized tax arrears data to identify the point of temporal shift between disinvestment (unpaid taxes) and re-investment, a trackable indicator of supply-side pressure towards gentrification. More recent work has used video or computer imagery, from services like Google’s street view, to allow large-scale field surveys of building and neighborhood conditions to be compared against census data (Hwang and Sampson, 2014). Still others have assessed gentrification with parcel-level data on building values, renovations, and sales (Helms, 2003). In some quantitative work, scholars have referenced city plans, newspaper articles, visual assessments of structures, and the perceptions of residents (Brown-Saracino, 2017). This branch of research typically uses *a priori* definitions of gentrified areas, assuming that certain areas are gentrifying or have gentrified, coupled with resident surveys or interviews to assess perceptions and consequences of the process.

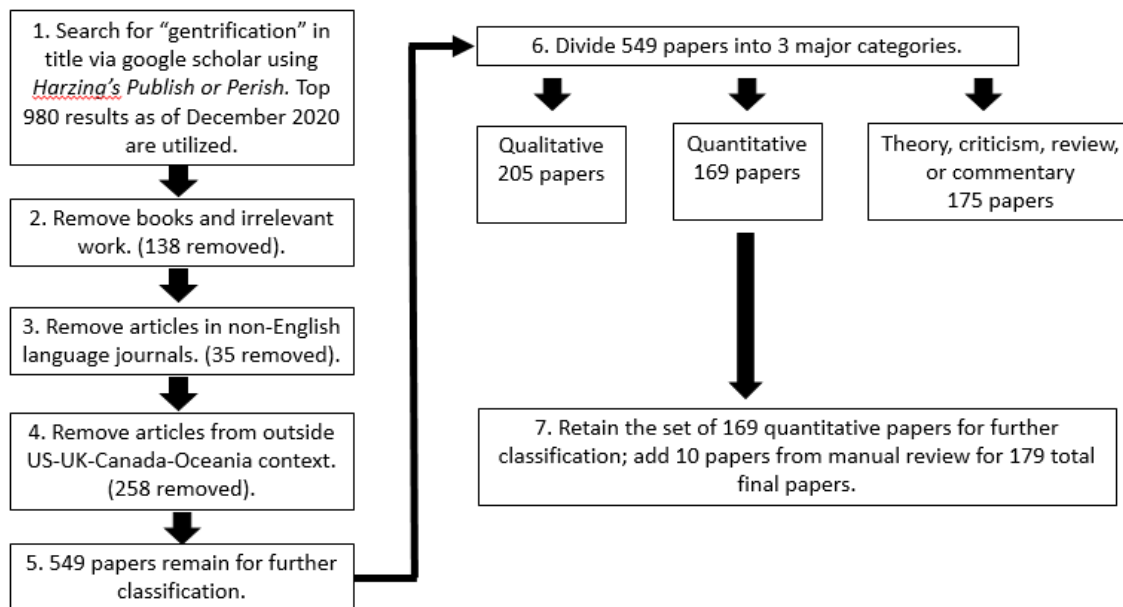
V. Review of quantitative methods used to define gentrification

A search for “gentrification” in the title of publications in Google Scholar returns over 7,900 results, with numerous duplications and frequent instances of work from non-peer-reviewed sources (e.g., think tanks, city governments, news media, or advocacy organizations). To create a more useful database, I used the software *Harzing’s Publish or Perish*, a publication database search tool which pulls articles based on author or title or other searches, to scrape Google Scholar with the search term gentrification applied to article titles. The top 980 unique results ranked by citation number were pulled, ranging in publication date from 1973 to 2020.

To further limit the set for analysis, books and book chapters were removed, along with pre-publication working papers, papers published at think tanks and other non-peer reviewed venues, and work deemed extraneous to urban studies. Next, 35 papers published in languages other than English in non-English language journals were removed. Finally, papers published outside of the US-UK-Canada-Anglo-Oceania context were removed. Although papers from outside this context may be relevant to gentrification theory and provide important empirical evidence, these studies are about urban regions subject to very dissimilar urbanization dynamics and planning regimes.

In this next stage I divided those papers into two camps: qualitative, in which gentrification is defined and studied without quantitative means; and quantitative, in which gentrification is measured through census or survey data or other numerical means. In order to divide the papers, I read the abstracts and the data and methods sections. The end goal was to obtain a complete set of papers in which a quantitative metric was used to define that at least one place is gentrifying or gentrified. Those two options, however, left out a wide body of theoretical, criticism, and commentary pieces, so those papers were moved into a third category. The flow chart in Figure 1 illustrates the entire classification process. After a manual review of the 169 quantitative papers, 10 additional important citations were added in. These were missed by the initial search process and obtained from reference lists in the set of 169 papers.

Figure 1. Flow chart to select papers for analysis



The quantitative papers were classified using a matrix in an Excel spreadsheet, manually, with information supplied by reading the methodology or other relevant sections. I gathered information to fill the matrix based on the following questions.

- What years were used as the start and end period of the analysis, and what was the corresponding range?
- What was the geographic unit of analysis, and geographic scope of analysis?
- What was the primary data source?
- What demographic or socioeconomic variables were used to (a) mark areas as eligible to gentrify and (b) measure change over time that indicates gentrification?
 - Were these variables representative of the demand side or supply side theories on the causes of gentrification?
- Was an index or other multi-component computational factor like **principal** components analysis used to measure gentrification?
 - Was some absolute numerical threshold used to mark neighborhoods as eligible or as having gentrified?

VI. Results

Time and Geography

Researchers have chosen a wide variety of time periods to conduct their analyses of gentrification. Figure 2 is a scatterplot showing the start year of analysis on the x-axis and the end year on the y-axis. The figure also contains a table at bottom right listing the number of papers which start or end their analysis in each decade. The scatterplot illustrates that there is a cluster of papers at the top right; these are papers that begin analysis after 1990 and end before the year 2010. This is visible in the corresponding table, which shows 66/179 papers beginning in the 1991-2010 period (37%) and 95 ending in that period (53%). Another visible trend is a fair number of long-range analyses beginning in the 1960s or 1970s and not ending until the year 2000 or later (the top central part of the chart). No studies in the dataset ended earlier than the 1970s, and only 35 (20%) began prior to that date.

Figure 2. Start and end year analysis scatterplot

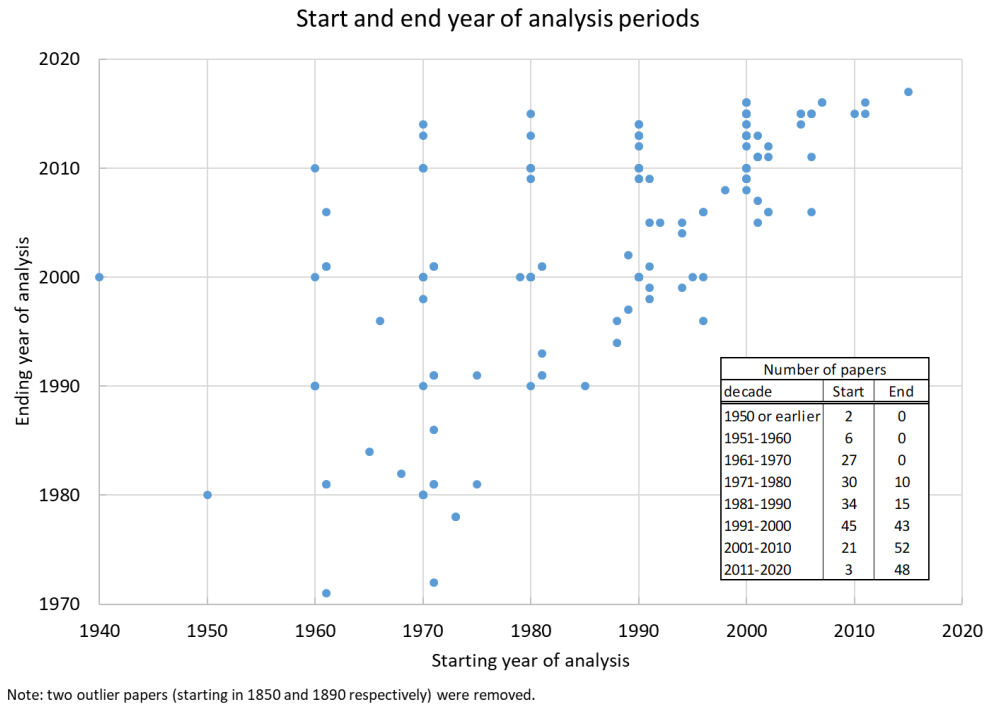


Figure 2 is further illuminated by data on inter-period measurement range. For example, an author may have studied 1970 to 2010 but within that period measured gentrification from 1970-1990 and 1990-2010. The vast majority (65%) of researchers measure gentrification over a timespan of approximately a decade. Only 37 papers (21%) measure demographic and/or economic change over a greater than 11 year period to declare whether or not gentrification has occurred in a given place. Forty-two papers (23%) measure changes over relatively short time less than a decade scales or assess data at single point in time.

Turning towards geography, we observe further evidence of the relatively consolidated nature of research on gentrification. Nearly half of the dataset (85 papers, 47%) limits analysis to a single city only; and a sizeable minority (15%) of papers are even further limited to one neighborhood or several neighborhoods in a single city. The remaining papers, just over one third of the set, tackle analysis at a larger scale. These papers pool data across multiple cities, an entire region or multiple regions, or even in a few cases, an entire country.

A majority of papers (52%) have relied on the census tract, or its equivalent in other countries, to assess gentrification. Only a minority of papers (14%) relied on units of geographic aggregation smaller than the census tract, including a few that rely on parcel-level data. Nearly a

third of papers, at 27%, used analysis areas that are larger than census tracts but still subdivisions of cities or towns. These sub-city level areas include various other census aggregations like zip codes or transportation analysis zones, and political subdivisions of cities like wards or boroughs. The remaining papers assess gentrification at larger scales: entire cities, entire counties, or at self-defined geographies such as pre-selected areas of countries or counties or villages.

Data sources and variables used for definition and assessment

The source of summary data used in research about gentrification is deterministic to the extent that scholars must rely on public data sources like the census, which produces data at fixed intervals and fixed geographic scales. Census data at narrow levels of geography are typically only available in the post-war period, further limiting the potential for analysis prior to the 1950s. Nearly three out of four papers have used census data in some way. The next largest share, only 14%, have relied on a non-census government source such as local government data on property sales to study neighborhood change. Prior to the availability of extensive, analysis-ready census data, some authors relied on private market demographic surveys in the 1970s and 1980s. For example, Henig (1980) utilized data from the now defunct R. L. Polk & Company's *Profiles of Change*. A group of papers has utilized field or personal surveys to assess change over time as well.

With a data source chosen, researchers must pick certain metrics or variables from that data source to study gentrification. These metrics and variables can be classified according to gentrification theory, which explains the causes of the phenomenon can be separate into two categories: supply and demand. Table 1 presents a list of variables used in each category.

On the demand side, authors have utilized demographic indicators to describe the populations that are moving in to gentrified areas: age, ethnicity, family composition, foreign born share, household size, population change or density, and race. Socioeconomic indicators include educational attainment, income, mobility rates, occupation, poverty rates, housing cost burden, and shares receiving public assistance. Much of this data is available in decadal or more frequent census surveys like the American Communities Survey; however, publicly available versions of this data do not track the same individuals over time, such that different time periods of data form a time series of the then-current residents of the neighborhood. Other data sources

like the Panel Study of Income Dynamics (PSID) do track the same families or individuals over time with great detail on their income and location; but the sample size is greatly limited which makes assessing aggregate neighborhood effects more challenging. Other indicators include the locations of coffee shops, judged by several authors to be proxy for demand from certain groups (Hwang and Sampson 2014). On the supply side, authors have used a variety of metrics to assess the composition and characteristics of the built environment. Typically, these indicators focus on the housing stock: property age, sales data, home values, rent prices, recent construction, unit and building characteristics, tenure,ⁱ and vacancy rates. Other supply side variables include the share of units used for short-term rentals, green roofed structures, data on loans in neighborhoods, property tax amounts and rates, data on tax arrears, and visual surveys of the quality or characteristics of the built environment.

Table 1. Variables used to identify or study gentrification

<u>DEMAND</u>	<u>SUPPLY</u>
• Age of residents • Number and location of coffee shops • educational attainment of residents • employment or unemployment rates of residents • Ethnicity of residents • family composition (share of couples or childless couples, share of same sex couples) • family or household income (average or median) • foreign born share • gini coefficient • household size • in-movement/mobility rates • occupation • per capita income or median income (individual) • population change • population density • poverty • race • rent burden (share paying over certain income) • share of artists • share receiving public assistance	• airbnb rental share • number of green-roofed structures • home prices (average, median, or from sales data) • housing age • housing stock change • loan data • number of bedrooms in housing units • property taxes • rent price (median, gross, average) • sales data • structure type • tax arrears data • tenure • unit size • unit type • vacancy • visual surveys

Nearly half of the papers (45%) use both supply and demand side variables to track change. A large plurality (29%) utilizes only demand-side metrics, and a much smaller share (7%) use only supply-side metrics. Note that 33 papers (18%) used an a priori definition of gentrified areas and are classified as such.

Methods of defining or measuring gentrification

The methods used to measure whether or not gentrification occurred exhibit the most variance. As such these methods are hard to classify, but some trends are evident. The simplest definitions declare some increase in a single variable in a study area, like educational attainment or home prices, to be gentrification. Complexity increases from there. Nearly a quarter of the papers, 41 (23%), in the set utilized statistical techniques to create indices or more precisely determine variables which indicate the presence of gentrification. One method is to use a weighted or non-weighted index of a set of demand or supply-side variables. For example, Ley (1986) equally weights the share of population in white-collar jobs and the share of population with a university education in census tracts to create a social status index. More complex methods utilized include principal component analysis of differences over time, a statistical technique which reduces a set of variables to provide a smaller set of the most influential (Bereitschaft, 2020). These more complex techniques allow authors to input a large number of potential causal factors and withdraw the most influential, rather than pre-selecting a few commonly utilized variables like education, occupation, or home prices.

The majority of the papers in the dataset, however, do not use such a method to combine variables. These 77% of papers track changes in individual variables, sometimes multiple variables, over time to indicate the presence of gentrification. 82 papers (46%) used some discrete threshold to determine whether gentrification occurred in a specific place. Freeman (2005) influenced numerous future papers by creating a threshold of comparison to change in the metropolitan area, without using an index or more complicated scheme. This original work marked eligible census tracts as gentrified when they experienced an increase in educational attainment greater than the metropolitan area average increase and also an increase in real housing prices. Others take a different approach and use increases in variables or indices relative to other tracts. For example, Hwang and Lin (2016) constructed a socioeconomic status index

from educational attainment and household income data at the tract level, and used that index to rank tracts in a metropolitan area. Census tracts which experienced a two-quartile increase in the SES index over any decade from 1960-2010 were said to gentrify. This differs, for example, from the approach of Ley (1986), which simply took the top 20% of tracts in the index, rather than tracts that passed some threshold increase.

Patterns and correlations in quantitative research methods

The structure of the data gathered for this section enables comparison of certain trends in quantitative methods. For example, it is possible to ascertain if there are significant differences in methods between papers that attempt to study gentrification at the city or sub-city level versus papers that study gentrification across cities, a region, or multiple regions. Such comparisons can point researchers to methodological gaps in certain areas of study. A complete breakdown of these results is outside of the scope of this paper due to the possible number of permutations. For example, one could also attempt to identify methodological differences between papers that focus on supply or demand side variables; or ascertain methodological differences between papers that study short or long time scales; or tease out the differences between papers that use different geographic units of analysis, etc. However, some important patterns are visible in the data, which are noted here.

First, as aforementioned, papers in about one third of the dataset study gentrification in multiple cities, a region, or an entire region. The remaining papers limit their geographic area of analysis to a single city or portions of a single city. While there were no discernable differences in time period or geographic unit of analysis between these groups, the larger-scale papers tended to use more complex methods. 30.0% of the larger scale papers used an index or other multivariate statistical operationalization of gentrification, but only 18.5% of the smaller scale papers did. The larger scale papers also were much more likely to use a specific threshold to qualify gentrification: 57.6% versus 39.0%. The larger scale papers were also much more likely to utilize both supply and demand metrics: 62.1% against 36.3%. Less than a fifth of papers in each group included race as a metric, with no discernable difference between the two. These results imply that papers analyzing gentrification patterns or consequences at a larger scale tend to use more statistical rigor, and also consider gentrification more holistically than smaller scale papers.

The dataset also reveals that complexity in gentrification research has been increasing recently. Papers using an index, principal components analysis, or other statistical operationalization of gentrification were published with an average date of 2013, versus 2008 for those without such methods. These papers also averaged using a longer time period (13.7 years) than those without such methods (10.2 years), and used more recent data, with an average end year of 2006 versus 2002. 58.5% of the more statistically complex papers used both supply and demand metrics in the definition of gentrification, against only 42.0% of the less complex work. The more complex papers were also more likely to use a larger geographic study area, with 48.7% using an area larger than one city, against 33.0% for the less complex papers. The next section compares these and other trends and draws conclusions based on the theoretical foundations of gentrification.

VII. Discussion

A number of conclusions can be drawn from the trends presented in the previous section. Beginning with the data on time, the two figures taken together illustrate that the majority of what is known about gentrification has been determined using data from 1980-2010. While some work has examined earlier periods, the 1950s-1970s remain understudied. Some of this is due to a desire to respect Glass's discovery of the phenomenon in London in the 1960s, as most research has examined periods after that date to see if the process progressed or became evident elsewhere; it is also an issue of data availability. Gentrification theory makes no requisite of time period and if demographic and socioeconomic data can be coupled with data on home or rent prices or other supply side indicators prior to the 1960s, then further research would be welcome.

Continuing with a critique on time, a general consensus exists to measure gentrification as occurring over 10 or fewer years within that time range. However, across the literature there is little to no theoretical discussion of why a ten-year interval, against a twenty or even thirty year interval, is the proper time length of measurement. It is apparent that the choice of time interval is made based on data constraints, but limiting it to a single decade on average is arbitrary. A stream of the literature discussing stage models of gentrification has found that the process follows a geographically idiosyncratic but still relatively predictable time path. Condensed, this

argument states that gentrification does not happen all at once and certain things happen first: slow in-movement of artists or LGBTQ individuals, with modest changes to tenure rates and rents and slower change to demographics and socioeconomics; then upgrades to the housing stock and in-movement of higher status groups and more rapid change; then new construction, displacement, commercial gentrification, and even super-gentrification (Lees, 2003; Van Criekingen and Decroly, 2003; Kerstein, 1990). Little research has been done to measure the lengths of time it takes for these processes to occur.

As with the data on time periods, the data on geography shows a lack of variance in gentrification research in terms of geographic scale. The majority of papers look only at single cities or subdivisions thereof and study change over time using a neighborhood-analogue like the census tract. It is also worth noting that over half the dataset has investigated gentrification in a single city or parts of a city; large scale comparative research across cities or metropolitan areas remains rare. The question for researchers on geography then is to identify if gentrification is unique within cities or even neighborhoods, or if the same trends and patterns occur in different cities over time.

Most scholars have understood Ruth Glass's original conception of gentrification as an inner-city phenomenon, yet some scholars have over time have studied at the scale of entire cities, metropolitan areas, suburbs alone or multiple suburbs, and even rural areas. This geographic extension of research has been fruitful as authors have found evidence of gentrification in suburbs, small towns, villages, and even rural areas (Brown-Saracino, 2017). Some analysts have criticized these approaches, such Bondi (1999) who asked if it was time to put the term gentrification to rest, or Maloutas (2011), who argued that spatiotemporal expansion of the definition of gentrification introduced a reduction in theoretical rigor. Others, such as Slater (2006) disagreed, arguing that it made no sense to focus Glass's fine empirical geography given dramatic change to global and local economies, cultures, and labor markets since the 1960s. Despite these arguments authors who do undertake large scale studies of metropolitan areas or regions treat tracts in central cities the same as tracts elsewhere, meaning these tracts must pass no different 'test' to be marked as gentrified based on their location. Socioeconomic or demographic change outside cities may, as Slater suggests, be of a different character than in central cities meriting divisions of these geographies in analyses. This potential area of research

remains poorly explored, as most quantitative studies which include suburban or rural areas treat those areas no differently than central areas.

Regarding geographic unit, authors of these papers have employed a wide variety of scales to measure analysis, but tend to stick with the best neighborhood analogue, the census tract. Quantitative work at scales smaller than the census tract remains rare and it is here perhaps that the most improvement could be offered. Analyses of gentrification at the tract level are limited to what census averages can describe about a population, masking detail on the distribution of income, educational credentials, and rents or home prices. In the US, census tracts can be relatively spatially large and have economically and demographically dissimilar pockets of neighborhoods within them. Without further geographic detail, these details are impossible to discern. A few scholars have improved upon this process by using block group or parcel level data (Lee and Newman, 2020; Helms, 2003).

Turning toward data sources used in the analysis, it is tougher to critique the choices made by authors. All are greatly limited by data availability and must rely on the census for demographic and socioeconomic information. That data can in some cases be coupled with local data on housing supply and characteristics from other government sources. Hammel and Wyly (1996) created a national-level resource in the US with their field survey of neighborhoods which can supplement census data; their data has been used by numerous successive papers (Hwang 2015, 2016; Freeman, 2009; Moore, 2009). The time commitment and resources required for this approach, however, have meant that it has not been replicated. Several have utilized Google Street View to undertake a similar field survey of structures (Ilic et al. 2019; Hwang and Sampson, 2014). Overall, however, there has been limited effort to cross-fertilize aggregate census averages with more specific local level data in the manner argued for by Hammel and Wyly decades ago.

Eighty-two papers (45.8%) have included explanatory variables or definitions of gentrification that include both supply- and demand-side items. That said, a plurality of papers (52, 29.0%) utilize only demand-side variables in order to understand the characteristics of gentrifying or displaced populations. These papers leave out measurement of home or rent prices, a puzzling choice given Glass's inclusion of investment in her definition. Metrics like occupation, education, and home or rent prices remain the most commonly utilized. Most papers which included a demand side metric (a total of 134) included either education or occupation or

both as a specific variable. A total of 115 did so, or 85.8% of papers measuring the demand side (64.2% of the entire dataset).

Race remains an uncommonly used metric, as only 31 papers (17.3%) included it in the operationalization of gentrification (note that a larger share of papers may have studied impacts or consequences with respect to race). This is likely due to Glass's theoretical foundation of gentrification as contingent on change in neighborhood social class composition, which is commonly measured with average or aggregate occupation or education statistics. In the US, race and social class correlate, but the recent findings on the nuanced links between race and gentrification, especially from Timberlake and Johns-Wolfe (2017) and Hwang (2015, 2014), clearly indicate that race and social class should both be addressed in empirical work.

Within the set of 31 papers that include race as a metric, all but two of the papers were published after the year 2000, and twenty were published after 2016, reflecting increased attention paid to the links between gentrification and race. Most of these papers (20) measured gentrification with both supply and demand variables, and all but five also included education or occupation as a metric (and all five of those also utilized income or poverty, both proxies for social class). The papers exhibited no clear trends in whether they measured gentrification across a single city, region, or multiple cities or regions, but most (22) utilized census tracts as their unit of analysis.

On measurement technique, the data revealed that analysis of gentrification still relies on relatively simple metrics. Only a quarter of papers studying gentrification with quantitative metrics have relied on more complex instruments like indices or factor analysis to define the process as occurring; most rely on simple increases in a single variable or multiple variables. Beyond that, the metrics used to qualify places as gentrifying tend toward vagueness. Less than half of the work assessed used some sort of specific threshold to mark whether or not gentrification occurred; the remainder used unspecified criteria to declare areas as gentrified or not. Such imprecision muddies the waters for discourse on gentrification and analysis of its consequences. Despite that, some patterns emerged from the data which showed that methodological complexity is increasing over time. Newer papers tend to use more complex methods and study gentrification at larger areas, while also addressing both supply and demand. These papers also utilize longer time scales and more recent data. This positive trend of increasing methodological nuance is undoubtedly crucial for deriving more meaningful conclusions about the consequences of gentrification

VIII. Conclusion

Over 40 years of study of gentrification with quantitative methods has produced a wide range of evidence on its presence and continued expansion throughout cities across the developed world. This expansion has been linked causally to both positive and negative consequences, though little research has assessed the positive and only recently has research turned to assess negative consequences other than displacement. Significant debate is ongoing as to the depth, prevalence, and severity of residential and commercial displacement of incumbent residents and businesses during the process of gentrification.

This paper revealed a number of trends through a systematic review of 179 papers published since the 1970s that sought to measure gentrification and its consequences. Authors have tended to measure gentrification over the same time periods and at the same geographic scales, due to data availability limitations. Analysis of time intervals is dominated by analysis at the decade time scale, despite little theoretical discussion of why or how that amount of time is the proper measurement. Geographic units of analysis are dominated by tracts or larger scales, with few papers analyzing gentrification at the block or address level. Definitions of gentrification are typically simple, and use of complex quantitative techniques to identify the process remains rare; further, definitions are often vague or arbitrary. These findings empirically validate the conclusions of Easton et al. (2020), wherein the authors noted that identification of gentrified neighborhoods is contested in research, as gentrification occurs unevenly across time and space, and spatial units used in research are too large to identify consequences like displacement that occur at the local level.

Gentrification research has emphasized the complexity of the process. No one definition is gospel. Future research on gentrification should consider utilizing multiple definitions of gentrification to assess consequences. This paper also highlighted that few papers have mixed methods, in which authors join census or other data with personal or field surveys to ground-truth gentrification processes; this has continued despite the influence of a series of papers in the 1990s by Daniel Hammel and Elvin Wyly. Authors should also ponder the findings of this paper and consider grounding their choices of measurement interval and geographic unit in theory before relying on decadal averages or census tracts as sole metrics of analysis. Further, despite

the phenomenon's links to racial inequality in the United States, few papers have considered race as a component in defining gentrification.

One major limitation of this work is that it did not classify the qualitative empirical literature, which is an even larger group (205 papers compared to 179 quantitative) in the dataset of 980 papers (Fig. 1). While assessing the methodologies of the qualitative literature was outside of the scope of this review, scholars seeking to empirically examine the consequences of gentrification should familiarize themselves with the qualitative literature. Brown-Saracino (2017) provides an indispensable overview and summary of contrasts between measurement techniques and methodological foundations in the qualitative and quantitative literatures. Qualitative scholars focus much less on identification gentrification's breadth and scale and instead focus on questions about the characteristics of gentrification on the ground, through analysis of the choices and beliefs of participants and bystanders in the process (Brown-Saracino, 2017). Barton (2016) finds that quantitative work may illuminate gentrification in areas where qualitative work has paid less attention, due to less media or social visibility in certain neighborhoods. Qualitative work, however, can answer questions on the real impacts and perspectives of incumbent residents and gentrifiers in a way that quantitative work cannot (Freeman, 2006). Both Barton (2016) and Brown-Saracino (2017) suggest that each side of the methodological divide can and should innovate through attention to the methodologies of the other.

Planners and researchers seeking to identify gentrification in their communities should take several lessons to heart from this review. First, use of neighborhood or sub-neighborhood level demographic and economic data is recommended, as scholars have identified that neighborhood level factors influence gentrification, and this data is now easily accessible. Second, if possible, it is recommended that scholars pair socioeconomic and demographic data with physical surveys of neighborhood conditions, or the perceptions of residents. Third, effort should be made to pair metrics that track both the supply and demand sides of the gentrification equation. A novel approach would be to combine time – matching associated economic cycles in metropolitan housing supply and demand – with data on both the supply and demand side. Further regarding time, this study has made clear scholars and planners must reasonably ground their measurement range and periods based on knowledge of local conditions.

While the COVID-19 pandemic has introduced uncertainty into the global economy and spawned a rash of opinions about the future of cities, scholars of gentrification know that the phenomenon has outlived dramatic changes to the global economy before. The 2020s will undoubtedly yield additional quantitative work on the subject as gentrification mutates and continues to spread.

Essay Two: Smart Growth and Gentrification: Unpacking the Relationship

I. Introduction: smart growth and gentrification – is there a relationship?

The smart growth agenda came to the fore in urban studies decades after British sociologist Ruth Glass coined the term “gentrification” in a socioeconomic assessment of London in the 1960s (Glass, 1964). Glass defined gentrification as transition in socioeconomic status in neighborhoods, wherein higher workers of a higher social status move in and upgrade the residences of departing working class residents. This process of neighborhood change continues today, though the geography of gentrification has expanded dramatically to include many cities across the developed world and even rural small towns (Brown-Saracino, 2017).

Gentrification has been described as an economic and social process that “flies in the face of” the dominant form of urban growth in the United States in the post-war era: suburbanization (Griffith, 1995, p. 241). While central city populations across the country generally decreased from the 1960s through the turn of the millennium, certain neighborhoods in certain cities experienced the redevelopment, reinvestment, and class transition known as gentrification. Concurrently, smart growth and its antecedent policies like growth management and contemporaneous movements like new urbanism and sustainability gained currency. These movements and policies were a reaction to the inefficiencies exacerbated by suburbanization, such as traffic congestion and related air pollution, and its aesthetic and ecological downsides like monotonous architecture and loss of green space to development. Calls for smart growth were also partially a reaction to the economic and social decay of once-vibrant urban residential and commercial areas due to suburbanization of economic activity.

Adherents of the smart growth movement believe that strengthening existing communities through economic development can improve metropolitan form and function. We argue that the tenets of smart growth movement, if enacted through policy, can catalyze gentrification by stimulating redevelopment in disadvantaged areas. Despite this potential consequence, smart growth’s principles are silent about the potential consequences of economic growth in existing communities. One primary consequence of gentrification is displacement, which can refer to residents, businesses, and neighborhood culture. Forced or voluntary relocation can occur through direct economic displacement, when residents or businesses can no longer afford real

estate due to price increases; exclusionary displacement, when those who might usually move to the neighborhood no longer can because of increased prices; and indirect displacement through social and cultural shifts that make the neighborhood less welcoming to individuals with lower incomes (Slater, 2009).

Since smart growth first propagated across the country around the year 2000, gentrification has diffused throughout the American metropolitan landscape into more neighborhoods each year (Hwang & Lin, 2016). Urban public policies that support denser infill development have become mainstream, while concerns about gentrification and displacement have risen in tandem. These policies include reducing required parking minimums, transfers of development rights, urban growth boundaries, reducing or waiving impact fees and adequate public facilities ordinances, mixed use zoning, increased residential density, construction of fixed transit lines, and more.

Scholars have begun to critique the relationship between smart growth, which promotes redevelopment and dense urban living, and gentrification. Some have argued that “too often, urbanists have prescribed compact development without evaluating the very real consequences of new, dense construction in terms of raising land prices beyond the means of current residents” (Chapple & Loukaitou-Sideris, 2019, p. 3). Empirical evidence of links between smart growth policies and increased or decreased gentrification remains rare. Cities and regions with smart growth policies must therefore blindly wrestle with the question: do smart growth policies exacerbate gentrification and its consequences, or can smart growth occur without gentrification?

In this chapter, we aim to increase knowledge in this area by answering that question through critical discussion of the literature and analysis of an empirical dataset. First, we explain what is known about gentrification. We then explain the reasons why smart growth may cause or exacerbate gentrification. Next, we present empirical data describing the amount and character of gentrification in US metropolitan areas since the year 1980 and discuss general trends. We investigate the extent to which smart growth can be linked to gentrification through descriptive statistical analysis and a mapping exercise. We then explain several ways that smart growth can be encouraged without exacerbating the negative consequences of gentrification. The final section illustrates areas for further research and offers conclusions.

II. What do we know about gentrification?

Background

Ruth Glass purposefully played on the historical term “gentry,” which refers to wealthy landowners, as she denoted the rehabilitation of aged housing stock, transformation of neighborhoods from majority renter-occupied to majority owner-occupied, increase in property prices, and displacement of working class residents in certain neighborhoods in London in the 1960s. Beyond detailing process at the local level, Glass described gentrification as “an inevitable development, in view of the demographic, economic, and political pressures to which London... has been subjected,” forming the crux of her argument that gentrification is a neighborhood process that cannot be attributed to one factor, but is instead the result of a complex set of metropolitan interactions (Glass, 1964).

Glass’s concept of gentrification began to enter the urban studies conversation in the United States in the early 1970s, when suburban growth was rampant, the growth management movement was nascent, and smart growth was decades away. Perhaps best exemplified by the ‘brownstoning’ movement in Brooklyn, New York, the press and the general public became aware of the process of gentrification, which was alternatively termed the ‘back to the city movement.’ Across the country, in cities like Washington, D.C., San Francisco, and Chicago, some homeowners were defying the norm of settling in new construction in the suburbs. They instead sought to purchase, live in, and rehabilitate the housing stock in dense urban neighborhoods close to downtowns (Lipton, 1977).

Early research generally focused on gentrification in a few isolated neighborhoods and residential housing markets – and especially on the purchase and rehabilitation of housing – in certain cities like London and New York. After the 1980s, however, it became clear that this process was occurring in many other places, and as investment continued to occur over decades, it became clear the process was not transient (Lees, Slater, and Wyly 2008). Despite general agreement around Glass’s original definition, no single definition of gentrification is commonly used in qualitative or quantitative work. Criekingen and Decroly (2003) noted that there was no unanimously approved empirical delimitation of the concept of gentrification 40 years after Glass coined the term, and that remains true today (Finio, 2021). For the purposes of this paper, and in line with current scholarship, we define gentrification as an influx of new investment and

new residents with higher incomes and educational attainment into a neighborhood (Chapple & Loukaitou-Sideris, 2019).

Measurement

Scholars have used a variety of qualitative and quantitative metrics to identify gentrification, track it over time, and measure the consequences of the process. Ruth Glass noted that gentrification occurred in disinvested, residential urban areas of London inhabited by the working class. As gentrification occurred, these areas experienced both an influx of financial capital – investment in the existing housing stock – and an influx of new residents of a higher social class. Contemporary empirical studies of gentrification follow this framework to measure gentrification, usually with publicly available data. First, researchers identify areas that can gentrify, which meet some criteria to be considered disinvested, such as by being home to a large share of working class individuals and families, or by having low rent or housing prices. Second, the researchers use quantitative metrics – often changes to home prices, education levels, or incomes – to specify which of those neighborhoods gentrify over some time period (Galster & Peacock, 1986).

That general framework has been operationalized in dozens of different ways by researchers since the 1970s (Finio, 2021). The most common approach is to use census data at some small level of geography, like the census tract, to assess socioeconomic and demographic conditions over time (Barton, 2016). In studies using census data, researchers seeking to qualify gentrification will most often analyze change variables like home prices, income, rent, education, occupation, and race, and more rarely indicators like poverty, residential tenure, age, ethnicity, and unemployment. Other studies have utilized field surveys of buildings to assess physical changes to neighborhoods such as investment in real estate, and combined that information with census data or resident surveys to assess change over time (Wyly & Hammel 1998; Hammel & Wyly, 1996). Technologically innovative work has used video or computer imagery to allow large-scale field surveys of neighborhoods to be completed digitally (Hwang & Sampson, 2014). Some have assessed gentrification with parcel-level data from local government sources on building values, renovations, and sales (Helms, 2003). In qualitative work, scholars have referenced city plans, newspaper articles, visual assessments of structures, and the perceptions of residents through interviews to understand the geographic boundaries and time scales of

gentrification (Brown-Saracino, 2017; Freeman, 2005). In some qualitative and quantitative work, scholars identify gentrification *a priori* without quantitative analysis, referencing other work or their own knowledge of the process to define geographic limits for study.

Though the methods described above are relatively straightforward, infill development presents a hypothetical problem for those seeking to identify gentrification and link it to smart growth policies. Is gentrification *only* rehabilitation and in-movement of higher status individuals into existing structures, or does construction of new buildings for wealthier residents on empty lots also qualify as gentrification? Smart growth calls for infill development on brownfield, industrial, or vacant parcels of land, particularly near urban downtowns. Despite early debate in the 1970s and 1980s on this topic, researchers have more recently argued that new-build gentrification, or infill on vacant or brownfield lots in disadvantaged areas, is not separable from the more traditionally recognized upgrades to and turnover of existing housing as a part of the gentrification process (Davidson & Lees, 2004). Earlier research tried to differentiate the two types of development, as infill development did not necessarily directly replace any existing residents. More recently scholars have found that infill development increases land prices, possibly driving local displacement, and more broadly occurs in tandem with demographic change and upgrades to the existing housing stock.

It is possible to imagine a hypothetical scenario of neighborhood gentrification where infill development, at least in the short run, would result in an influx of financial capital and new wealthier residents, but not displacement of existing residents as they remain in their unchanged nearby homes. This would be smart growth *without* gentrification – or at least without gentrification’s most impactful consequence. Commenting on whether or not gentrification occurred in such a place would depend on the scale of measurement. For example, at the census tract level, in-movement of higher-class individuals into wholly new buildings coupled with complete stasis in the incumbent lower-class population in existing buildings would result in an average increase in most socioeconomic indicators like income, home prices, or educational attainment. Depending on the magnitude of that increase, that could be defined as gentrification using common method described above. These and other measurement questions are critical for finding the boundaries of gentrifying neighborhoods. Once those boundaries are identified, many scholars attempt to identify the causes and consequences of gentrification.

Research on causes

Decades of research have established evidence that gentrification is caused by a range of factors that operate at both the city and regional scale. These factors can be broadly separated into three categories: the demand side, the supply side, and the political sphere. Beginning with the demand side evidence, many have found that those of higher social and economic class have been more likely to re-inhabit central cities as de-industrialization has occurred and economies have advanced (Lees et al., 2008). The supply side evidence has shown through economic data how certain parcels of land in central cities become undervalued relative to their potential value and eventually experience redevelopment (Smith, 1979). Evidence on the political front has shown that city governments themselves may accelerate gentrification as they use various policy instruments to encourage new residents and businesses to locate in disinvested areas (Griffith, 1995).

Narrowing the focus to the neighborhood scale, there is ample evidence that social, economic, and built environment characteristics – related to all three of the above factors – are related to the process of gentrification. In a review, Brown-Saracino (2017) finds that gentrification's likelihood increases in neighborhoods in proximity to downtown areas, cultural amenities, public transportation, and other gentrifying areas, as well as in neighborhoods with quality housing stock, single-family homes, and older buildings. Heidkamp and Lucas (2006) found that predictors of gentrification at the neighborhood level also include rents, home values, household incomes, household size, education levels, the presence of large institutions providing professional employment, parks, and adjacency to waterfronts. With respect to racial composition at the neighborhood level, Hwang and Sampson (2014) find that demographics matter, as certain neighborhoods that are majority Black are less likely to gentrify than more diverse places. This finding was replicated by Timberlake and Johns-Wolfe (2017), and further confirmed by Sutton (2020), finding that the pace of gentrification declines as the share of Black and Latinx households rises. On the political and governance front, the impact of public transportation investments on neighborhoods has been well documented, and empirical evidence shows gentrification can be caused by such investment (Zuk et al., 2018). Exploratory models of housing markets show that households bid up the cost of housing near public transportation, potentially causing gentrification (Dawkins & Moeckel, 2016). Little to no evidence exists that attempts to link smart growth policy to gentrification at the neighborhood scale.

At the metropolitan scale, only a few scholars have attempted to find a causal link between political factors and gentrification. Landis (2015) studied neighborhood change in a dataset of numerous US metropolitan areas and found that the presence of urban containment boundaries, or geographical boundaries on urban density and urban utility services, was linked to increased neighborhood upgrading. Neighborhood upgrading was defined only by strong increases in neighborhood household income, which does not necessarily mean gentrification occurred. Nelson et al. (2007) studied gentrification (defined as transition in residential tenure from rental to ownership) in metropolitan Portland, OR and were unable to causally link the presence of that region's urban growth boundary to increased owner occupancy. Those pieces of empirical work embody the evidence on this front, leaving open the question of smart growth's responsibility for gentrification at the regional scale.

Research on effects

Turning toward the positive and negative effects of gentrification, we note that while significant attention is paid to displacement, a body of research on other effects does exist. On the positive side, gentrification can stabilize declining areas, increase property values, decrease vacancy rates, increase tax revenue, reduce urban sprawl, and more (Atkinson, 2004). In addition to displacement, however, gentrification can cause community conflict, increased homelessness, and loss of social and economic diversity (Hyra, 2017). Qualitative work on the perceptions and experience of incumbent residents in gentrifying neighborhoods has found highly nuanced perspectives, as some residents appreciate greater access to services and commerce, while others, may feel unwelcome or unable to afford new amenities (Freeman, 2006).

Japonica Brown-Saracino noted that gentrification is increasingly viewed in qualitative and micro-level studies as a social problem that is “deeply problematic and consequential for longtime residents” primarily due to displacement (2018, p. 517). Studies focused on displacement tend to assume that it is always a consequence of gentrification (Chapple & Loukaitou-Sideris, 2019). Chapple and Loukaitou-Sideris, however, state that “displacement may stem from either disinvestment or investment, and because of this, displacement is not necessarily directly induced by gentrification” (2019, p. 40). However, other scholars reject such disassociation of gentrification and displacement. Slater (2009) argued that gentrification

research that finds little evidence of displacement has methodological problems, and further, is far removed from the critical origins of the gentrification debate. For Slater, gentrification has always been linked to inequality and class struggle, and thus displacement.

Commenting on this divide in the literature, Brown-Saracino noted recent macro-scale quantitative evidence suggests that “displacement is far from endemic” (p. 520). Indeed, some recent empirical evidence indicates that residents with low incomes in gentrifying neighborhoods are not displaced at higher rates than residents of similar socioeconomic characteristics in non-gentrifying neighborhoods (Delmelle & Nilsson, 2020; Ding et al., 2016; Ellen & O’Regan, 2011; Freeman, 2005). Other evidence has countered that displaced residents in gentrified neighborhoods are more likely to relocate to disadvantaged areas, and that homeowners are less likely to be displaced than renters (Martin & Beck, 2018; Ding et al., 2016, Newman & Wyly, 2006). Qualitative evidence has shown that long-term residents who are displaced are often negatively psychologically impacted by the swift changes gentrification can bring to a neighborhood (Pattillo, 2007; Betancur, 2011; Hyra, 2017). This evidence supports Mindy Fullilove’s (2016) thesis that residential displacement, which can have a number of causes, causes traumatic psychological stress to residents who are displaced.

As evidenced by this research, gentrification can have a wide range of impacts on cities and their residents. In the next section we offer conjectures on why smart growth and its related policy measures may cause gentrification and thus some of these impacts.

III. Why might smart growth cause gentrification?

The normative goal of smart growth is to achieve a more efficient – in terms of land consumption, carbon emissions, and environmental protection – distribution of economic growth and human activity across a region. Once achieved, this results in all residents being better off. The smarter distribution of growth is promoted through ten principles, which include the following four contextually relevant items:

- Strengthen and direct development toward existing communities
- Mix land uses
- Create walkable neighborhoods
- Foster distinctive, attractive communities with a strong sense of place

These principles all promote changes to the built environment and the form of cities and regions, but do so without mentioning socioeconomics or demographics. We argue that via these principles, smart growth can cause the socioeconomic and demographic change commonly recognized as gentrification. These principles of smart growth can be furthered by the public sector through regulatory and incentive measures, but also by private market actors through investment.

Why might directing development towards existing communities spur gentrification?

Neighborhoods that are eligible to gentrify are by definition existing communities – disinvested areas home to residents of lower socioeconomic status. These neighborhoods are often in older urban environments that include walkable street networks, a variety of dense housing types, commercial districts close to or mixed with residential areas, access to public transportation, and sometimes proximate long-standing institutions like universities, hospitals, or government offices. These features have all been found increase the likelihood of gentrification at the neighborhood level (Heidkamp & Lucas, 2006).

Scholars have emphasized the importance of inner, or central area revitalization and economic development to smart growth (Ye et al. 2005, Porter 1999). Porter (1999) noted that one of the main thrusts of smart growth policy was to revitalize inner areas, which are defined as urban areas fully developed at some point in the past. Some of these places had become less populated and relatively underutilized by the late 1990s when smart growth coalesced as a movement. Burchell et al.'s (2000) summary of the policy goal of this first aforementioned principle encapsulates this issue: “restoring and adapting existing structures, neighborhoods, and business areas to more effectively serve market demands” (p. 823). The forgotten, disinvested areas of many cities and suburbs no longer served market demands. More critically, these areas no longer served market demands of the middle and upper classes and the modern industrial economy and held too many people of color. Through new development encouraged by the public sector, these areas could regain economic activity. Ye et al. (2005) note that smart growth economic development policies were designed to add housing to city centers that served a range of incomes, along with amenities and employment. In sum, all of these development activities in central areas may accelerate gentrification by increasing land values and rents.

Why might mixing land uses, creating walkable neighborhoods, and fostering a sense of place spur gentrification?

Increasing the share of mixed land uses, or the juxtaposition of residential and commercial uses in the same parts of neighborhoods or even within structures themselves, is a goal of smart growth. This principle was primarily a reaction to suburbanization's auto-dominated separation of commercial areas far from downtowns into strip malls with large parking lots. Mixed land uses are much more likely to be in legacy neighborhoods that pre-date the automobile and strict zoning regulations that segregate these uses explicitly.

Mixing land uses has the potential to spur displacement because improved access to amenities may increase land values and thus home prices and rents. From a critical viewpoint, it can be argued that advocacy for mixing land uses has historically been unconcerned, intentionally or unintentionally, with the negative effects on incumbent populations. Advocacy for mixing land uses instead focuses on environmental benefits, economic growth, and contribution to walkability and sense of place in neighborhoods. Some, such as Nelson et al. (2002) have even argued that these increased amenity benefits potentially outweigh increased housing costs, though this argument perhaps incorrectly assumes that incumbent residents can afford to stay where they are.

Walkability and a sense of place, both positive neighborhood attributes that are difficult to quibble with on merit, can also be linked to gentrification. Walkable neighborhoods have been shown to command higher land and housing prices, and increasing shares of higher-income, more highly educated households are paying for housing in walkable neighborhoods in US cities (Li et al., 2015). Thus while pedestrian improvements and denser development may increase walkability, they may also drive up housing costs. While a strong sense of place, or the qualitative aspects of neighborhoods that make them pleasant, is intangible, it is similarly a neighborhood amenity that can drive up land market prices. In seeking to create activated, dense, and busy neighborhood centers with lively public spaces, which are valued by higher-income residents, planners may indirectly increase home prices and invite gentrification.

The connection to urban containment, transportation, and empirical evidence

Beyond economic development and revitalization, there are further links between smart growth and gentrification. Many states, regions, and local governments have passed growth

control laws since the 1970s. These laws govern the growth of the urban envelope through instruments like urban growth boundaries, or protective regulations for farmland and ecological areas, or more generally by restricting residential density in outlying areas.

A stream of literature from the early 2000s focused on the impacts of these growth management and smart growth policies on housing affordability, city revitalization, and infill construction. While these papers did not directly address a link between growth controls and gentrification, the findings of the work are relevant. Nelson et al. (2002) note that smart growth and growth management policies can increase the desirability of communities and thereby increase housing prices. Dawkins and Nelson (2003) found that central cities in states with growth management programs attracted higher shares of residential development than central cities in states without such programs. Nelson et al. (2004) examined a similar question at the metropolitan scale and found that central cities in metropolitan areas with urban containment policies had attracted more development than central cities in metropolitan areas without such policies. Landis (2006) analyzed growth control programs in California and found that such policies can increase infill and limit sprawl, but also significantly increase housing prices. This body of work shows that smart growth policies can successfully redirect growth inward toward existing communities, but at a cost of increased housing prices. These two factors – an influx of financial capital and an increase in housing prices – are potentially parts of a gentrification process, though they do not necessarily include class turnover and upgrading.

Smart growth also calls for reduction in vehicle miles traveled and transportation greenhouse gas emissions. Often, these goals are promoted through investments in public transportation and pedestrian and biking facilities (Ye et al., 2005). This has required increased public investment and transportation funding for public and non-motorized modes, which has also been linked to neighborhood gentrification (Zuk et al., 2018). The mechanism here is through a connection to increased land value, as residents with the highest incomes may bid up rents near transit, to the detriment of residents with low incomes (Dawkins and Moeckel, 2016).

Smart growth, through normative goals and policy solutions it advances, can potentially cause gentrification. Empirical research has highlighted potential links between smart growth and gentrification, but a central question remains. Can neighborhoods experience smart growth – increased development and population increases – without seeing simultaneous increases in

incomes, education, and home prices? In the next section we explore this question with a large panel data set of US census tracts.

IV. Methods, data, and identifying gentrified tracts

In this section we compute the share of census tracts in selected US metropolitan areas that have gentrified over two time periods since 1980. The census tract dataset comes from Brown University's Longitudinal Tract Database (LTDB), limited to all tracts in the 100 largest metropolitan areas in the United States (Logan et al. 2014). We divide the data temporally into two periods, with the first drawing on data from decennial censuses in 1980 and 2000. The second time period includes the 2000 census and also the Census American Community Survey (ACS) five-year sample from 2014-2018. We utilize the 2010 boundaries for metropolitan statistical areas in each time period, in order to hold a reference area constant across the two time periods. The LTDB is spatially weighted such that census tract boundaries for the 2014-2018 ACS are held constant backward in time, allowing for boundary consistent comparisons of tracts in each of the three measurement periods. Census tracts are an imperfect proxy for neighborhoods, as they are spatially heterogeneous and generally contain more than four thousand residents, but have nonetheless been used in numerous studies of neighborhood change and gentrification as they are the best available data at that scale (Timberlake and Johns-Wolfe, 2017).

Though our selection of time periods is constrained by the availability of decennial census data much like other empirical work on this topic, we justify selection of time periods based on other literature (Finio, 2021). Following Hackworth and Smith (2001)'s classification of gentrification into temporal phases, we divide our dataset at the year 2000. The second or anchoring phase of gentrification began in the 1980s and peaked by the mid-1990s. The third wave began around the turn of the millennium and has since progressed into fourth or even fifth waves, depending on the locality and economic circumstances (Aalbers, 2019). Thus our dataset captures the second phase of gentrification prior to 2000 and the latter phases in the second measurement period.

To measure gentrification we follow several examples and build an index of socioeconomic status (SES) to analyze gentrification in the measurement periods. Landis (2015) utilized median

household income as a single component to track socioeconomic change in tracts, and classified some of that change as gentrification. Hwang and Lin (2016) utilized adult education level and average household income in a two-component index to identify gentrification, and Timberlake and Johns-Wolfe (2017) utilized poverty, adult education level, occupation, and average family income as components of their index.

We build upon these techniques by constructing a multi-component index of SES using factor analysis, a technique used often throughout the urban sociological literature for building a more robust measure from several census variables (Yonto & Thill, 2020; Timberlake & Johns-Wolfe, 2017; Hwang & Lin, 2016). We use factor analysis to treat SES as a latent construct that describes the shared covariation among four variables that assess both the supply and demand aspects of gentrification: median household income, median home value, median gross rent, and the share of residents age 25 and over with a Bachelor's degree or higher education level. Median household income and the education level variable capture change in the socioeconomic status of residents in the census tract, which illuminates the demand side of the gentrification process. Home values and rents assess the supply side of gentrification, as they serve as a proxy for changes in land values.

A census tract is eligible to gentrify in 1980 or 2000 if it is below the median SES value for its home metropolitan area in the starting year. Tracts above the median SES value in either year are ineligible to gentrify because they have higher home and rent prices, higher household incomes, and higher education levels than the median level, and thus do not meet the typical criteria of being disinvested areas home to low-income populations. If an eligible tract increases in SES by at least twenty percent between 1980 and 2000, it is marked as gentrified. The analysis is repeated for the 2000 to 2014-2018 period, and tracts that gentrified in the first period can gentrify again so long as they are below median SES in 2000.

Table 2 presents summary statistics for all tracts, which have three possible statuses in each time period: ineligible to gentrify, eligible but did not gentrify, and eligible and gentrified. Out of 20,647 census tracts eligible to be gentrified in the 100 largest U.S. metropolitan areas 6,817 (33 percent) gentrified between 1980 and 2000. Between 2000 and 2018, 4,175 out of 23,228 eligible census tracts gentrified (18 percent). In the 1980-2000 period, both a higher share and a higher absolute number of tracts gentrified than in the latter period.

Table 2. Summary of Gentrified Tracts

Category	1980-2000	2000-2018
Total tracts	36,805	36,216
tracts ineligible to gentrify	16,158	12,988
tracts eligible to gentrify	20,647	23,228
gentrified tracts	6,817	4,175

Note: Although we define “eligible” tracts as those below the regional median SES score, the difference between the figures are not strictly half because ineligible tracts also include those with no data. Because of continuing urban growth there are fewer eligible tracts in 1980 since fewer tracts were inhabited.

One interesting result from the analysis of this dataset is that the number of tracts that gentrified in the latter period is nearly 40 percent lower than the first period. This finding is at first glance misaligned with Hwang and Lin (2016), who found an increasing share of gentrification over time in each decade from 1970 to 2010. However, the measurement process in this paper and that of Hwang and Lin are quite different. Their qualifier for gentrified was much stronger, and cumulative over time (1960 was a static base year for comparison) while this paper treats each two-decade period as unique, so results are not directly comparable.

V. Unpacking the relationships between socioeconomic status, demographic change, and smart growth

In this section we compare changes in SES against changes in the number of housing units in the tract, tract population, and the racial minority share of tract population, using descriptive statistics and charts. The analysis aims to answer the following questions: is the SES increase in gentrified tracts tied to increased housing construction – possibly smart growth – or can the increase be explained without change in the housing market? Is gentrification accompanied by increases in population and the share of the population that is of a minority racial group? Last, how is this gentrification distributed spatially and does that distribution change between the time periods?

In this analysis, it is necessary to make certain methodological compromises. No dataset exists that accurately measures – with simple, quantitative indicators – the presence of smart

growth policies in every one of the 100 metropolitan areas. Each metropolitan area has many unique polities that each have their own level of influence over growth policy. Thus, to proxy smart growth, I look at changes in housing supply and population, which are two key aspects of smart growth, as they represent increasing housing supply and bringing new residents to certain areas. Whether these are caused by smart growth policies is a question challenging to answer at a multi-metropolitan scale, but the empirical mapping exercise will allow us to infer answers to those questions. This analysis captures the broader shifts in socioeconomics and housing supply and cost and the tract level – the forces of the housing market – and does not directly measure the actions of governments. Smart growth, however, requires both the actions of governments and market actors to invest in communities.

We find that change in SES is positively correlated with increased housing construction in gentrified tracts. We also find that the strength of this correlation increased in the 2000-2018 period relative to the 1980-2000 period: gentrification has acquired a steeper relationship with social and physical environment change in recent decades. Despite these findings, it remains possible and common for census tracts to gentrify without growth in the number of housing units. It is also possible and common for non-gentrifying census tracts to have significant growth in housing units while SES stagnates or decreases. Through a mapping exercise, we show that gentrification in Washington, DC has become more spatially concentrated near the region's core. This gentrification has become more connected to increases in housing construction, providing evidence of a link between smart growth and gentrification.

Visualizing the relationship between gentrification and housing supply change

The relationship between changes in tract level SES and changes in housing supply can be effectively visualized in a scatterplot. Figure 3 (on page 50) is a scatterplot that compares change in SES paired with change in housing supply for each tract in the 1980-2000 period. There are two sets of points: orange points are census tracts that have not gentrified while blue tracts are those tracts that have gentrified. SES (measured as change from 1980 to 2000 in the index) is on the y-axis; thus all gentrified tracts are above the x-axis by definition. Change in the number of housing units (the 2000 value minus the 1980 value) is measured on the x-axis, such that tracts with increases in housing supply are to the right of y-axis.

In the chart, the quadrants of the graph are marked with Roman numerals. Observations in the first quadrant (I) are those tracts that saw an increase in SES and an increase in the number of housing units. In quadrant II, tracts saw an increase in SES but a decrease in housing units. In quadrant III, tracts saw decreases in both SES and the number of housing units. In quadrant IV, tracts saw a decrease in SES but increases in the number of housing units.

Overall, there are more tracts in quadrants I and IV, which is intuitive, given that the dataset represents all metropolitan tracts during a period of strong demographic and economic growth across the US generally from 1980-2000. The gentrified tracts show a wide dispersion on either side of the y-axis, but appear to be more heavily concentrated to the right side. This indicates gentrification is more common in places experiencing growth in housing supply. There is no clear pattern between the degree of change in SES and the change in housing supply across quadrants I and II.

Figure 4 displays the same data in the same manner as Figure 3 but for the period of 2000-2018. Note the flattened distribution compared to the previous period, and the steep declines in SES in many census tracts. Gentrified tracts appear to be more concentrated in quadrant I, at first glance; quadrant I also has a longer tail to the right for gentrified tracts. There also appear to be fewer gentrified tracts that have large decreases in housing supply. The overall relationship between gentrification and housing supply change is more clearly positive in Figure 4 than Figure 3.

There are several takeaways from these charts. First, increases in housing supply *without* simultaneous increases in tract SES appear to be quite common – leaving open the possibility of housing supply growth, even smart growth, without gentrification. Second, it appears that gentrification is more likely to occur on average in tracts with housing supply growth. Third, there has been a shift between the two time periods that warrants further investigation: the relationship between gentrification and positive housing supply growth appears stronger in the second, more recent time period. In the next subsection we review summary statistics and simple statistical tests of differences between means of these and other variables to further confirm this.

Note that there is no geographic restriction on where these tracts are located within metropolitan areas. Tracts at the suburban or exurban fringe are in the dataset and can gentrify. As an extreme example, a low-income tract comprised of farmland in 1980 would gentrify by 2000 if new, expensive housing were built on the farmland and the tract SES accordingly rose as

newcomers with higher educations and incomes arrived. This may not be the prototypical example of smart growth, which is associated with infill development. However, this association is not always true, as the principles of smart growth do not restrict development to central locations. While those areas are prioritized as good candidates for development, smart growth can occur in suburban areas. New developments are often touted as smart growth if they have dense development, walkable street grids, integration of uses, and conform with new urbanist style – even if these developments are quite far from urban cores. A primary example of this style of ‘smart growth’ development at the fringe is the Kentlands development in Montgomery County, Maryland – over 15 miles from downtown Washington, DC. Kentlands was built on rural land in the 1990s, with little access to public transit, but offers walkability, mixed land uses, and a strong sense of place. In the following section, we will take a closer look at where these gentrifying tracts are physically located.

Figure 3. Housing Units and SES, 1980 to 2000

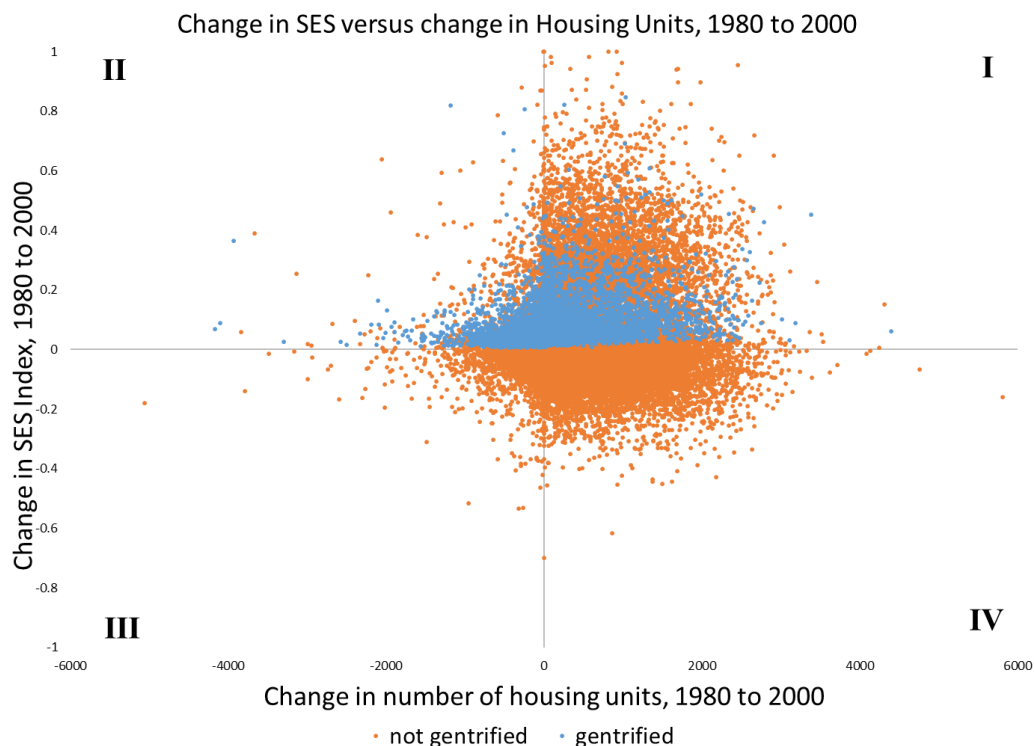
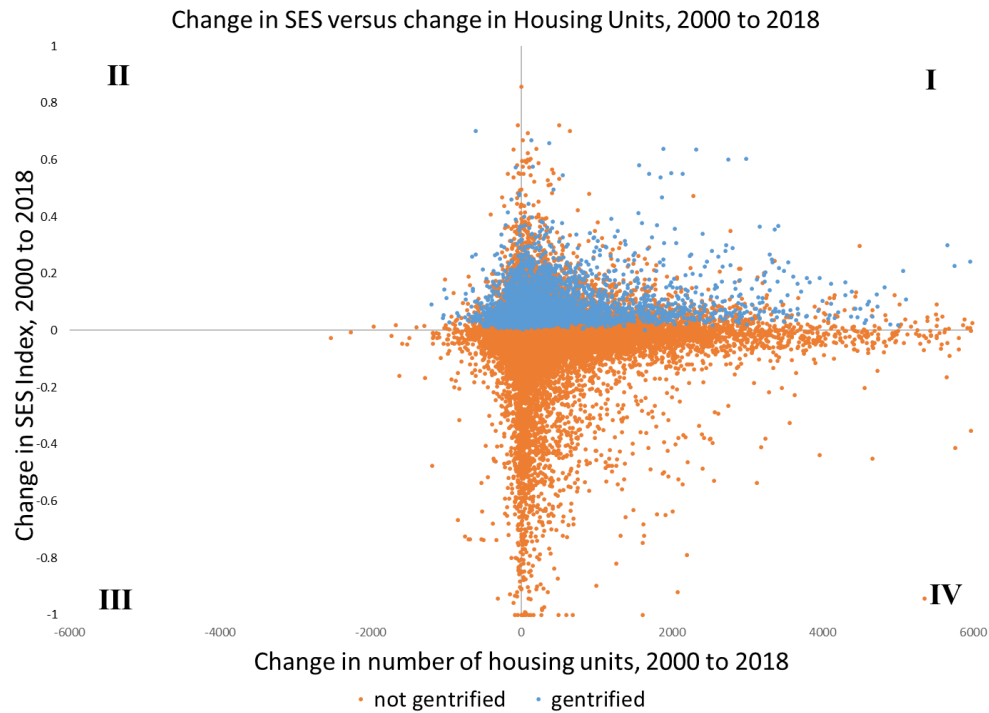


Figure 4. Housing Units and SES, 2000 to 2018



The statistical relationships between SES components and other variables

While the scatterplots illuminate the relationship between SES and single variable, there are many other factors that relate to gentrification and SES has many components. Table 3 displays a list of summary statistics for these factors for the set of gentrified, and not gentrified, tracts for each time period. What is first notable is that by definition, SES increases more in gentrified tracts than non-gentrified tracts in both time periods. This and the following comparisons are validated by t-tests of differences in means reported in Table 3 in the first and second column. Between 1980 and 2000, gentrified tracts on average saw a statistically significant higher rate of increase in the share of the population with a bachelors degree or more, median rent, median home price, and median household income than not gentrified tracts. This relationship is inverted for housing units, population, and the share of the population that is nonwhite, as each of these variables had a larger increase in non-gentrified tracts in that time period.

In the second time period, gentrified tracts on average had a smaller increase in the share of the population with a BA or more and the share of the population that is non-white. Changes in rent and home prices were greater in gentrified tracts than in non-gentrified tracts. Gentrified

tracts also have a faster rate of housing unit growth and population growth than non-gentrified tracts in the second period, unlike the first period.

Table 3. Summary Statistics – within time period change

1980-2000	gentrified tracts			not gentrified tracts		
	Median	Mean	St. Dev.	Median	Mean	St. Dev.
Change in SES	0.06	0.08	0.08	-0.01	0.03	0.14
Change in share of population with a BA+	7.9%	11.4%	11.8%	6.9%	8.7%	10.6%
Change in Median Rent	\$232.76	\$290.65	\$239.54	\$195.51	\$281.60	\$348.02
Change in Median Home Price	\$49,761.40	\$77,036.78	\$98,926.98	\$25,214.22	\$54,448.41	\$113,678.16
Change in Median HH Income	\$19,962.26	\$24,709.09	\$28,096.61	\$11,240.15	\$15,002.29	\$33,569.64
Change in Housing Units	82.50	216.04	603.97	227.00	413.84	596.62
Change in Population	273.00	511.71	1622.86	536.00	916.97	1590.77
Change in Share of Population that is non-White	4.9%	8.1%	16.8%	9.6%	15.0%	16.8%
2000-2018	gentrified tracts			not gentrified tracts		
	Median	Mean	St. Dev.	Median	Mean	St. Dev.
Change in SES	0.06	0.09	0.07	0.00	0.03	0.10
Change in share of population with a BA+	3.7%	5.0%	7.3%	7.4%	9.5%	11.0%
Change in Median Rent	\$314.81	\$388.76	\$351.55	\$182.69	\$216.96	\$399.73
Change in Median Home Price	\$107,775.68	\$169,156.31	\$192,844.42	\$59,866.13	\$102,647.19	\$159,626.63
Change in Median HH Income	\$5,699.12	\$2,169.19	\$36,333.80	\$2,834.89	\$5,282.91	\$40,038.85
Change in Housing Units	134.00	421.10	858.84	95.00	293.81	669.20
Change in Population	55.70	1051.20	2495.89	254.00	796.61	2007.18
Change in Share of Population that is non-White	0.2%	2.6%	24.0%	9.2%	12.7%	17.7%

Table 4. t-tests of differences in means, summary statistics

t - tests of differences in means	within a single time period		between time periods
	difference in means, gentrified versus not		gentrified tracts only, difference in means
	t-value, 1980-2000	t-value, 2000-2018	t-value, 1980-2000 versus 2000-2018
Change in SES	<i>51.85</i>	<i>43.12</i>	-1.45
Change in share of population with a BA+	<i>17.59</i>	<i>-36.49</i>	<i>35.35</i>
Change in Median Rent	<i>2.67</i>	<i>29.74</i>	<i>-15.91</i>
Change in Median Home Price	<i>17.02</i>	<i>21.57</i>	<i>-28.65</i>
Change in Median HH Income	<i>25.56</i>	<i>-5.23</i>	<i>34.30</i>
Change in Housing Units	<i>-25.03</i>	<i>9.30</i>	<i>-13.52</i>
Change in Population	<i>-19.10</i>	<i>6.39</i>	<i>-12.45</i>
Change in Share of Population that is non-White	<i>-31.04</i>	<i>-26.53</i>	<i>13.06</i>

*Italicized numbers are significant at the 1% level.

The third column of Table 4 shows the t-statistic for a difference in means test between the two time periods for gentrified tracts only. The statistics show that the means are statistically different from each other for all variables except the change in SES. In 1980-2000, the rate of change for the share of the population with a BA+, median household income, and the share of the population that is non-white was higher than the 2000-2018 period. The rate of change was higher in 2000-2018 for change in rent, home prices, housing units, and population. This latter finding confirms what can be observed in the figures in the previous section – the relationship between SES change and housing unit change shifted between the two periods right, with a greater increase in housing units in the second period.

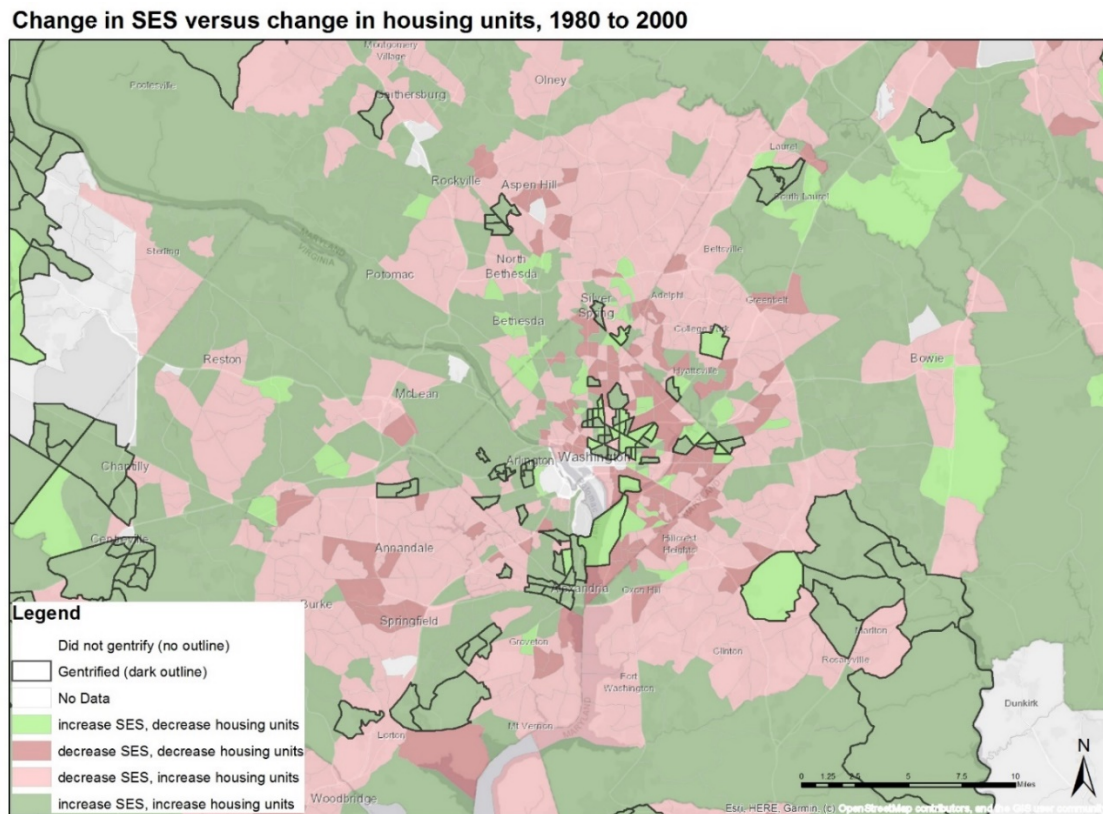
Three clear patterns can be confirmed based on these statistics. First, gentrification has shifted in character between the two time periods. In the 1980-2000 period, gentrified tracts saw slower housing unit construction and population growth than not gentrified areas, but faster socioeconomic change and home price appreciation. In the 2000-2018 period, gentrified tracts saw faster rent and home price increases, and more construction and population growth than not gentrified tracts. Despite this, gentrified tracts saw slower demographic change in terms of education and race than not gentrified tracts. Second, the main drivers of gentrification in the first period appear to be education and income; but in the second time period the main drivers are home prices and rent. Last, there is evidence of a shift between the two time periods within the set of gentrified tracts. The more recent time period saw more rapid home and rent price increases than the first time period, but slower household income growth. Gentrified tracts in the more recent period had very slow growth in the minority share of the population, but much more rapid home construction and population growth than in the first period. Stated otherwise, more recent gentrification may be more visible in the plain: gentrified tracts are experiencing faster home and rent price increases, more condominiums and homes being built, and more in-movement of newcomers who tend to be white, unlike existing residents.

Mapping change in SES and gentrification in the Washington, DC region

By taking a closer look at one metropolitan area known to have experienced rapid gentrification – Washington, DC – we can illustrate if the shifts identified through statistics also play out spatially within and across the time periods. Figure 5 illustrates the data from Figure 3 on a map of the City of Washington DC and nearby suburbs in Virginia and Maryland. The

darker green shade shows tracts that saw increases in both SES and housing supply, and the light green shade indicates increased SES but a drop in housing supply. Dark red signals a decrease in both housing supply and SES, while light red marks a decrease in SES but increase in housing supply. Gentrified census tracts are outlined in a dark black line and by definition due to the increase in SES requirement, are all shaded light or dark green.

Figure 5. Change in SES and change in Housing Units, DC Area, 1980-2000



Gentrified tracts are scattered throughout the region but there is a significant cluster near the core of Washington, DC and in Arlington County, VA to the west of DC. Gentrified tracts are mostly dark green in the suburbs. But in the central part of the region – the center of Washington, DC – about half of tracts saw a decrease in housing units. This spatial pattern of gentrification in the region’s core was identified in the 1980s by Lee et al. (1985) and Gale (1987), and confirmed to continue into the 1990s by Knox (1991) and Wyly and Hammel (1998). All identified gentrification in neighborhoods like Dupont Circle, Adams Morgan, and Capitol

Hill. These are mostly residential areas that surround the commercial and office downtown core, with older and architecturally interesting housing stock, public transit, and proximity to wealthy neighborhoods and major institutions.

Declines in socioeconomic status and even losses in housing supply were apparent across much of eastern DC, particularly in the NE and SE quadrants of DC near Maryland. This is unsurprising given DC's economic and social context during this period, as many Black families left Washington for the suburbs – particularly moving east toward Prince George's County, MD (DeRenzis and Rivlin, 2007).

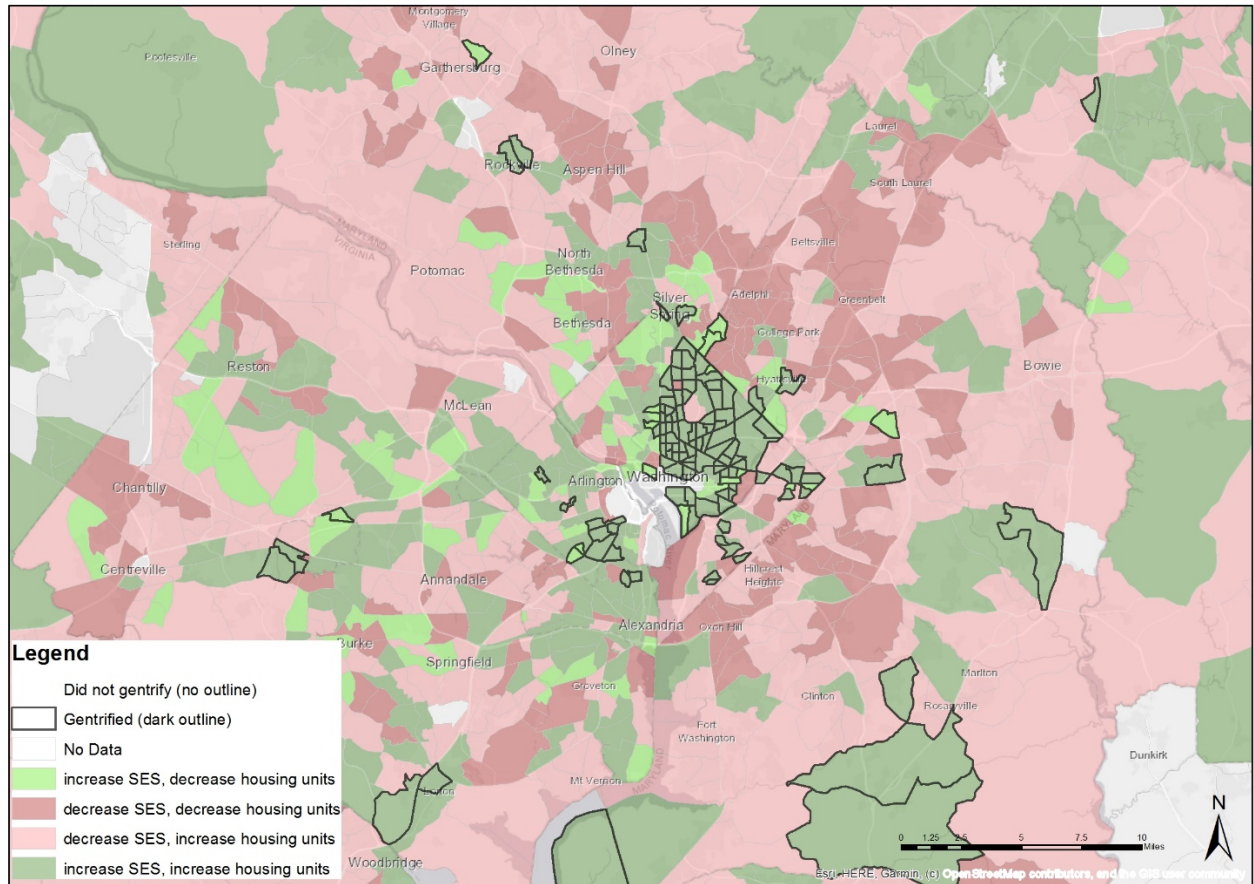
As with Figure 5, Figure 6 illustrates the same data for the 2000-2018 period. There is an immediately noticeable difference in color, as decreasing SES became much more common in the ring of suburbs around the region compared to the prior period. Gentrification is much more of a rarity in the further flung suburbs, and the gentrification of the core has greatly expanded to include much of the NE and SE quadrants of DC.¹ Nearly all tracts in the core are dark green, indicating increases in SES and housing construction.

This pattern matches recent evidence on the spread of gentrification in central cities, and anecdotal evidence of rapid demographic and housing market change within the district itself. Jackson (2015) found expansive gentrification in the same parts of DC and linked it to decline in the city's Black population. Hyra (2017, 2014) studied the rapid pace of gentrification in and around Shaw, a neighborhood near the southern part of the main cluster of dark green tracts, and found significant evidence of gentrification and its negative impacts on social cohesion for existing populations in the area, particularly for Black residents. Gentrification at the outer edges of DC, while not studied empirically in journals, has been reported on by the regional press, in inner suburbs like Arlington (VA), Silver Spring, Takoma Park, and Hyattsville (in MD), all present on the map. Gentrification observed in Silver Spring, Takoma Park, and Hyattsville could be potentially linked to the eventual construction of the Purple Line light rail system, a new circumferential rail link in the Maryland suburbs (Finio, n.d.). These sources all generally point to the construction of new housing as a marker for gentrification – whether or not it is a causal link. This data supports the evidence that recent gentrification in DC has been accompanied by new construction in most neighborhoods.

¹ Note that tracts that gentrified in the 1980-2000 period can gentrify again in the next period, so long as those tracts remain below the SES median and SES increases by 20%.

Figure 6. Change in SES and change in Housing Units, DC Area, 2000-2018

Change in SES versus change in housing units, 2000 to 2018



The map also supports evidence of socioeconomic decline, potentially linked to the spread of suburban poverty in the inner suburbs (Lung-Amam et al. 2021). Most notably, nearly all gentrified tracts in the 2000-2018 map (Figure 6) are shaded dark green, indicating a simultaneous increase in housing units and SES.

Discussion

Assessing the links between smart growth and gentrification is challenging due to the abundance of confounding factors at play between smart growth policies, change to the physical built environment, housing prices, demographics, and socioeconomics. This section has instead offered a brief statistical analysis coupled with a qualitative mapping assessment to describe the relationship between gentrification and smart growth. Gentrification strengthened after the year

2000 and is, on average, more likely to occur in census tracts with more housing construction. In the one metropolitan area studied, Washington, DC, that gentrification is concurrent with increased housing construction happening in the regional urban core and several inner suburbs – especially ones near transit. These areas have been and remain explicit targets for smart growth (Metropolitan Washington Council of Governments, 2007).

The identified shift in the pattern of gentrification between the 1980-2000 and 2000-2018 period begs mention of the stream of literature that addresses gentrification through a temporal or stage model. Shaw (2008) summarizes the progression of this stage process over decades: the first newcomers to a disadvantaged neighborhood are artists, bohemians and counter-cultural types who share a neighborhood with the incumbent residents without greatly changing neighborhood income. This leading edge of in-movers, who more likely to be white in the most recent period, makes the neighborhood more attractive to prospective buyers with more money, who may rehabilitate houses upon moving in, creating a feedback effect in the neighborhood. The next wave brings in investors and developers who construct new housing, replacing lower quality housing and residents with lower incomes and accelerating gentrification. Lees (2003) and others have identified a final stage: “super-gentrification” – where even the middle class is priced out of a neighborhood through construction of luxury housing and incredible price appreciation for existing housing. The quantitative and mapping evidence above may point toward a stage model of gentrification being verifiable at a large scale. In the first two decades, gentrification was weaker than in the latter two decades, as it was not accompanied by as much housing construction and was more demographic in nature. In the second time period, there was greater home price appreciation and much more home construction in gentrifying neighborhoods. This certainly played out in Washington, DC, where much of the central core of the city was gentrifying despite a decline or stagnation in the housing stock in the 1980-2000 period. This pattern shifted as gentrification expanded to many more tracts in the 2000-2018 period, and nearly all gentrified tracts in DC saw increases in the housing stock. It is also notable that while race is not included as a metric used to identify gentrification, the t-tests showed that newcomers to gentrified neighborhoods are more likely to be white in the 2000-2018 period than they were in the 1980-2000 period. This potentially aligns with a stage model that would require higher education and income on average for in-movers over time, and given socioeconomics in the US, those new comers would be more likely to be white.

These clearly identifiable patterns in both the national-scale and regional-scale data provide some answers about potential links to smart growth, but also pose additional questions. Smart growth, at least as a coherent regional policy, did not full emerge until several years after the year 2000. Thus tying “smart growth” directly to gentrification in the 1980-2000 period is impossible. The question then remains: did smart growth policies have an impact on the identified shift in the strength and location of gentrification in the 2000-2018 period? The results for Washington, DC clearly show that the city experienced simultaneous rapid increase in housing growth and SES in gentrifying neighborhoods, but the answer to that question is still unclear. Smart growth policies – like increased residential density near transit, for example – may shift demographic and socioeconomic neighborhood outcomes at the margins. Smart growth policy changes, however, may happen *in response to* rapid demographic and socioeconomic change in regions, rather than being a leading cause of such shifts. Rather than assessing precise statistical estimates of the *how* and *why* of gentrification, it is perhaps more worthwhile to first identify the process and then analyze and respond to its consequences. We now know that gentrification is occurring, and occurring rapidly in neighborhoods with new housing construction. How then can policymakers shift the burden of the consequences of gentrification away from incumbent lower income populations, particularly in areas with new housing construction?

VI. *How can we achieve smart growth without adverse impacts?*

In gentrifying neighborhoods, existing residents with low incomes, unless protected by housing subsidies, strong anti-eviction laws, rent control, permanent affordable housing, or other policies, may be unable to bear the increases to rents, prices, and property taxes brought about by gentrification. Existing residents may be forced to move or excluded from previously affordable areas. Further, existing residents may own and operate small businesses in gentrifying areas. As rents and incomes rise, these businesses and the residents and local culture they support may be displaced as well. If planners accept, *prima facie*, that residential displacement makes residents with low incomes worse off, then corrective measures should be taken. As we show in our empirical exercise, many metropolitan areas are experiencing significant gentrification concurrent with housing construction increases.

Many cities are already undertaking these measures, which are often characterized as anti-displacement policies (Zuk et al., 2019). Cities are already providing for affordable housing in both time-tested and innovative ways, supporting small businesses, and attempting to preserve local culture. They are accomplishing this through policies that range from strong market regulation, such as residential rent control, to market-based incentives, such as density bonuses awarded to developers in exchange for the construction of affordable housing (Abu-Khalaf, 2018). Additional policies include impact fees charged to developers that are used for community benefit, foreclosure assistance measures, just-cause eviction laws, and legalization of community land trusts. These policies have in some cases been coupled with smart growth policies, such as transit oriented development (TOD), which increases housing supply near dense transit nodes. Many new TOD projects now require inclusionary zoning, which preserves a portion of new housing construction for lower income households to both rent and purchase.

As the supply of affordable housing shrinks due to gentrification, some cities have expanded certain programs. For example, the Washington state requires that public land dispositions are offered via right of first refusal to public agencies that seek to construct affordable housing (Arabo & Leonard, 2018). In a similar effort, Los Angeles's transit agency has an explicit affordability target, such that 35 percent of housing units developed on agency land will be affordable (LACTMA, 2018). Seattle's Sound Transit has a similar program, the "80-80-80" rule, requiring 80 percent of suitable surplus transit property to be held for developers who make 80 percent of units affordable to families or individuals with incomes below 80 percent of median income (City of Seattle, 2015). Inclusionary zoning programs, which apply to all new development projects, have also become popular in the decades since they originated in Montgomery County, MD. Inclusionary zoning can be targeted to hold units at very low cost for those most vulnerable to displacement. Developers can recoup costs of providing affordability through density bonuses, like those offered in Los Angeles and Chicago, which allow developers to build at greater residential densities (City of Los Angeles, 2018; City of Chicago, 2018). Such policies offer a win-win for smart growth and those who oppose displacement due to gentrification. Inclusionary zoning policies can offer units both for rent and for sale, granting homeownership opportunities to residents with moderate incomes in neighborhoods where market prices are out of reach.

In Washington, DC, city leaders have responded to gentrification on multiple fronts. The city's Housing Production Trust Fund has had a strong commitment of \$100 million directly from city coffers, funded through real estate transfer taxes and general funds. Such funds, now common across the country, are dedicated sources of revenue for constructing affordable housing, which can be targeted to gentrifying areas. Washington, DC also has the Tenant Opportunity to Purchase Act, which offers residents of apartment buildings a chance to collectively purchase their buildings with the right of first refusal when a sale is proposed; this policy has preserved over 1,000 units (City of Washington, D.C., 2018). Many other jurisdictions have supported tenants through "just cause eviction" laws, which establish rigorous procedures for landlords to evict tenants, requiring landlords to prove cause. Such policies have been shown to reduce eviction rates (Cuellar, 2018). Such actions are critical in the wake of rampant market-driven eviction in gentrifying areas (Smith and DeFilipis, 1999).

On the commercial side of the economy, smart growth policies can be tweaked to promote sustainable economic development that supports locally owned small businesses, through policies like commercial rent control, or urban design which allows for smaller or shared commercial spaces. While some cities have explored the potential for commercial rent control and commercial inclusionary zoning, no policies have been implemented at scale in the US. Small businesses are only one part of a larger cultural environment of schools, public service centers, open spaces, etc., that provide a sense of place. Public non-commercialized space is also a critical part of building inclusive communities. As neighborhood land values increase under market pressure, space and place for un-monetized community expression must be preserved. Without attention paid to all these aspects of space in areas facing gentrification, existing residents can lose their sense of place.

Land-value capture offers perhaps the most potential to stave off the negative consequences of gentrification. With some exceptions, cities remain hesitant to charge differential taxes on their most expensive land, which is generally the land most ideal for high-rent residential and commercial development. Capturing high land values through geospatially differential tax instruments and reallocating that money to fund public amenities, affordable housing, and other public goods remains an underutilized option in American urban policy.

VII. Conclusion

In this chapter we have argued that smart growth policies can be linked to the process of gentrification in US cities and found preliminary evidence of this through data and mapping. While the increasingly rapid spread of gentrification and dramatic price increases for urban residences in some cities would have been hard to predict 20 years ago, some forethought by smart growth advocates about displacement should have been possible. As Atkinson (2002) observed, critiques of gentrification have produced analysis about its negative consequences for decades. The original architects of the smart growth movement mostly ignored the potential for smart growth policies to catalyze the negative impacts of gentrification, especially residential displacement of incumbent residents with lower incomes. Now many cities are scrambling to implement policies that protect existing residents from displacement and boost housing supply.

We have shown that gentrification is increasingly concentrated in areas experiencing rapid housing construction. These areas are often in central cities and home to sizeable shares of poor and disadvantaged residents, who must contend with increased housing prices brought about by gentrification. It is possible, however, to achieve the goals of smart growth without gentrification. It will take serious commitments from cities, especially regarding commitment to fund construction or preservation affordable housing, and innovation with regard to tax policy such as land value capture. Common-sense tools that have worked nationally, such as inclusionary zoning and laws protecting tenants' rights, are the best place to start. The forces of the market, if left unchecked, will continue to result in displacement and replacement of residents in gentrifying neighborhoods.

Essay Three: Gentrification and Economic Development in Maryland's Purple Line Corridor

I. Introduction

Maryland's counties of Prince George's and Montgomery are home to nearly two million people and directly border the District of Columbia to the east and north. Together, these predominantly suburban counties host about a third of the population of the Washington metropolitan area, which has expanded rapidly in the post-war era (Knaap et al., 2020). The State of Maryland, together with federal backing and a private partnership, is constructing a new light rail transit system known as the Purple Line which will circumferentially span the inner suburbs of these two jurisdictions and link a series of dense, transit oriented activity centers. The Purple Line is currently under construction and is expected to open by 2026. It has survived political challenges over a decades long planning process, and is touted as both a boon to economic development and a sustainable transportation option in a congested and densifying region.

During the planning and construction process for the Purple Line, many neighborhoods in the Washington metropolitan area have been experiencing gentrification. Gentrification is a pressing issue for city planners and policymakers in cities across the United States because it is a shift of new residents with higher incomes and financial capital into formerly disinvested neighborhoods, which can displace incumbent residents and their businesses, culture, and social networks (Freeman and Braconi, 2004). In and around Washington, DC, gentrification has been coupled with displacement of primarily Black populations from urban neighborhoods, and continues to have a high social cost via loss of neighborhood culture and social cohesion (Hyra, 2017; Jackson, 2015). Further, gentrification has been noted to cluster spatially near stations of the existing regional subway system (Turner and Snow, 2001). The Purple Line project thus poses a challenge to planners and policymakers alike: will there be a continuation of this local paradigm of neighborhood upgrading and displacement in newly transit-accessible and historically disinvested neighborhoods, or can a new transit corridor develop more equitably?

Scholars have confirmed a link between neighborhood gentrification and public investment, but evidence causally linking displacement of residents and businesses to those factors is murkier (Chapple & Loukaitou-Sideris, 2019; Zuk et al. 2018). Displacement in this context is the forced removal out of, or blocked relocation into, gentrified areas for residents

with lower incomes and the businesses they patronize (Marcuse, 2016; Slater, 2009). Scholars have already identified real estate price increases that are attributable to future transit service in the Purple Line Corridor in advance of the line's opening (Peng and Knaap, 2020). Researchers have not yet, however, identified any past or ongoing gentrification in the Purple Line corridor at the neighborhood level, and further, study of gentrification explicitly in suburbs is relatively rare (Finio, 2021). There is limited empirical evidence regarding the impact of gentrification on small businesses, because most gentrification research focuses on demographics, residential real estate markets, and the displacement of residents. This is a critical gap in research, because small businesses in minority neighborhoods are a key part of the social and community fabric, and are engines of economic mobility particularly for immigrants and their descendants (Lung-Amam, 2021; Portes and Zhou, 1992).

This paper aims to identify and assess gentrification in neighborhoods along the Purple Line Corridor and analyze the impact of that gentrification on small and medium sized businesses. I find that gentrification is extensive in the Purple Line corridor, even well in advance of the transit line's opening. I also find that a location in a gentrifying neighborhood means that a business is more likely to close. These findings will inform planners and policymakers dealing with the consequences of significant investment in public infrastructure in gentrifying areas.

In the following, I first provide socioeconomic, geographic, and political background on the Purple Line project. I next review the links between public investment, gentrification, and economic development. In the following section I review the methods and data used to assess the presence of gentrification and its impacts on small and medium sized businesses. The next section presents findings and relates those to ongoing local advocacy and policymaking. The final section concludes by identifying needed policy interventions, trends to watch, and opportunities for future research.

II. Background on the Purple Line and its Corridor

The Purple Line is under construction and expected to open by the year 2026. The 16-mile alignment will host 21 stations, four of which will adjoin existing Washington Metropolitan Area Transportation Authority (WMATA) metrorail stations. The train will travel each way from a western terminus at Bethesda in Montgomery County to an eastern terminus at New Carrollton

in Prince George's County. Along its path it will pass through a number of relatively dense suburban communities, business districts, and the main campus of the University of Maryland, College Park. The Purple Line will connect directly to three Maryland Area Regional Commuter (MARC) train stations and one Amtrak station on the busy Northeast Corridor (Maryland Department of Transportation, 2021). Approximately 173,000 people live within a half-mile radius of the train alignment (National Center for Smart Growth, 2021). Daily ridership is projected to be roughly 60,000 by 2030, equivalent to approximately 10% of the entire six-line metrorail system's average daily ridership in the year 2019 (Shaver, 2015; WMATA, 2021). This circumferential rail line will be the first modern rail line (in both the Washington metropolitan area and the United States) which is not a radial part of a hub-and-spoke system directly connected to a central business district. Figure 7 shows the Purple Line and its corridor of dense suburban communities, business districts, and the main campus of the University of Maryland.

Figure 7. The Purple Line and its Corridor

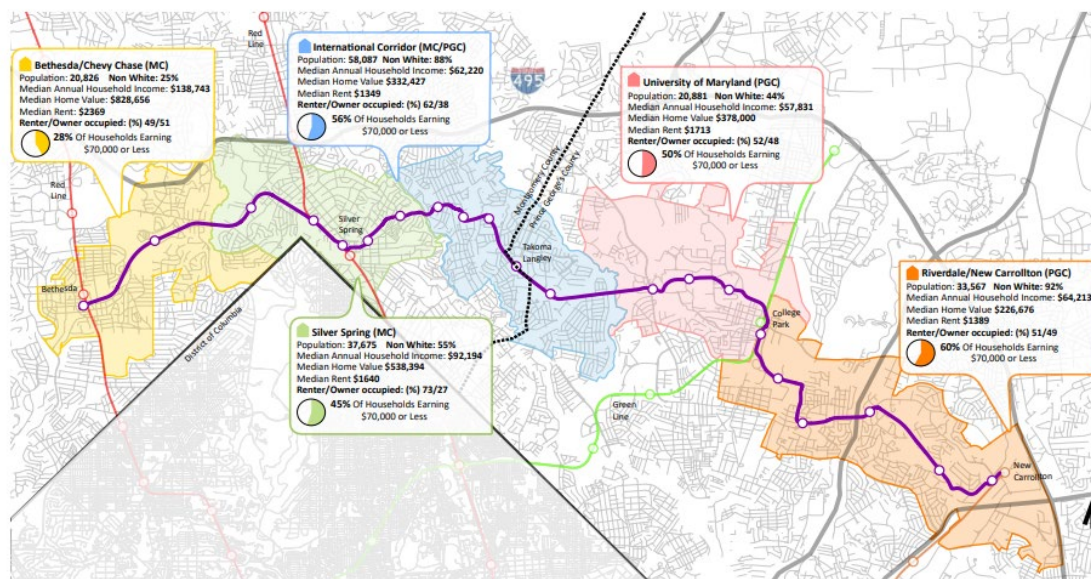


Image credit: Purple Line Corridor Coalition, Housing Action Plan, 2019

The Purple Line project has survived decades of political headwinds and tailwinds. The line's earliest planning vestiges date to considerations in the 1980s for a trolley line along a dismantled rail corridor between Bethesda and Silver Spring in Montgomery County. In its current form, it was approved by then Governor Martin O'Malley during the Obama administration. The line survived challenges made on fiscal grounds by Governor Larry Hogan

shortly thereafter, primarily due to support from the business community and local governments (Action Committee for Transit, 2021). The project is partially funded via federal, state and local government funds but would not be possible without a public-private partnership, in which a consortium of private companies are funding part of the construction cost and operating the line in exchange for future revenue. The total value of the construction itself and the 30-year operating contract will amount to at least \$9.3 billion (Shaver, 2022; Maryland Department of Transportation, 2016). Environmental lawsuits, construction delays, and contracting difficulties with the public-private partnership have slowed progress and significantly delayed the initial projected opening date from initial estimates of 2021 to 2026 (Shaver, 2022).

Across relatively short distances, the Purple Line passes through neighborhoods with a wide variety of socioeconomic and demographic conditions. Land use in and around station areas varies from city-like urban downtowns in unincorporated Silver Spring and Bethesda, to moderately dense residential suburban neighborhoods built in the mid-20th century, to a major land-grant University campus, to strip-mall auto-dominated environments centered on arterial roads. The west side of the corridor, centered on Bethesda's business district, is a regional center of privilege where mostly highly educated residents earn large incomes and live in housing which on average costs 3-4 times as much as the median home in the US (Purple Line Corridor Coalition, 2019). Just a few miles to the east, after passing through the Silver Spring business district, the train passes through densely populated majority-minority neighborhoods in the Langley Park area, which is an immigrant gateway, particularly for recent Latinx arrivals from Central America (Price & Singer, 2008). In these neighborhoods and others near the eastern end of the line such as Riverdale, household incomes are below the US average, up to a quarter of adult residents have not completed high school, poverty rates in some areas exceed 20 percent of the population, and many residents do not speak English at home (National Center for Smart Growth, 2017). The 173,000 residents who live within about a half-mile of the alignment are over one third Latinx, and majority non-white (National Center for Smart Growth, 2017).

The juxtaposition of a \$9.3 billion dollar transit investment against existing socioeconomic inequality in this corridor, in a region that has experienced significant gentrification, has caused concern amongst some planners and social justice advocates. In 2014, a group of concerned academics, advocates, planners, government officials, non-profits and private citizens calling itself the Purple Line Corridor Coalition (PLCC) formed to advance a

vision of an equitable transit corridor. The PLCC has parallel missions of advancing affordable housing preservation and construction, increasing investment in workforce development, expanding community placemaking, and protecting minority-owned local small businesses during and after the construction of the line (PLCC, 2017). PLCC remains heavily engaged in the local planning process, and through a non-binding community development agreement, the coalition influences local and state government, the non-profit sector, and the business community to better prepare for a more equitable transit corridor. The PLCC has called for preservation of 17,000 affordable housing units and preservation of existing minority-owned small businesses. However, gentrification pressure in the Corridor threatens progress toward these goals (PLCC, 2019). The challenges the PLCC is attempting to address are not unique to Maryland or the Purple Line Corridor, as scholars across the country have investigated the connections between public investment and gentrification for many years.

III. The links between transit investment, gentrification, and economic development

Few topics elicit greater debate in planning and urban studies today than gentrification and its primary consequence, displacement (Brown-Saracino, 2017). Gentrification has many boosters and is arguably an indirect policy goal of many local governments, but is simultaneously viewed as a social problem, much like concentrated poverty or environmental injustice. Planners advancing modern, sustainable public transit options, such as light rail retrofitted into auto-oriented suburbs, find themselves caught in a wicked battle at the edges of Campbell's planning triangle, which depicts the tension between social and economic justice, environmental sustainability, and economic growth (Campbell, 1996). A growing city arguably requires economic development and transportation options that are sustainable, but public investment, even in a heavily regulated land and housing market, may result in increased social inequity in the form of gentrification and displacement. This section outlines the parameters of this conflict, evidence for its existence, and gaps in understanding.

Understanding gentrification and commercial displacement

Scholars generally agree that gentrification can be defined as the influx of new investment and new residents with higher incomes and educational attainment into a neighborhood that is disadvantaged or poorer than average (Chapple & Loukaitou-Sideris, 2019).

The process was first observed in working class neighborhoods in London in the 1960s by Ruth Glass, and has since been observed in cities across the developed world while persisting through global business cycles (Lees et al. 2008). In the United States, gentrification has expanded into additional neighborhoods and regions at an accelerating rate in the 21st century (Hwang and Lin, 2016). In the Washington metropolitan area, gentrification has been observed for decades and is increasingly viewed as problematic for two main reasons. First, it displaces incumbent residents, their culture and social networks, and potentially excludes them from economic growth. Second, it is either a cause or a symptom of a broader crisis of housing unaffordability.

Gentrification is a process of neighborhood change that can be attributed to three forces that act upon residential location choice and property values, relating to demand, supply, and political power. First is the demand side, which is the set of demographic and social forces that encourage some higher-income populations to move into disinvested poorer neighborhoods (Lees et al., 2008). Second is the supply side, the set of micro and macroeconomic forces that, over time, create neighborhoods that can be gentrified (Smith, 1979). The third factor is political power, meaning the actions of government at various levels that can influence urban redevelopment and gentrification (Griffith, 1995). In the Washington metropolitan area, rapid regional macroeconomic growth coupled with demographic forces has pushed individuals with higher incomes and education toward centrally accessible, older and disadvantaged neighborhoods since the 1980s (Gale, 1987). Suburban and central city policymakers have capitalized on this pattern by directing growth into established, urban areas, which has led to the displacement of tens of thousands of Black residents, mostly out of the District of Columbia into the suburbs (Prince, 2016).

As supply, demand, and neighborhood culture shift during gentrification, changes to commercial markets occur as well. The phenomenon of commercial gentrification, or the upscaling of businesses in gentrifying neighborhoods to serve the tastes of newer and more affluent residents, is coincident to residential gentrification (Zukin et al., 2009). This process can alienate and exclude incumbent residents from commercial spaces along racial and class lines (Freeman, 2006). These negative consequences are then compounded by the potential loss of neighborhood stores that serve as community institutions and engines of economic mobility for minority populations (Sutton, 2010).

Studying links between small business displacement and gentrification, however, is challenging. Without precise time-series micro-level data on businesses, it is difficult to understand how and why businesses open and close, as such activities happen frequently for dozens of possible reasons. Further, it is challenging to directly relate those changes to the long-term process of neighborhood gentrification, which is often measured over decades. Other work has shown that commercial gentrification can increase access to retail options in low income neighborhoods, though it may not benefit incumbent residents with low incomes, and further those same individuals may lose jobs during industrial transition periods occurring simultaneously to gentrification (Meltzer and Ghorbani, 2017; Meltzer and Schuetz, 2012).

Several papers have explored links between gentrification, shifts to the local economy, and business closures. Much of this research focuses on gentrified formerly industrial neighborhoods in New York City and has found that gentrification is associated with shifts from blue collar to white collar or service employment, and increased rates of business closure (Yoon and Currid-Halkett, 2015; Zukin et al., 2009, Curran 2007). Meltzer (2016), also investigating New York, finds that business displacement of businesses is no more prevalent in gentrifying neighborhoods than other areas; but finds mixed results overall about business retention and disruption. Glaeser et al. 2020 found in five cities that business closure rates are higher in gentrifying neighborhoods, but hypothesize this is linked to the global impact of e-commerce rather than a shift to luxury service and retail. In Chicago, Mir and Sanchez (2007) found that small firms in the service sector in gentrifying neighborhoods faced increasing complaints and inspections, and additional regulatory pressure due to environmental issues. Limited empirical evidence has shown that small minority owned businesses fare poorly in gentrifying neighborhoods (Ong et al., 2014).

It has been noted that “there is almost no literature inquiring about any possible connections between commercial gentrification and investment in transit infrastructure,” and what literature does exist finds inconclusive results (Chapple & Loukaitou-Sideris, 2019, p. 176). While this relationship has been investigated elsewhere, it has not been in Maryland. The Purple Line is the largest investment in transit in Maryland for decades, and this will influence supply and demand for housing and commercial space both nearby and regionally. The relationship between gentrification and public investment has been investigated, but with inconclusive results.

Gentrification and public investment

Gentrification theory suggests two paths by which new rail transit could catalyze gentrification. First, on the demand side, new rail transit could provide increased accessibility to jobs, which makes neighborhoods more desirable to workers with higher incomes. These highly paid workers may value leisure time and city amenities, and thus desire neighborhoods proximate to employment via transit to reduce the financial and time opportunity costs associated with commuting (Baum-Snow and Hartley, 2020). Second, on the supply side, investment in transit may shift the bid-rent curve for land near new transit stations upward, as increased accessibility to various parcels of land will increase the willingness to pay of both prospective commercial and residential users. In disadvantaged areas, this shift in prospective or current land values could be enough to trigger redevelopment and associated gentrification, filling in the rent gap between potential and actual land values (Smith, 1979). Scholars have analyzed the impact of increased accessibility on property values and this work, with some nuance, has found that rail transit adds a price premium to nearby properties, which decreases with distance from rail stations (Giuliano and Agarwal, 2010; Knaap et al., 2001).

Evidence of these links between transit investment and gentrification has appeared in empirical literature. Scholars seeking to assess the factors that influence why one neighborhood is more likely to gentrify than another have identified the presence of nearby public transit, particularly rail transit, as a causal factor (Brown-Saracino, 2017; Turner and Snow, 2001). A review of the links between rail transit and gentrification found that several studies have provided evidence that proximity to rail transit is linked to neighborhood upgrading, in terms of increased property values and socioeconomic change, but cautioned that the amount of research is limited (Zuk et al., 2018). Most recently, Chava and Renne (2021) found gentrification was more likely in neighborhoods that became home to new light rail transit stations – both before and after completion of new stations – than in neighborhoods without such stations in cities across the US. These papers and others identification of gentrification at some level of geography using a variety of methods.

Mapping and identifying gentrification and understanding its impacts

Researchers studying gentrification have produced dozens of studies that quantify where and how gentrification is occurring, and in doing so have employed a wide variety of methods (Finio, 2021). Typically, scholars first identify areas that are eligible to gentrify, and then specify which of those neighborhoods gentrify over time via change in various demand or supply side indicators (Galster and Peacock, 1986). Use of different mapping and identification methods can produce differing conclusions about the location and severity gentrification, which can have policy implications if anti-gentrification or anti-displacement measures are deployed on a geographic basis (Preis et al., 2020).

Despite inconsistencies in identifying gentrification, researchers are increasingly relying on such methods to attempt to answer questions about the consequences of the phenomenon (Finio, 2021). Increasing amounts of empirical evidence indicate that incumbent residents of gentrifying areas do not face higher displacement rates than peer residents in not gentrifying areas (Delmelle and Nilsson, 2020; Ding et al 2016; Ellen and O'Regan, 2011; Freeman, 2005). Qualitative evidence, however, has shown that long-term residents are displaced in gentrification processes, and are also negatively psychologically impacted (Pattillo, 2007; Betancur, 2011; Hyra, 2017).

Using the Purple Line Corridor as a Case Study

This section has highlighted the complexities of gentrification scholarship and identified a multifaceted gap in the research. The Purple Line offers a unique opportunity to attempt to fill this gap with timely empirical evidence, as it is being built in an economically diverse part of a region that is already experiencing gentrification. This study will be the first to identify gentrification in the Purple Line corridor, providing additional evidence on the link between public investment and gentrification before a massive public investment is complete. Second, this study will contribute knowledge on the relationship between public investment and commercial gentrification by examining the small business economy inside and outside of gentrifying neighborhoods in the transit corridor.

IV. Methods and Data

To measure gentrification in the Purple Line corridor, this study employs census data at two time periods, 2000 and 2015-2019. Between these time periods, gentrification is measured at the census tract level,ⁱⁱ and I use the term neighborhood interchangeably with the term census tract. Following Chava and Renne (2021) the study area is made up of all census tracts in Montgomery and Prince George's counties and excludes tracts from elsewhere in the metropolitan area. This focuses variation in tracts on the within-county data, without subjecting comparison trends to higher levels of change due to inclusion of other areas like Washington, DC or Arlington. To harmonize data between 2000 and 2015-2019, data from 2000 is from the Longitudinal Tract Database (LTDB) from Brown University, which provides a spatially weighted dataset of census data with consistent boundaries (Logan et al., 2014).

I construct a weighted socioeconomic status (SES) index of four variables, which capture supply and demand side attributes of gentrification at the neighborhood level, following Hwang and Lin (2016) and Timberlake and Johns-Wolfe (2017). Components of the index include inflation adjusted median home, rent and household income values, and the percent of the population age 25 and over with a bachelor's degree. With the index, I rank-order census tracts in each time period in order to measure change for individual tracts from one period to the next, following Landis (2015). I utilize use z-scores to compare change in relative tract position in the index over time. Census tracts are eligible to gentrify if they are below the 40th percentile of median household income for the study area in the base year; and further, only if those tracts in the base year have a lower share of housing stock built in the prior 30 years than the study area average (Freeman, 2005). With these two qualifiers, eligible tracts are low-income areas that have seen little new construction and have not been receiving an influx of financial capital. With a set of eligible tracts defined, I then identify which of those tracts gentrified. Gentrified tracts are those from that set which saw 60th percentile or higher increase to their socioeconomic status (SES) index from 2000 to 2015-2019. I map gentrified tracts in the two counties as a whole and within a pre-defined geography comprising the Purple Line Corridor and compare trends across those areas (National Center for Smart Growth, 2017). I note that the definition of gentrification is slightly more strict in this essay than the previous, though the same time length and variables are used. This stricter definition has a stronger eligibility requirement based on income alone, rather than all SES, and also restricts tracts with recent construction from being eligible. The purpose of this is to isolate the "strongest" gentrifying tracts, with the rationale that

gentrification will impact the local economy in these tracts the most, or at least to the greatest degree.

With the set of gentrified census tracts identified, I then measure changes to the small business ecosystem using a novel data source: microdata on firms from the State of Maryland unemployment insurance system, a state-level primary source of the national Quarterly Census of Employment and Wages (QCEW) produced by the Bureau of Labor Statistics. This data source offers address-specific firm level quarterly records of employment and total wages paid for the time period 2009 to 2018. I define small businesses as those with ten or fewer employees (Purple Line Corridor Coalition, n.d.). I aggregate data on employment and wages within gentrifying neighborhoods and outside those areas to assess trends over time. I also construct a simple survival model using logistic regression to analyze trends in reasons why firms closed between the years 2015 and 2018.

To assess the relationship between gentrification and businesses, I first produce time series tables and charts that compare total employment and total inflation adjusted wages inside and outside of gentrifying neighborhoods, for all businesses and small businesses. I then use logistic regression to identify the reasons for firm closure between the year 2015 and 2018, to assess if the Purple Line or neighborhood level gentrification have an impact on the likelihood that a firm closes. The *a priori* assumption for this regression is that firms in gentrifying neighborhoods face a higher likelihood of closure than firms not in such neighborhoods, and that proximity to the construction of the Purple Line will also increase likelihood of closure. This is not to say that higher rates of closure mean commercial gentrification – in the sense of upscaling and replacement of businesses – is necessarily occurring. It does, however,

To complete the regression analysis, I construct a logistic regression model of firm closure. In this model, firm survival takes the functional form of equation (1).

$$\textbf{Equation (1)} \\ P(y = 1|x) = G(\beta_0 + \beta_0 x_1 + \dots \beta_k x_k)$$

Firm survival is the value y where 1 means firm closure and 0 means the firm remains open. $P(y = 1|x)$ is the probability that the firm closes, given a set of firm and other characteristics x . The function $G(\beta_0 + \beta_0 x_1 + \dots \beta_k x_k)$ is the general logistic distribution function where $\beta_k x_k$ is the set of coefficients and independent variables on which firm closure is presumed to vary.

To construct the model I utilize the set of firms that were open in the year 2015 and were either still open or closed in the year 2018. Firm open status is defined as having at least 1 employee in any quarter of 2015. Firm closure by 2018 is defined by absence of records for that firm in the QCEW dataset in any quarter in 2018 so long as that continues through the following quarters, and into 2020. Firms are identified with a unique tax account identifier that does not change if the firm's physical address changes. Firms must be located in the Purple Line Corridor in the year 2015 to be included in the analysis. Firms that relocate after 2015 remain included in the survival analysis. 2019 and 2020 data in the dataset was found to be unreliable with respect to total employment, though firm records are consistent, and is thus excluded from the overall trend analysis, but included for the survival analysis.

The dates were chosen for the following reason. First, the 2015-2018 time period is as close to the end of the gentrification measurement period as possible as it overlaps with the 2015-2019 ACS 5-year sample. Thus, firms in gentrified neighborhoods are subject to the conditions of a gentrified neighborhood according to the operationalization of gentrification. Second, construction on the Purple Line began in August 2017 and continued throughout the year 2018 (US Department of Transportation, 2017). At the beginning of the time period in 2015, Governor Larry Hogan gave his approval for the project to proceed officially (McCartney, Hicks and Turque, 2015). Thus between 2015 and 2018, the anticipation and construction effects of the Purple Line were first fully observed. According to the Small Business Administration, about two thirds of businesses with employees survive at least two years, and about half survive at least five years (Small Business Administration, 2012). In the next section I present results for both where gentrification occurred and the degree of change it brought to various neighborhoods, and the regression model.

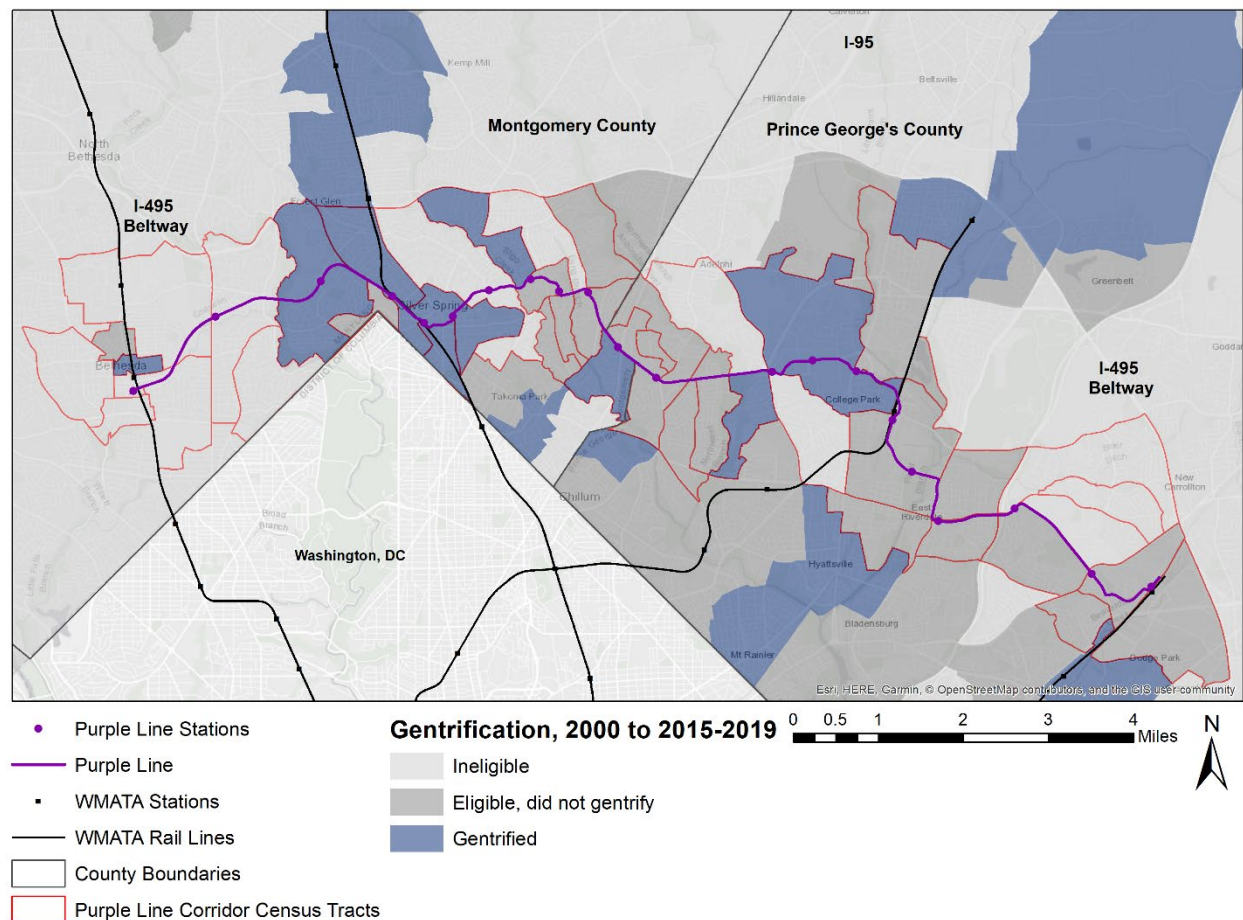
V. Findings

Gentrification

In the year 2000, 117 of 433 census tracts in the two-county study area were eligible to gentrify, as each tract had a median household income below \$86,689 and over 47.8% of the housing stock was built prior to 1970. Over the period 2000 to 2015-2019, 27 out of 433 census tracts in the two counties gentrified, equal to 23% of eligible tracts, or 6% of total tracts. Those

27 tracts were evenly spread across the two counties, which each have nearly the same total number of tracts. The 27 tracts, however, were disproportionately geographically concentrated in a small area: the Purple Line corridor. Figure 8 reflects this concentration with a map of metropolitan gentrification and a focus on the narrow Purple Line Corridor.

Figure 8. Gentrification, 2000 to 2015-2019, Purple Line Corridor



Gentrification in the Corridor appears to be concentrated in and around Silver Spring, a major transit-oriented development node along metrorail at the northern apex of Washington, DC. To the west, a small census tract has gentrified in downtown Bethesda, another dense central business area. To the east, gentrification has taken hold along the county border in Takoma Park, and also to the east in Hyattsville and College Park. Gentrification also appears nearby, but outside the immediate corridor, in Wheaton and Hyattsville. The far eastern end of the Corridor

has many eligible tracts in the Riverdale and New Carrollton areas, but by 2015-2019, gentrification had not yet occurred.

The corridor hosts 47 of the 433 tracts (11%) in the two-county study area (Table 5). The majority of that area was eligible to gentrify (32 tracts, 68%), which highlights the relative economic disadvantage of most neighborhoods of the Purple Line corridor in the year 2000. Ten of those eligible tracts, or 21% of the entire corridor, did gentrify over the period. These ten tracts account for 37% of the gentrification in the study area, which is well above the corridor's share of total tracts (10.8%). Outside the Purple Line corridor, 85 tracts were eligible to gentrify and 17 did (20%); inside the corridor, 32 were eligible to gentrify and 10 did (31%) (Table 5).

Table 5. Gentrification in the study area and Purple Line Corridor, 2000 to 2015-2019

	Total Tracts	Tracts ineligible to gentrify	Tracts eligible to Gentrify	Tracts which did not gentrify	Gentrified Tracts
Purple Line Corridor	47	15	32	22	10
Montgomery	215	184	31	17	14
Prince George's	218	132	86	73	13
Two County Total	433	316	117	90	27
Shares (as percentage of two county total)	Total Tracts	Tracts ineligible to gentrify	Tracts eligible to Gentrify	Did not gentrify	Gentrified Tracts
Purple Line Corridor	10.8%	4.7%	27.4%	24.4%	37.0%
Montgomery	49.7%	58.2%	26.5%	18.9%	51.9%
Prince George's	50.3%	41.8%	73.5%	81.1%	48.1%
Shares (as percentage of each listed area)	Total Tracts	Tracts ineligible to gentrify	Tracts eligible to Gentrify	Did not gentrify	Gentrified Tracts
Purple Line Corridor	100%	31.9%	68.1%	46.8%	21.3%
Montgomery	100%	85.6%	14.4%	7.9%	6.5%
Prince George's	100%	60.6%	39.4%	33.5%	6.0%
Two County Total	100%	73.0%	27.0%	20.8%	6.2%

There are notable differences in changes to the components of the socioeconomic status index between 2000 and 2015-2019 when comparing the three groups of tracts: ineligible, gentrified, and non-gentrified. Table 6 (p. 77) presents summary data across the same geographies as Table 5, for both time periods, on the four components of the index: median home values, median household income, median rent, and the share of the population age 25 or over with a bachelor's degree.

Gentrified tracts in all areas saw increases in real median home values above 75%, compared to generally 60% or less in ineligible and non-gentrified places. The Washington metropolitan area experienced a strong housing market from 2000 to 2015-2019, and even disadvantaged places saw increases in real home prices over the period that were much higher than increases to median income (Begley et al. 2019). In gentrified areas, real median household income increased by at least 20%; but there was stagnation or even decline in non-gentrified areas, and small increases in ineligible areas. Median rents increased more slowly than home prices, but increased in all sets of tracts, and the highest trends in rent increases were in gentrified tracts. Educational credentials increased everywhere over the period, mirroring regional and national trends, but within gentrified areas, the upward trajectory was most strong. Some gentrified areas saw more than a doubling of the college-educated population over the period.

The Purple line corridor embodies a magnification of these trends. The gentrified areas of the Purple Line corridor saw a greater home value increase (over 90%) than other gentrified areas, and ineligible and non-gentrified places. These trends resulted in median home values exceeding a half million dollars by 2015-2019 – higher than all other gentrified areas. Rents increased by almost 50% in the Purple Line corridor, adding over \$500 to the real median rent cost in gentrified neighborhoods, though these increases were similar in percentage to other areas. Median household income in the corridor increased from a relatively low level –\$68,789 – to over \$85,000. The share of the population with a bachelor's degree increased from one in three to nearly two in three in less than twenty years – the highest share in any area. These trends in the 10 gentrified tracts in the Purple Line corridor are notable when compared to milder gentrification outside the Corridor, especially for education and home values.

Table 6. Characteristics of ineligible, gentrified, and non-gentrified tracts, 2000 to 2015-2019

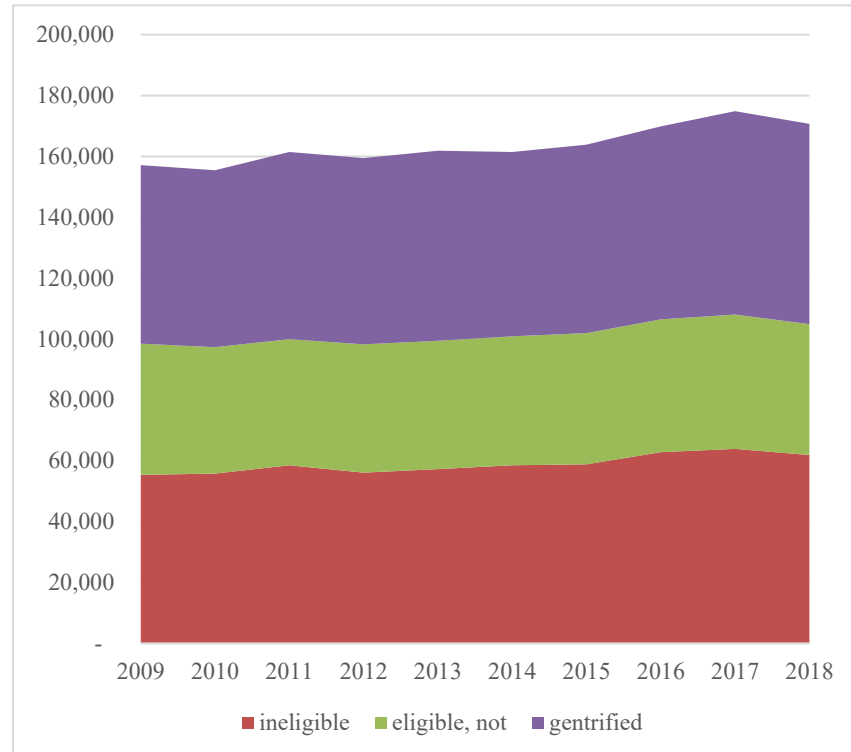
Gentrified		PL Corridor	Montgomery	Prince George's	Two Counties
Median home value	2000	\$268,935	\$275,958	\$188,518	\$232,238
	2015-2019	\$512,530	\$506,714	\$330,038	\$421,648
	percent change	90.6%	83.6%	75.1%	81.6%
Median household income	2000	\$68,789	\$74,424	\$65,026	\$69,899
	2015-2019	\$85,078	\$93,455	\$76,621	\$85,349
	percent change	23.7%	25.6%	17.8%	22.1%
Median Rent	2000	\$1,138	\$1,126	\$1,024	\$1,077
	2015-2019	\$1,661	\$1,700	\$1,517	\$1,612
	percent change	46.0%	50.9%	48.2%	49.7%
Share of population with BA+	2000	34.3%	34.6%	14.3%	24.8%
	2015-2019	64.6%	61.8%	39.9%	51.2%
	percent change	88.5%	78.6%	179.7%	106.6%
Non-gentrified		PL Corridor	Montgomery	Prince George's	Two Counties
Median home value	2000	\$196,078	\$240,980	\$179,212	\$190,880
	2015-2019	\$309,776	\$386,882	\$248,325	\$275,714
	percent change	58.0%	60.5%	38.6%	44.4%
Median household income	2000	\$66,792	\$70,428	\$62,811	\$64,250
	2015-2019	\$67,268	\$71,089	\$62,485	\$64,110
	percent change	0.7%	0.9%	-0.5%	-0.2%
Median Rent	2000	\$1,049	\$1,171	\$987	\$1,022
	2015-2019	\$1,437	\$1,587	\$1,365	\$1,407
	percent change	36.9%	35.5%	38.3%	37.7%
Share of population with BA+	2000	17.9%	26.9%	10.6%	13.7%
	2015-2019	28.5%	41.0%	19.6%	23.6%
	percent change	59.6%	52.4%	84.6%	72.7%
Ineligible		PL Corridor	Montgomery	Prince George's	Two Counties
Median home value	2000	\$402,963	\$367,068	\$230,020	\$309,820
	2015-2019	\$675,033	\$550,406	\$312,038	\$450,960
	percent change	67.5%	49.9%	35.7%	45.6%
Median household income	2000	\$132,809	\$125,523	\$100,896	\$115,236
	2015-2019	\$145,672	\$132,078	\$101,360	\$119,246
	percent change	9.7%	5.2%	0.5%	3.5%
Median Rent	2000	\$1,627	\$1,579	\$1,297	\$1,461
	2015-2019	\$2,140	\$2,039	\$1,893	\$1,979
	percent change	31.5%	29.1%	46.0%	35.5%
Share of population with BA+	2000	45.1%	39.2%	21.2%	31.7%
	2015-2019	68.9%	61.2%	37.6%	51.4%
	percent change	52.6%	56.1%	77.2%	62.0%

With trends in gentrified areas and the Purple Line corridor identified, I turn to the conditions of the local economy. In gentrifying areas, businesses may have been able to expand due to the influx of spending power, or they may have been pushed out due to escalating rent costs. Given that incomes in gentrifying areas increased more in both relative and absolute terms than in non-gentrified and ineligible places, it is hypothesized that aggregate economic activity will increase. Aggregate economic activity is measured by total wages paid per quarter, and the average number of employees in a given quarter.

Business Trends

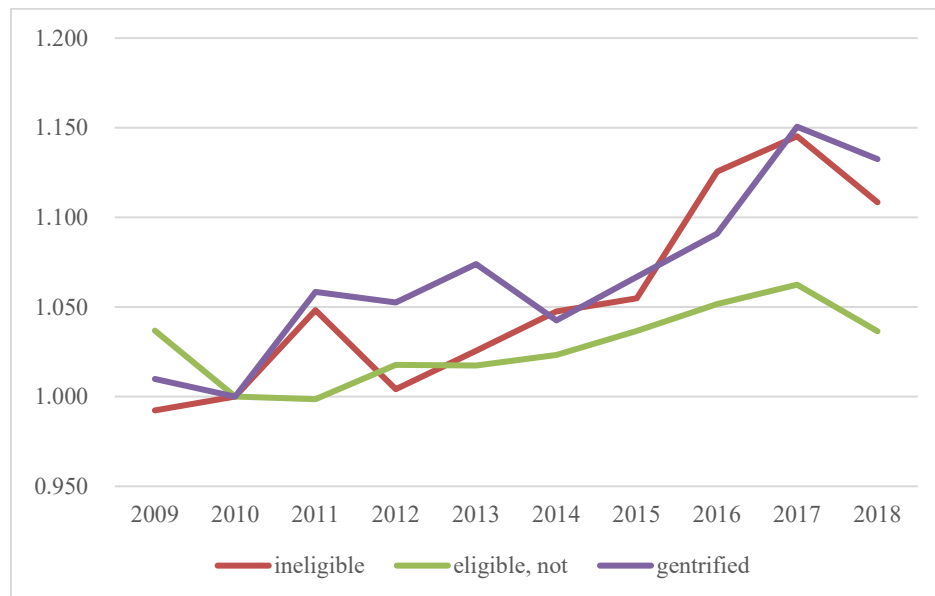
The stacked area chart below, Figure 9, shows that employment has remained relatively consistent as a share of total employment in each of the three census tract types in the Purple Line corridor between 2009 and 2018. The bulk of the employment in the corridor is in gentrified tracts and ineligible tracts, which aligns with where these tracts are physically located. The main employment centers of Bethesda, Silver Spring, and College Park are either ineligible to gentrify, or gentrified.

Figure 9. Employment in the Purple Line Corridor, by Tract Category



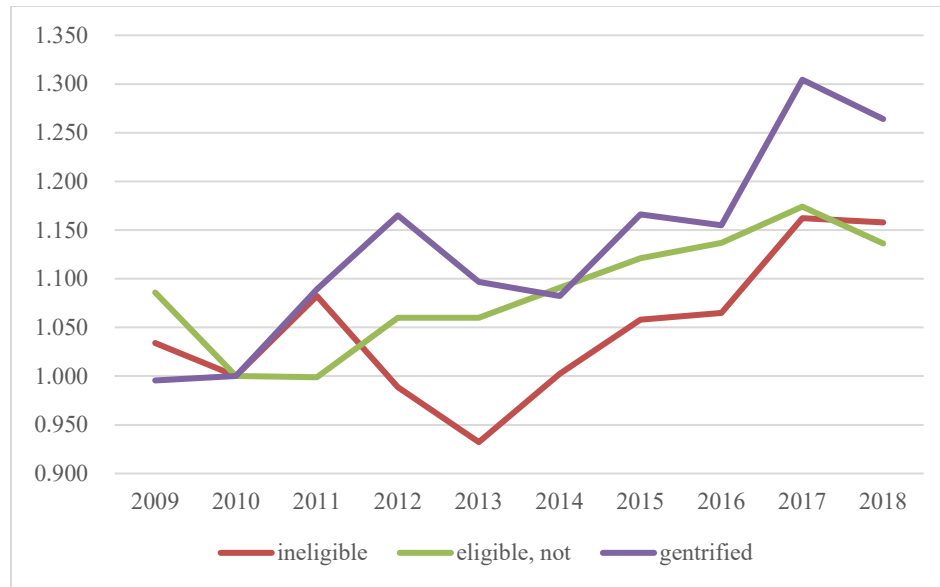
When this chart is indexed so that the trough of the recession (2010) is set equal to 1.0 for each value in Figure 10, a different trend is more clearly visible. Gentrified tracts have 13% higher employment than in 2010 – an increase that exceeds the increase in ineligible areas (11%) and eligible but not gentrified areas have total employment up just 4% over that 8-year period

Figure 10. Employment in tract categories, indexed to 2010 = 1.0



The trend in real total wages (in 2020 dollars), in Figure 11, when indexed in the same manner, shows that gentrified tracts are paying over 25% more in wages in total than in 2010. Ineligible and not gentrified areas are paying about 15% more. Normalizing by the number of employees leads to an un-interpretable number because the QCEW does not include information on the number of hours worked by each employee at each firm. Thus it is impossible to derive any meaningful trends in the distribution of wages per employee.

Figure 11. Real wages in tract categories, indexed to 2010 = 1



Additional charts in the appendix show further trends for this employment and wage data, including maps. Most of the employment growth occurred in central business district areas that host many businesses and also large institutions: Bethesda, Silver Spring, and College Park. When employment growth is analyzed by sector, interesting trends emerge. Blue-collar employment – in industries like construction, manufacturing, transportation and warehousing, and wholesale trade – has been falling since the year 2009 in gentrified tracts, while remaining roughly steady elsewhere. Gentrified tracts are seeing an increase in white collar employment – finance, insurance and real estate (FIRE), public administration, and management industries – while the other two areas are seeing decreases. No clear trend is evident for retail employment or arts, accommodation, and entertainment industries, other than perhaps a slight uptick in both gentrified and ineligible locations.

In summary, the aggregate statistics suggest that gentrifying areas are experiencing further concentration of employment and wages – along with some industry shifts – that are not being experienced in ineligible or not gentrified places. This matches expectations and is logical given that gentrified areas are experiencing growth in income, land values, and education levels. How then do these trends play out for small business?

Table 7 illustrates the trend in the number of small businesses, defined as businesses with ten or fewer employees, across the different areas. Overall, there was a decrease in the number of small businesses over the period 2010-2018. This decrease was wholly driven by decreases in the

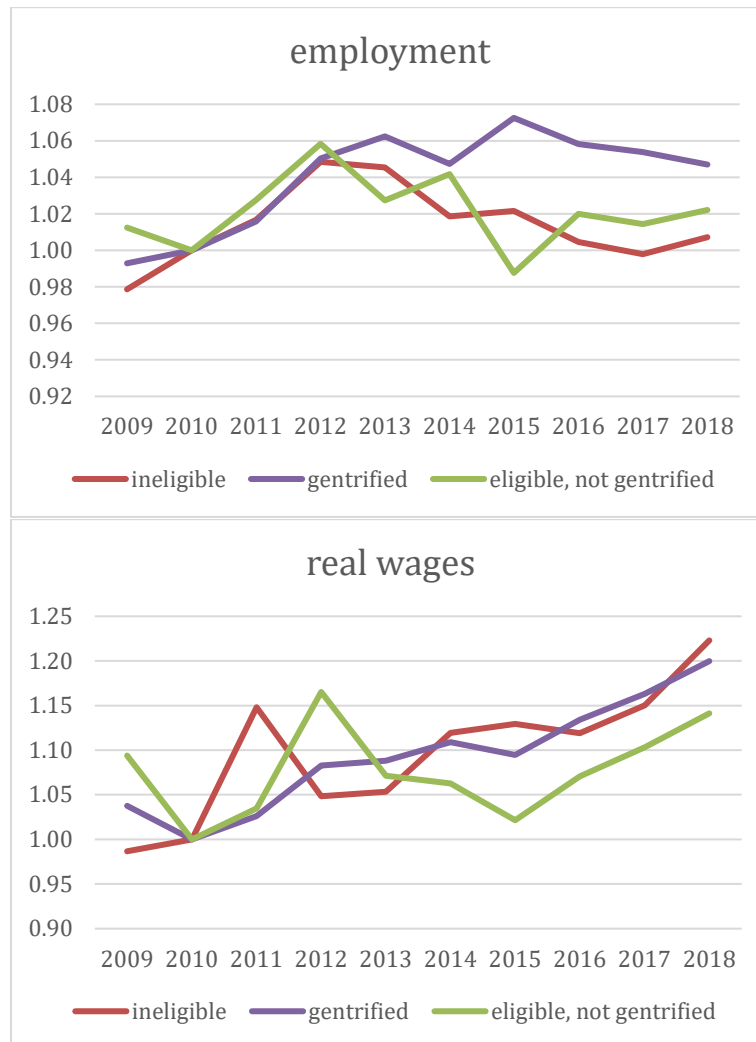
total number in ineligible areas. Gentrified and not gentrified areas saw a similar increase of 34 and 42 businesses respectively. This net change in the number of businesses does not reveal information about why businesses closed or remained open.

Table 7. Count of Small Businesses in different tract categories, 2009 to 2018

	ineligible	gentrified	eligible, not gentrified	total
2009	2436	1636	1595	5667
2010	2675	1797	1582	6054
2011	2758	1898	1650	6306
2012	2733	1876	1625	6234
2013	2847	1939	1641	6427
2014	2687	1857	1605	6149
2015	2629	1819	1599	6047
2016	2616	1828	1622	6066
2017	2570	1847	1644	6061
2018	2582	1831	1624	6037
Absolute change, 2010-2018	-93	34	42	-17
percent change 2010 to 2018	-3.48%	1.89%	2.65%	-0.28%

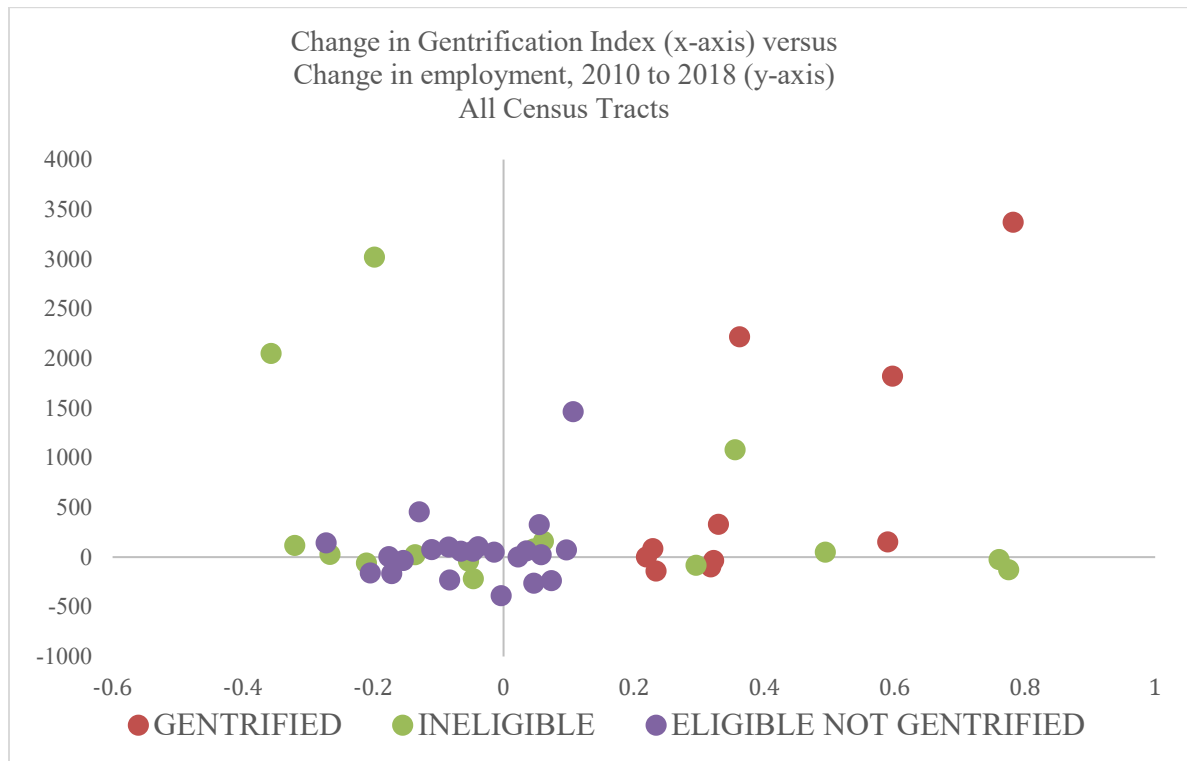
Small businesses in gentrified areas have roughly 5% more employees in total than they did in 2010, which aligns well with the slight increase in the total number of small businesses. Total employment at small businesses in gentrified areas has increased more than in other areas. For wages, all areas exhibit an increase, though ineligible areas have the fastest increase. Gentrified areas are paying out roughly 20% more in wages at small businesses than they were in 2010.

Figure 12. Employment and wages at small businesses, indexed to 2010 = 1



A simple scatterplot of one of these trends provides visual confirmation of the link between census tract level gentrification and change in employment. Each dot on the chart represents one census tract. The y-axis represents the change in employment (at all businesses) in the tract between 2010 and 2018. The x-axis shows the absolute change in the gentrification index over the 2000 to 2019 period. Gentrified tracts are on the right side of the chart, as they saw increases in the gentrification index. A weak positive relationship seems to exist both for these tracts alone and all the tracts together, in that as the gentrification index increases, employment increases.

Figure 13. Scatterplot of change in gentrification versus change in employment, census tracts



Analyzing these wage and employment trends through regression analysis would be challenging due to many unobserved characteristics of the firms, such as annual sales. However, the descriptive analysis confirms the hypothesis that businesses generally, and small businesses in particular, in gentrifying areas are experiencing overall economic growth. Confirmation of this hypothesis, however, leaves open the question of whether or not this growth is equitable, and whether businesses are also experiencing higher rates of closure in gentrifying areas. In the next section I interrogate this business trend more deeply by constructing a simple model of firm closure using logistic regression.

Business closure regression analysis

Given that change appears to be more rapid for businesses in gentrifying areas, a further set of questions can be posed. Are firms more likely to close if they are located in gentrifying areas? What influence does the Purple Line – which possibly causes disruption because of construction – have on the likelihood of closure? While these questions can be analyzed

descriptively, regression analysis allows for quick comparison of the influence of various factors. The logistic model results can be interpreted by asking which independent variables make business closure more or less likely. While this analysis does not answer a question about commercial gentrification – whether the firms in gentrified neighborhoods are upscaling to serve the more expensive tastes of newcomers – it will provide results that illustrate whether there is more churn of businesses in these neighborhoods. It is clear from the data that there are more businesses in these neighborhoods, but the assumption is that these businesses are more likely to close as a consequence of residential gentrification.

Given the functional form of equation (1), table 8 presents the independent variables on which the likelihood of firm closure is presumed to vary. The dependent variable takes a value between zero and one, where one is equal to firm closure in the year 2018. All variables after EMP15 are dummy variables that take the value of 1 if the criteria listed in the table are met. The first two distance variables are taken with respect to the alignment of the Purple Line tracks; firms further than 0.25 miles from the Purple Line are unobserved. The station area types are classifications of different station types, which can be further investigated in appendix Table 8; firms in residential station areas are unobserved. Firms take a value of 1 for these dummy variables if they are within ¼ mile of a station within the respective area type. The land use variables leave firms in institutional or other land uses unobserved. The NAICS code dummies are based on 3-type categorization of the various 2-digit NAICS codes, explained in appendix Table 8; white-collar industries are unobserved.

Table 8. Names and meanings of variables for logistic regression

Variable Name	Meaning
EMP15	firm-level employment in 2015
TENTH	firm is within 1/10th mile from Purple Line
TtoQUARTER	firm is between .1 and .25 miles from Purple Line
CBD_STA	firm is in a central business station area, 1/4 mile buffer
AUT_STA	Firm is in auto-oriented station type, 1/4 mile buffer
SUB_STA	Firm is in subcenter station type, 1/4 mile buffer
COUNTY	Firm is in Montgomery County
COMM	Firm located in a commercial land use area
INDUS	Firm located in an industrial land use area
RES	Firm located in a residential land use area
BLUE_C	Firm is of Blue Collar NAICS industry type
SERVICE	Firm is of service NAICS Industry type
G0019	Firm is in a gentrified census tract

Table 9 presents regression results for two specifications of the model. For all businesses, the location of the firm relative to the Purple Line takes a positive and significant coefficient for both dummy variables. The effect of increased likelihood of closure is stronger for the firms closer to the line. Firm location in a central business district station area (Bethesda or Silver Spring) is also significant and positive, indicating higher likelihood of firm closure in those ¼ mile station buffers. The County variable is significant and takes a negative sign, indicating that firms in Montgomery County are less likely to close. Firms located in industrial land use areas are less likely to close, with statistical significance. Firms in service sector industries are also less likely to close, with statistical significance. Firms in gentrifying neighborhoods are more likely to close, with statistical significance. With regard to substantive significance, the greatest absolute value of coefficients measured is for those on industrial land uses and service sector NAICS codes. These coefficients are similar in absolute value to being in the 1/10th mile buffer.

Table 9. Regression results, logit firm closure model

All businesses					
Dependent variable = 1 if a business open in 2015 is closed in 2018					
Independent variable	Estimate	Std. Error	t value	pr (> t)	significance
(Intercept)	0.455	0.039	11.534	0.000	
EMP15	0.000	0.000	-1.777	0.076	
TENTH	0.083	0.026	3.152	0.002	**
TtoQUARTER	0.059	0.024	2.429	0.015	*
CBD_STA	0.058	0.020	2.919	0.004	**
AUT_STA	-0.032	0.032	-1.000	0.317	
SUB_STA	-0.024	0.040	-0.610	0.542	
COUNTY	-0.038	0.019	-2.041	0.041	*
COMM	0.017	0.031	0.547	0.585	
INDUS	-0.091	0.040	-2.254	0.024	*
RES	0.038	0.032	1.189	0.234	
BLUE_C	0.023	0.023	0.986	0.324	
SERVICE	-0.087	0.014	-6.048	0.000	***
g0019	0.045	0.015	2.991	0.003	**
6160 degrees of freedom; AIC 8844.6					
McFadden R ² = 0.014					

Subsample model with small businesses only					
Independent variable	Estimate	Std. Error	t value	pr (> t)	significance
(Intercept)	0.567	0.046	12.440	0.000	***
EMP15	-0.017	0.003	-5.299	0.000	***
TENTH	0.080	0.028	2.840	0.005	**
TtoQUARTER	0.055	0.026	2.136	0.033	*
CBD_STA	0.047	0.023	2.070	0.039	*
AUT_STA	-0.043	0.035	-1.235	0.217	
SUB_STA	0.044	0.045	0.981	0.327	
COUNTY	-0.054	0.020	-2.659	0.008	**
COMM	-0.007	0.036	-0.197	0.844	
INDUS	-0.097	0.048	-2.019	0.044	*
RES	-0.022	0.036	-0.615	0.538	
BLUE_C	0.037	0.026	1.401	0.161	
SERVICE	-0.099	0.016	-6.232	0.000	***
G0019	0.041	0.017	2.441	0.015	*

5058 degrees of freedom; AIC 7239.5

McFadden $R^2 = 0.018$

Note: *** = significant at 0.1% level, ** = significant at 1% level, * = significant at 5% level.

The results for the land use and station area and county variables take their expected signs. Business competition and turnover is likely higher in CBD areas, so businesses in these areas are more likely to close. Firms in Montgomery County are less likely to close, perhaps because of higher incomes and better access to customers when compared to the Prince George's part of the Corridor. One surprising result is the negative coefficient on service sector firms; the coefficient means that service sector firms are less likely to close than white-collar sector firms.

The results for the small business subsample confirm the results of the all-business regression by retaining the same signs and significance on all of the aforementioned variables. For the small business subsample, the size of the firm is significant, such that larger firms (up to ten employees) are less likely to close than smaller firms. The values of the coefficients are broadly similar across the regressions, further confirming the results.

VI. Discussion

The results of the regressions, taken together with the descriptive data on aggregate firm, employment, and wage growth, paint a nuanced picture of how businesses are changing and

reacting to growth and gentrification in the Purple Line Corridor. In the aggregate, employment, wages, and the number of businesses both large and small are increasing across the Corridor. This is unsurprising, given that the Corridor is seated centrally in a rapidly growing metropolitan area. Further, the Corridor has existing locational advantages. The Corridor already hosts multiple forms of transit, has several major activity centers, and is home to the main campus of a top-ranked national research university.

This area, like much of the urban core of Washington, DC, has been experiencing neighborhood-level gentrification since the year 2000. The general pattern of this gentrification has been that older neighborhoods with homes and apartments built between the 1920s and 1950s have become more expensive as more residents with higher incomes and levels of education have moved in. In activity centers that allow for growth like Bethesda, Silver Spring and College Park, this turnover of housing stock in quiet neighboring suburban areas has been matched by new housing construction of apartments and condos that host middle and upper income residents. It is simple to surmise that the resulting addition of spending power to the Corridor has had spillover effects in certain neighborhoods, perhaps resulting in the trends of increased employment and wages in gentrifying neighborhoods across the Corridor. Complicating the picture, however, is a story of endogeneity with business growth. Are new businesses in the Corridor – perhaps law firms, medical offices, or high-end restaurants – responsible for in-movement of new residents?

The descriptive analysis completed in this essay cannot answer that chicken and egg question. I hypothesize that the story of demographic upgrading and gentrification in the Purple Line Corridor has more to do with structural and regional affects, given the small boundaries and locational advantage of the area, than it does the single actions of any given employer. Local businesses may enjoy and capitalize upon the agglomeration effects catalyzed by increased population and income growth, and these businesses may in turn further stimulate the local economy. With the QCEW data and the logistic regression, it is possible to draw conclusions about firm closure, the Purple Line, and gentrification. Does this increased growth and transit investment come with increased risk of closure for local businesses?

The answer to that question is a clear “yes,” even after controlling for numerous location-based factors. With the results of any regression, caveat emptor, as the QCEW data lacks critical information on the true drivers of firm success: revenue, debt service costs, rent costs, input

costs, etc. These variables would greatly increase the fit of the regression, as failing firms that are losing revenue or have spiraling debt costs would be more likely to close. In the regression, all firms are treated equally without this data. The regression does however control for firm size and location with respect to numerous factors. These location factors appear to influence the likelihood of firm closure. It is also possible that the increased rates of closure are pointing toward a higher rate of business turnover in gentrifying areas and places close to the Purple Line. Stated otherwise, businesses are churning, or naturally opening and closing faster in these areas. However, this may not be indicative of displacement, but rather stronger competition to survive on valuable land near transit or in gentrifying neighborhoods.

If it is because of construction related displacement, firms closer to the Purple Line are more likely to close for two possible reasons. The first and perhaps most likely is because of construction disruption. Firms very close to the Purple Line – within 1/10th of a mile – were more likely to experience disruption from utility work, closed roads, noise, and more, after construction groundbreaking in 2017. Customers accordingly may have found storefronts more challenging to access, reducing firm revenue. Second, these firms may be subject to increasing commercial rents in advance of the Purple Line. While data confirm that the Washington region is experiencing significant increases in housing costs, information on commercial rents was not available for this analysis. However, recent work has found that both multifamily rents and single-family home prices have been increasing in advance of the Purple Line's opening, due to anticipation effects.

In both regressions, the coefficient and sign on the gentrified census tract variable are positive, and significant. This indicates that firms located in gentrifying tracts were more likely to close than firms in other areas. There are two possible reasons for this, both of which tie back to theory on gentrification. First, when a neighborhood gentrifies, new residents with higher incomes move to the neighborhood. These residents may have different preferences than incumbent residents and businesses may not cater to them. Second, gentrification as measured in this index also captures increases in housing costs, which serve as a proxy for land costs. A gentrifying neighborhood may be experiencing increases in commercial land costs in response or in tandem to the residential land cost increases.

These findings provide further empirical confirmation of several trends identified in other work. The results that show that business closures are more likely in gentrifying neighborhoods

confirm those of Glaeser et al. 2020, but with data from a different metropolitan area than those studied in that work. The results in this paper also tentatively back the series of papers that identified increased closures, industrial transition, and other secondary effects in New York City's gentrifying industrial areas of lower Manhattan and Brooklyn (Curran, 2007; Yoon and Currid-Halkett, 2015). This work builds on those papers by simultaneously testing the impact of new investment in transit alongside gentrification, much like the work of Ong et al. that looked at transit-oriented development (TOD) and business changes in Los Angeles (2014). This work also confirms a result from that paper that showed that firm exit rates were higher in TOD areas.

VII. Conclusion

Gentrification is occurring in Maryland's Purple Line Corridor in advance of the line's opening. Since the year 2000, some neighborhoods in the Corridor have attracted residents with higher incomes and higher levels of education and property prices and rents have risen accordingly. Other empirical work has identified that some of this property price appreciation is due to speculation and anticipation effects in advance of the Purple Line's opening date. Of further note to policymakers is that many neighborhoods along the Purple Line remain not gentrified, particularly in the eastern part of the Corridor in Prince George's county. Given the area's investment in transit, locational advantage in the region, proximity to other gentrified areas, and presence of large institutions, it is not unreasonable to assume that gentrification will continue to spread into Hyattsville, Riverdale, College Park, and New Carrollton in the 2020s. Empirical work on transit and gentrification has shown that once transit stations open, gentrification is likely to continue or even accelerate (Chava and Renne, 2021).

This neighborhood gentrification and economic growth has brought mixed results for the local business economy. On one hand, employment, wages, and the number of small firms have all increased since the year 2010 in gentrifying neighborhoods. These increases are occurring at higher rates than increases in neighboring areas that are already wealthy or not yet gentrified. On the other hand, it appears that this growth comes at a cost. Firms located in gentrifying neighborhoods are more likely to close than firms in other areas, even after accounting for numerous other locational factors. Further, relative proximity to the Purple Line – either its stations or the tracks themselves – is associated with increased likelihood of firm closure. Further

research should confirm this story by analyzing trends in commercial rents and reasons for firm closure, ideally with qualitative methods.

Overall, critical questions remain unanswered. The Purple Line Corridor is an exceptionally demographically diverse part of the Washington region, particularly with respect to immigrant populations and their second and third generation descendants. The QCEW dataset used for this analysis provides no indication of the race or ethnicity of the business owners, so the impact of increased closures in gentrified areas cannot be disaggregated by such factors. Further investigation of this area should test the hypothesis that small business owners who are members of racial or ethnic minority groups are more likely to face firm closure than white business owners. For many, small businesses provide a step up the economic ladder, particularly for immigrant workers who may not have the skills or education required to compete in the region's rigorously class-based information economy. Public investment in transit should boost such economic opportunities for small business owners, many of whom are immigrants, and their employees in their own neighborhoods, and not take those opportunities away or displace them elsewhere.

Conclusion

The three essays that comprise this dissertation advance academic understanding of gentrification and its consequences, provide insight into policymaking, and pose further questions for a future research agenda. In this concluding section I review each of these items in turn, beginning with a summary of findings that relates the work herein to the gentrification literature.

Advancement of academic understanding of gentrification and contribution to the literature

A series of recent papers have made clear that the gentrification literature is beset by measurement issues that cloud interpretation of the relationship between gentrification and a variety of social outcomes. These measurement issues are a root cause of an ongoing divide between the qualitative and quantitative empirical work that attempts to understand how gentrification causes displacement and what the consequences of displacement are (Brown-Saracino, 2017). These large-scale measurement issues, which are beyond the scope of qualitative research, make understanding the likelihood of gentrification induced displacement and its effects on those who are displaced a very challenging endeavor (Easton et al. 2020). Further, as the literature on the effects of gentrification has ballooned, the number of methodologies used to understand it has expanded as well. Unfortunately for scholars and policymakers, these differing methods will result in different conclusions about where gentrification happens, what its effects are, and therefore how best to mitigate its negative consequences (Preis et al. 2020). In the three essays of this dissertation, I address these measurement issues and provide clarity for future researchers on key questions through literature review, case study, critique, mapping, and quantitative empirical methods.

In the first essay of the dissertation I inventory the dozens of methods scholars have used to define, delimit, and track gentrification in quantitative research since the 1970s. While this paper does not arrive at the impossible – a universally agreed upon empirical definition of gentrification – it does make numerous critiques that should improve consistency in empirical worth. I find that empirical methodologies in gentrification identification are lacking in cohesion and specificity. Much of our knowledge of gentrification is based on case studies of a few large cities or parts thereof. Too frequently, critical choices like variables, time periods, geography,

and more are divorced from the theoretical foundations of gentrification in favor of convenience. In response, I call for scholars to follow innovations in mixed methods approaches made decades ago, to use variables that track both the supply and demand side of gentrification, and to match choices of time and geography to local conditions.

In the second essay, I critique the smart growth movement, questioning how the movement's calls for a more efficient and sustainable form of metropolitan growth ignored potential for gentrification and displacement. The principles of smart growth inarguably directly call for gentrification. Many principles of the movement have been found, empirically, to be associated with higher housing costs when enacted through planning policies, especially in central cities. With an empirical data exercise, I find that the form of gentrification has shifted broadly from the 1980-2000 period compared to the 2000-2018 period. Following stage models of gentrification, it seems that gentrified neighborhoods in the second time period have been attracting more housing development and population growth. I conclude that gentrification has been more visible and more impactful in such neighborhoods in recent years, as smart growth policies have continued to call for more growth in such areas. A case study exercise in Washington, DC confirms this hypothesis, as the form of gentrification has shifted there to include significantly more housing construction concurrent with gentrification. Planners and policymakers in many cities across the country today are dealing with this challenge directly as they attempt to balance equitable growth, preserve affordable housing, and reduce metropolitan greenhouse gas emissions through denser growth and more public transit. These decisions are all the more critical as gentrification continues to spread in central cities.

The third essay focuses on two counties in the Maryland suburbs of Washington, DC, where the state government is massively investing in public transit through ongoing construction of a new light rail line, known as the Purple Line, due to open in 2026. I find that gentrification has been occurring in several neighborhoods around this Purple Line Corridor, and that gentrification has dramatically changed these neighborhoods since the year 2000. Home prices have doubled, education levels have doubled, rents are up significantly, and incomes are growing in these neighborhoods. In nearby not gentrified areas, incomes are stagnant, and increases in the other listed factors are much slower. While this gentrification may be due to locational advantage and other factors commonly associated with the phenomenon, the investment in the Purple Line may nonetheless be a root cause. Beyond the story of demographics and land price effects,

gentrification is found to have an impact on local businesses. Regression results indicate that firms closer to the Purple Line, and firms in gentrifying neighborhoods, are more likely to close than firms elsewhere, even after controlling for numerous factors. Gentrification has shifted the socioeconomic character of these places and made it harder for firms to survive – even before the new transit line is operational.

Drawing connections between the three essays neatly illustrates a problem that all quantitative researchers face when studying gentrification. As the first essay concludes, there is no perfect instrument for measuring gentrification, and definitions should be dependent on spatial and temporal context. There is no one definition of gentrification, nor will there be, but this does not preclude greater consistency across scholarship in definition and measurement choices based on the conclusions of the first essay. With this in mind I slightly adjusted a similar definition of gentrification for the two quantitative essays to provide appropriate context for the geographic levels at hand. Beyond the identification of gentrified places, further compromises must be made in measurement. Without perfect data on policy impacts and home prices and demographics at a unit level scale, neighborhood averages must be used, as in essays two and three. Proxies must be chosen for identification of causes and consequences, such as looking at growth in the housing supply as a proxy for smart growth, or by looking at firm closure as a proxy for commercial displacement caused by gentrification. These compromises and proxy choices, however, do not invalidate results, and when taken in their context, do provide meaningful and interpretable results. The same is true for other papers that measure the consequences and causes of gentrification. Scholars should, however, take care to be consistent in their own measurement of gentrification, and justify their choices for measurement of gentrification itself, and the consequences thereof.

Policy relevance

This dissertation provides several conclusions that will be of use to policymakers responding to the consequences of gentrification in American cities. The first essay will inform practitioners who want to understand how they can identify and track gentrification. This essay explains how to choose variables to measure gentrification and also the scope of choices that must be made about geography, time, and data sources. Beyond that, the essay provides clarity that no single definition of gentrification is gospel, so policymakers would be well suited to

entertain multiple definitions of gentrification to triangulate its strongest effects. This choice is critical if policymakers hope to use maps of gentrified areas to target anti-displacement policies like rent control, increased protections for renters, targeted investments in affordable housing, and more.

Planning at the metropolitan scale is rare in the United States and all urban planners are at the whim of macroeconomic forces with regard to generational scale economic development and residential location choice trends. Despite this, many regional coalitions continue to advocate for the principles of smart growth – particularly for denser residential growth around transit and in the cores of central cities. The findings of the second essay should give pause to smart growth advocates who do not consider gentrification and displacement as a potential consequence of their efforts. Increased housing construction in gentrifying neighborhoods is a clear trend over the last 20 years across US metropolitan areas, and this continued agglomeration of wealth in formerly disadvantaged areas likely means that many people are – over the long term – being priced out of these neighborhoods. Smart growth advocates should take care to promote an equitable vision of their agenda, which protects those who do not have the economic means to control their housing location choice, especially in rapidly gentrifying areas. This equitable vision should include protections for existing tenants under redevelopment, provision of affordable housing through inclusionary zoning and other means, and protection for small businesses.

Planners and advocates for small business will find evidence of concern in the third essay. The evidence shows that gentrification and increased rates of closure of businesses are already happening in gentrifying neighborhoods, well in advance of the opening date of a new transit line. While these results are limited to an analysis of a unique case study area, the evidence presented is supported by other research. Efforts to protect businesses during construction of new transit are critical, but further efforts must be made to ensure small businesses can survive gentrification and the costs of construction simultaneously. Planners must be prepared to assist businesses and preserve affordable housing even before construction begins, meaning during the planning process. Inclusion of such efforts in plans is warranted, rather than cursory investigations of the status of the local economy and existing supply of affordable housing.

A further research agenda

It is my hope that with the evidence presented here, policymakers seeking to shape the trajectory of gentrifying neighborhoods can better protect their most vulnerable residents. To better inform those policy choices, however, further work that builds on this dissertation is needed. The first essay's review of the literature leaves open empirical work that could suggest a best method, or multiple equally justifiable methods, for identifying gentrifying places. Such methods could be tested against each other and scored for validity in predicting upcoming gentrification. Further, these strictly quantitative methods could be backed by qualitative data to truly evaluate how neighborhoods are changing on the ground, building on the mixed methods work of Hammel and Wyly (1996). Such effort could lead toward consistent measurement of gentrification, which would lead to more comparable measurement of impacts, which could in turn lead to better informed policymaking.

The second essay's evidence that smart growth and gentrification are linked could be empirically validated through regression analysis in a case study of a certain city or region. Are smart growth policies at the local scale truly driving displacement of long-term residents and construction of new housing? Or is it impossible to tease out these effects due to the vast set of forces that act upon property markets? Answering these questions at a national level would be challenging. However, work building upon that of Nelson et al. (2004, 2007) could introduce gentrification or its components as dependent variables in regressions that seek to measure the impact of smart growth on this form of neighborhood change, change that this dissertation illustrates has real consequences.

The third essay leaves open a set of interesting distributional and equity questions. Gentrification appears to lead to more business activity overall, in terms of the number of firms, the total wages paid out by the firms, and the number of people hired at these firms. However, to whom do the profits of these firms accrue? Are their employees paid more or less than before? Are the owners or employees local residents? Gentrification also appears to challenge the survival rate of firms inside gentrifying neighborhoods, though the reasons for that are not proven by the results. Is it due to increased commercial space costs, or increased competition from other new firms? Is it due to changing preferences of new customers? Last, and perhaps most notable in the current political environment, are minority business owners more likely to fail, or be displaced, in a gentrification process? Do these firms move elsewhere in the region?

With additional independent variables in an improved time-series model, additional regression analysis could tease out these effects. With this further evidence, it could potentially be established that minority owned businesses fare even worse in gentrifying neighborhoods, justifying public intervention to preserve these businesses.

Concluding remarks

Gentrification remains ascendant in America, even after 50 years of shaping both places and the experiences of people that call gentrifying places home. This dissertation has shown that without careful consideration of numerous factors, gentrification is easily misunderstood and improperly identified, mistakenly catalyzed by normative policymaking, and possibly observed and acted against far too late, despite effects that should be anticipated. With a better understanding of where gentrification is located and its potential negative effects on small businesses, policymakers can prepare to help those who may be affected. This dissertation has addressed these gaps in understanding through three essays that better inform methodology and policy.

Appendices

Table A1. NAICS Codes Categories

2 Digit NAICS	NAICS description	Dummy Category
11	Agriculture, Forestry, Fishing and Hunting	Blue Collar
22	Utilities	Blue Collar
23	Construction	Blue Collar
31,32,33	Manufacturing	Blue Collar
42	Wholesale Trade	Blue Collar
44,45	Retail Trade	Service
48,49	Transportation and Warehousing	Blue Collar
51	Information	White Collar
52	Finance and Insurance	White Collar
53	Real Estate and Rental and Leasing	White Collar
54	Professional, Scientific, and Technical Services	White Collar
55	Management of Companies and Enterprises	White Collar
56	Administrative and Support and Waste Management Services	White Collar
61	Educational Services	Service
62	Health Care and Social Assistance	Service
71	Arts, Entertainment, and Recreation	Service
72	Accommodation and Food Services	Service
81	Other Services (except Public Administration)	Service

Table A2. Station Area Typology

Category	Description	Stations
CBD /Urban	These stations are located in areas with dense employment, high-rise buildings, and an urban street grid.	Bethesda, Silver Spring Metro, Silver Spring Library
Suburban / Institutional	These stations are located in areas with almost wholly residential zoning or are entirely on the UMD College Park campus.	Dale Drive, Manchester Place, Campus Drive, 16th St.
Subcenter / Town Center	These stations are located in areas with a mix of residential and commercial uses at a smaller built scale than the first category. Street grids are partially urban and friendlier to pedestrians.	Lyttonsville, Connecticut Avenue, Long Branch, Baltimore Avenue
Auto Oriented	These stations are in areas with sprawling, auto-oriented land uses primarily on major roads.	Piney Branch, Takoma Langley, Riggs Road, Adelphi Road, Riverdale Park, Beacon Heights, Glenridge, New Carrollton

Figure A1. Purple Line Map. Credit to Maryland DOT / Maryland Transit Administration.

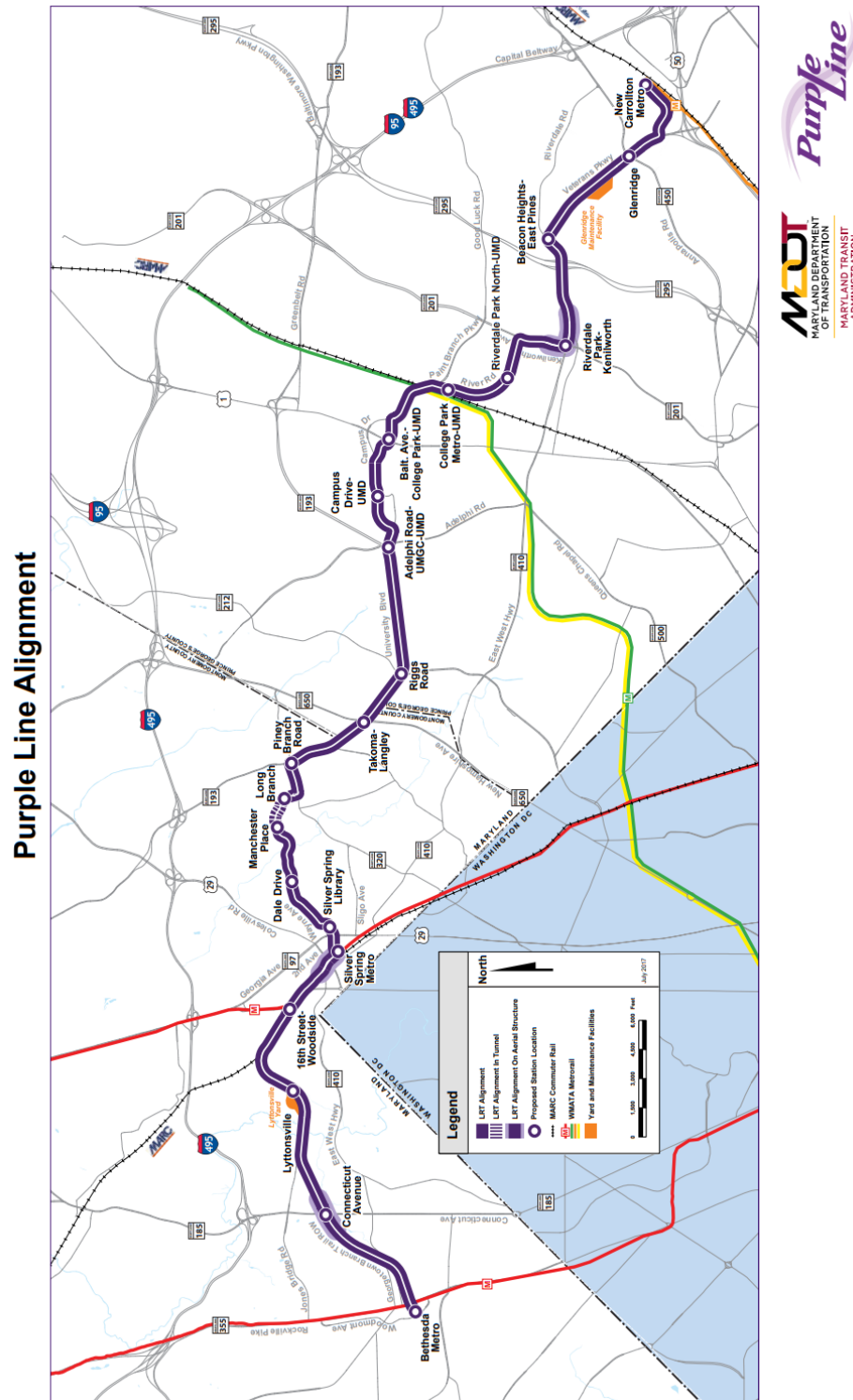
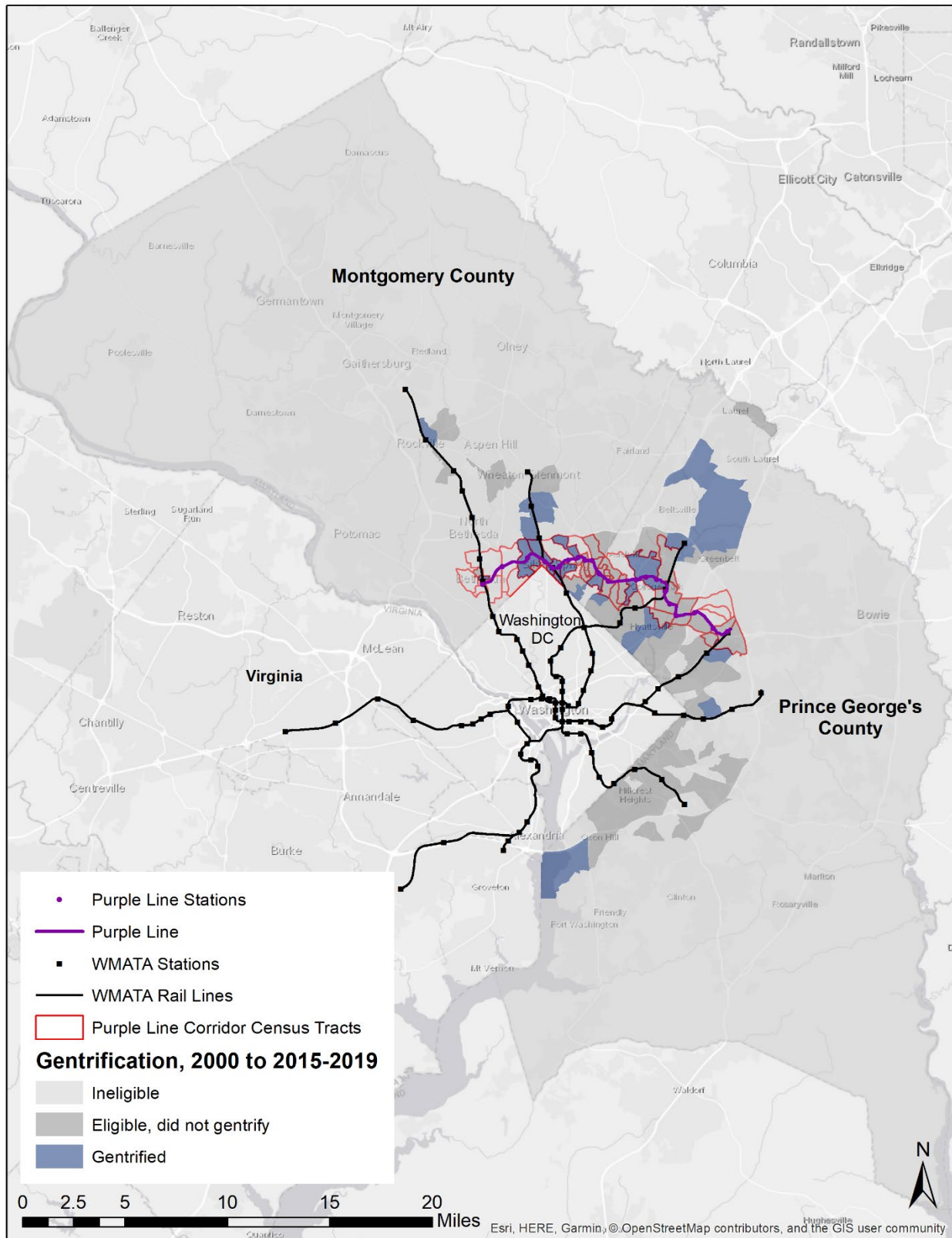


Figure A2. Gentrification map of the two county study area.





UNIVERSITY OF
MARYLAND

College Park, Maryland 20742
P: 301.405.8000 F: 301.314.9583
<http://www.arch.umd.edu>

SCHOOL OF ARCHITECTURE, PLANNING, AND PRESERVATION
NATIONAL CENTER FOR SMART GROWTH RESEARCH AND EDUCATION

April 7th, 2022

2123 Lee Building
7809 Regents Drive
College Park MD, 20742

Dear Dean Fetter,

I am writing to certify that the examining committee has determined that Nicholas (Nick) Finio made substantial contribution to a work previously published and included in his dissertation as one essay in a three-essay format dissertation. As Nick's dissertation advisor, I can vouch that he was the primary author of the piece. The work in question is Nick's second dissertation essay, which is titled "Smart Growth and Gentrification: Unpacking the Relationship." Nick lists Eli Knaap, PhD, as the co-author of the piece.

This piece is a significantly changed and re-titled version of a book chapter for a new publication that I served as an editor for, *The Handbook on Smart Growth*, published by Elgar. The chapter for the book was called "Smart Growth Without Gentrification?" and Nick and Eli co-authored this book chapter. Nick was the author of the majority of the writing and analysis in the book chapter, and the majority of the writing and analysis in the revised version for the dissertation. The dissertation essay includes several new analysis sections which were not in the book chapter, which Nick completed on his own. Eli's contribution to the original work was specifically about data collection for a national-level census dataset, with input from Nick on which variables to collect and how to construct an index from that data.

The inclusion of this work in this dissertation has been approved by myself as Nick's dissertation advisor by Professor Hiroyuki Iseki, the PhD Program Director for the Urban and Regional Planning and Design program.

Sincerely,

Gerrit-Jan Knaap
Professor and Director

Hiroyuki Iseki
Associate Professor and Director, URPD Program

National Center for Smart Growth
And School of Architecture, Planning, and Preservation
1112M Preinkert Field House
College Park, MD 20742

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ⁱ Tenure could be considered both a supply or demand indicator, but here is classified as a supply indicator as it illustrates the potential for conversion from renter occupancy to owner occupancy.

ⁱⁱ 2015-2019 data is from the Census American Communities Survey, which provides demographic and socioeconomic data for census tracts over pooled 5-year average periods. Further details on measurement choices are available in the technical appendix, which also offers and details additional results not presented in the following section. The technical appendix also further details the gentrification index and includes summary tables on index results, and small business data.