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Master’s Thesis Doc

Random thoughts

“City streets, gardens, golf courses, kitchen sinks, and garages are all teeming with life, connected and regulated through systems of power and fixed through investments of capital… political ecology might integrate critical theories of urban growth, decay, investment, and control with ecosystem analysis of daily life. (Robbins, 2004, p. 216)”

construct a sustainable city that is economically diverse and socially just seem to be taking hold.

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Define

Neighborhood change is a spatio-temporal process associated with the movement of people and capital. Gentrification can then be considered a subset of neighborhood change, manifested through a sustained period of disinvestment, followed by an influx of investment, simultaneously accompanied by changes in community demographics that are reflected in differences in household income, educational attainment and family structure. This narrow definition of gentrification avoids speculation about either the positive or negative effects of gentrification on the incumbent neighborhood, city or specific individuals (ecological fallacy).

## Early Gentrification Theory

British sociologist, Ruth Glass, first coined the term gentrification in the late 1960’s, describing the process she observed in London, by which poor ghettos were displaced by increasingly affluent neighborhoods. Her interdisciplinary work, *London: Aspects of Change* (1964), brought together fields of sociology, geography, history, medicine, and urban planning. The phenomena she described would later be dissected by American scholars in the decades following, attempting to describe the theory, causes, history, responses, and case studies of the many manifestations of gentrification. The contemporary view of housing economics at the time rested on a filtering and succession model in which new, spacious suburban housing is filled by well off families looking to upgrade while their previous smaller home is filled in by poorer occupants (McKenzie 1924). Gentrification exists within this model only as an exception to the rule and necessitates a more complex explanation than the filtering model could afford.

The gentrification epidemic has not hindered by a lack of scholarship interest. Figure x shows publication trends of gentrification-related studies in the peer-reviewed literature (Web of Science, 2018). These studies cut across academic disciplines that include urban studies, geography, environmental studies, sociology, economics, history, and political science. General disagreement in nearly every aspect of gentrification. This research circumnavigates around many of these disagreements and focuses on identifying and predicting gentrification through quantitative analysis.

Early studies of gentrification were largely preoccupied with appointing the central causes behind gentrification that had, at the time, been limited to cities such as London, New York, and San Francisco. Two competing theoretical movements would wage a high stakes battle on the topic. David Hamnet (1991) emphasizes the theoretical discord writing “*...Gentrification is a frontier not just physically, economically, socially and culturally, but also theoretically, ideologically, and politically. It comprises a contested boundary zone between radically different theories and explanations. And it is arguably this aspect of gentrification, above all others, which has kept the gentrification debate at the forefront of urban geographical literature for over a decade*.” The boundary zone he described is differentiated by “*proponents of the imperatives of capital and profitability*” on one side and “*the proponents of culture, preference, and human agency*” on the alternate side. The theoretical divide can be condensed into a variety of contrapositions that include structural Marxism versus liberal humanism, supply-side versus consumption-side economics, or by the flow of capital versus the flow of people.

The first movement advancing its theory of gentrification contended that its fundamental basis centers on the macro-economic patterns of investment and disinvestment in the built environment. This theory is put forth by Neil Smith as early as 1979. It describes the inertia of the macro-economy that precipitate conditions necessary for gentrification to occur. Smith established the rent-gap theory that economically explains investment decisions that are triggered by a disparity between the current rental value of a property and its potential rental value (Smith, 1979). Smith explains that as a neighborhood declines, the rent gap widens until it reaches a point at which “*developers can purchase shells cheaply, can pay the builders’ costs and profit for rehabilitation, can pay interest on mortgage and construction loans, and can sell the end product for a sale price that leaves a satisfactory return to the developer.*” (Smith 1979). Smith argued that gentrification and redevelopment patterns are part a larger, systemic feature of the capitalist economy. He emphasized that uneven development and investment patterns are inherent to capitalist economies as actors continually seek to maximize profits wherever possible. Investment in one geographical area (suburbs) creates barriers to further development in that same area. Investment in one area likewise leads to underdevelopment of other areas (inner cities). Gentrification could then be seen as part of an inevitable process in which suburban housing markets saturate, profit margins there shrink and underdeveloped areas in inner-cities become attractive investment opportunities. In the macro-economic lens of Neil Smith, gentrification could be viewed as an inevitable consequence of the repositioning of capital. Smith would prescribe consumer preferences as an important, but secondary cause of gentrification, declaring *“The so-called urban renaissance has been stimulated more by economic than cultural forces. In the decision to rehabilitate inner city structure, one consumer preference tends to stand out above the others - the preference for profit, or, more accurately a sound financial investment.*” (Smith 1979).

The alternate theory, emphasized consumer preferences, human agency, and consumption side demand as the necessary forces for gentrification. David Ley (1980) argues that the flow of people, as opposed to the flow of capital, is the largest factor behind the origins and causes of gentrification. In his paper, “*Liberal Ideology and the Post-Industrial City* “, Ley discusses the critical elements that characterize a shift from industrial cities to post-industrial cities. Among these are the labor force transition from blue collar jobs to white collar jobs, manufacturing to service-based urban economies, and rapid technological advancements. Ley’s post-industrial thesis highlights the role individual actors’ lifestyle preferences, values, and aesthetics. In this model, it is the combination of labor market transitions and changing values that produce a sufficient pool of potential gentrifiers. Consumption-side efforts to explain gentrification therefore begin with the individual actor’s demand for inner-city amenities. Ley prioritizes this population’s ability to “restructure the built environment and accelerate gentrification” (Ley 1986).

Both consumption and demand-side explanations offer much to a comprehensive understanding of the causes of gentrification. Critical to each theory is the starting point to explain conditions necessary for gentrification. Each theory offers a necessary, but incomplete explanation to gentrification. Smith’s rent-gap explanation is most useful when framed not as a deterministic trigger for gentrification, but rather as a catalyst that can provide valuable insight into which areas are primed for potential gentrification. Without the production of potential gentrifiers, acting on their preference for inner-city living, gentrification does not exist, irrespective of the rent gap. The dueling explanations for gentrification pioneered by Smith and Ley have been refined by other researchers into a complimentary and comprehensive explanation for the causes of gentrification.

Another early debate focused on the future magnitude and effects of gentrification, of which there were primarily two camps. The first group subscribed to gentrification as a “localized small scale process, while maybe symbolically important, purely temporary and of little long-term significance”. Berry (1985) dismissively compares gentrification to “Islands of renewal in seas of decay”. Others[[1]](#footnote-1) backed the idea that the process was not only part of larger, albeit infant “back-to-the-city” movement, but also had the potential to “reverse the historic decline of the central and inner city, and should be actively supported by federal urban policies.[[2]](#footnote-2) Smith, true to his Marxist principles, stated “*Gentrification is part of a larger redevelopment process dedicated to the revitalization of the profit rate*.” (Smith 1982). The fact that gentrification has remained a central topic across multiple disciplines for nearly 40 years lends credence to Smith’s supply side argument towards understanding gentrification. Several waves of homebuyers, social structures, preferences, and politics have evolved in the decades following Smith’s writing. What has remained constant are developer’s commitments to maximizing profits and the persistent concern over gentrification on a much larger scale today than many of the early theorists may have anticipated.

New waves of homebuyers with shifting preferences continually enter and transform the market. Most recently, these potential homebuyers have emphasized accessibility, public amenities, public transit, and cultural diversity (source on preferences). These actor’s pursue their housing preference and capitalize on Smith’s rent gap theory, to move into urban neighborhoods. On paper, this heightened developer and consumer interest could simply trigger long overdue private and public capital investments that could serve to revitalize a neighborhood. In fact, this description could suggest positive terms such as “revitalization”, “rehabilitation”, or “renewal”. Several studies point to the positive effects of gentrification on the incumbent residents. A study by the Philadelphia Federal Reserve Bank identified increases in credit scores among low-income residents in gentrifying neighborhoods (Ding and Hwang 2016). The same study concluded that low-income residents were no more likely to move from their homes in a gentrifying neighborhood than a non-gentrifying one. Lance Freeman’s 2005 study concluded the potential for household to be displaced in a gentrifying neighborhood to be only 1.3% on a national scale (Freeman 2005).[[3]](#footnote-3) Then there are the benefits to the built environment, including better amenities, local services, and increased tax revenue for homeowners. However, Clay (1979) points to two different outcomes of revitalization: incumbent upgrading and gentrification. Typically, the arguments for gentrification are that it stimulates urban development. As Andres Duany argued in “Three Cheers for Gentrification,” gentrification is “the rising tide that lifts all boats” as it “rebalances a concentration of poverty by providing the tax base, rub-off work ethic, and political effectiveness of a middle class, and in the process improves the quality of life for all of a community’s residents” (Duany, 2001, p. 36)

In practice and the majority of literature, however, these unabated profit-seeking investment patterns play out with unaffordable rents for adjacent neighbors, below-market offers for property owners of color, social and financial pressures, as well as health effects (CDC) (Brookings). These issues ultimately lead to one of several modes of displacement, defined by Marcuse (1986) as either physical, economic, chained, or exclusionary displacement. Displacement or the threat of displacement is the central concern of gentrification, without which the influx of capital would be considered “revitalization”. George and Eunice Grier (1978) present an early definition of displacement: *“Displacement occurs when any household is forced to move from its residence by conditions that affect the dwelling or its immediate surroundings, and that: 1) are beyond the household’s reasonable ability to control or prevent; 2) occur despite the household’s having met all previously imposed conditions of occupancy; and 3) make continued occupancy by that household impossible, hazardous, or unaffordable.”*

Measuring displacement, however, presents analytical challenges that aggregated data like the US Census are ill-suited for considering the longitudinal data needed to track displacees. Distinguishing gentrification-induced displacement apart from voluntary migration and incumbent upgrading make measures of displacement increasingly more difficult (Atkinson 2000). As a result, a majority of studies attempting to quantify the magnitude of displacement employ a narrow definition covering only evictions or unaffordable price increases. The inability to consistently and effectively measure displacement has stalled local and federal government efforts to curb gentrification in the United States.

The problem is further confounded by disagreements in the operational definition of gentrification and displacement. Depending on the motive of the study, narrow or wide definitions could be applied to overestimate or underestimate the impacts of gentrification. Additionally, researchers have disagreed as to the scope of studies with larger scopes downplaying city-specific crises. The lack of appropriate comparison groups has also plagued researchers ability to quantify displacement. Time scales used in analyses can also bias the impacts of gentrification; limiting the temporal scope of analysis could discount early gentrified areas. Additionally, researchers work with a limited set of variables that they deem important and are required to simplify a complex process into a measurement of change over a handful of variables.

Perhaps the most problematic aspect in identifying and predicting gentrification is its unique character that is specific to each city. The combination of homebuyer preferences, developer motives, and government interventions make it difficult for a one-size-fits-all approach to the problem, let alone a solution. The majority of gentrification research has centered on private actors and capital, however, there are a variety of pathways that government investments can signal neighborhood upgrading. Without careful planning and considering the delicate balance of negative externalities, government planned projects may have the unintended consequence of spawning new pockets of gentrification. Below we outline several different market disruptions that may trigger or advance the gentrification process

Recent research has studied the impacts of public transportation investments designed to improve accessibility for low-income residents and their possible unintended consequences in raising housing prices. This renewed investment has the potential to attract wealthier residents, leading to potential displacement of the most transit-dependent riders away from transit infrastructure towards the suburbs where transit options are sparser. Much of the academic research in this area has focused on the appreciable housing price impact of transit oriented developments (TODs). This research generally takes the form of either hedonic price models[[4]](#footnote-4) or pre/post studies with outcomes differing widely across studies; On the high end of the spectrum, housing near transit premiums were found as high as 45% in Santa Clara County, California (Cevero and Duncan 2004), 24% in a national study spanning 12 metros (Pollack, Bluestone, Billingham 2010) and 17% in Chicago (McDonald and Osuji 1995). Several more studies found appreciation rates between 5 and 15% including Boston (6.7%) (Armstrong 1995), San Francisco (10-15%) (Cervero 1996), San Diego (17% for condominiums, 6% for single family homes) (Duncan 2008), London (9.3 %) (Gibbons and Manchin 2005), and Portland (10%) (Knapp et al. 2001). On the contrary, other studies found little effect or a negative effect between proximity to rail transit and property values in Atlanta, Buffalo, and Southern New Jersey (Chatman et al. 2012; Bowes and Ihlanfeldt 2001; Hess and Almeida 2007). The disagreement between literature could either be reflective of methodological differences between studies or larger city-specific differences in housing tenure, extent and quality of transit systems, housing market conditions, and surrounding developments (Wardrip 2001). Furthermore, these studies account only for housing values and do not differentiate between gentrification and incumbent upgrading. Future work in this area will likely focus on connecting the impacts of TOD home values to the potential for displacement. In brief, TODs may be a double edged sword, having the capacity to increase accessibility for low-income neighborhoods without vehicle access, while at the same time carrying the danger of pricing these communities out of local housing markets. This is not to say public transportation efforts should be avoided, but rather to point out the tight line that local governments are forced to walk and their obligation to thoughtfully consider all potential externalities, even in seemingly beneficial or benign policies that are explicitly designed vulnerable households.

Gentrification has the potential to manifest itself through other seemingly benign environmental missions including the remediation of contaminated sites and large green infrastructure projects (LGIPs). The growing concern of environmental gentrification revisits common themes of increased property values resulting from an influx of investments. Hazardous waste sites represent negative community amenities and a danger to public welfare. To protect against these harms, the Environmental Protection Agency (EPA) places the most dangerous sites on the National Priorities List (NPL) for extensive remediation (deemed Superfund sites). Many who live near these contaminated sites lack the residential mobility to move to safer locations prior to cleanups. More than 15 million people, or 5 percent of the US population lives within 1 mile of an EPA-designated Superfund site. This population is 49.3 percent minority compared to the national percentage of 38.4 percent. They are also above national averages in percentage below the poverty level (16.7%), linguistically isolated (8.4%), and have less than a high school education (16.3%) (U.S. EPA, Office of Land and Emergency Management Estimate. 2017.) Gamper-Rabindran and Timmins (2011) found EPA remediation of hazardous sites on the National Priorities List led to a 26 percent increase in mean household income and a 31 percent increase in college graduates. In addition to brownfield and Superfund redevelopments, other green initiatives (often popular and supported by local governments) have incredible potential to anchor additional private investments driving housing costs to unsustainable levels for incumbent residents. The high-profile redevelopment of the Highline in New York City from a defunct railroad line to an elevated greenway prompted a 103% increase in median square foot property values for adjacent housing between 2003 and 2011 (Huynh et al 2011). It is all too enticing for developers and cities to capitalize on an underutilized or newly remediated land by building up transformational greenspaces that attract wealthier clientele. For the city the new green space is justified by environmental benefits that include improved air quality, noise abatement, and quality of life with the added benefit of additional tax revenue and positive optics. Looking deeper however, these large transformations are a luxury that many neighborhood residents cannot afford in order to stay in their homes. Contrasting with the Highline, a community in Greenpoint, Brooklyn

Climate Gentrification has emerged as yet another possible frontier of gentrification in environmentally high-risk cities. A Harvard study identified a positive relationship between single-family home appreciation values and their elevation. Researchers hypothesized that the increase in housing appreciation for higher elevation homes is due to consumer preference and awareness of increased flooding risks. Climate disruptions in the real estate market may not be limited to low-lying coastal cities, but part of a larger trend as consumers preferentially shift from high-risk geographies to lower-risk geographies (Keenan 2018). Climate gentrification has the potential to affect cities at risk to wildfire, coastal cities, and cities with limited access to potable water.

## History

The inception of the gentrification narrative is marked by the exodus of affluent, white households from urban areas to the suburbs following World War II. Prior to 1945, only 13% of Americans lived outside of major urban areas (Nicolaides and Wiese, 2017). While no one factor can single-handedly explain “white flight”, a conglomeration of preferences, policies, and market conditions contributed to the mobilization away from the city center including systemic racism, redlining, municipal disinvestment, and the construction of the federal highway system, among other factors. Suburbanization and increased segregation continued throughout the civil rights movement. By 1967, riots and civil unrest led to the Lyndon B. Johnson administration commissioning a report to undertake the cause of widespread racial disorder. The most prominent and polarizing statement of the report concluded “Our nation is moving toward two societies, one black, one white- separate and unequal.” Economic transformations and the passing of the Fair Housing Act of the 1968 symbolize a shift from an era of extensive, racialized suburbanization towards a period of relative diversification and increasingly complex metropolitan structures.

After 1970, the suburbanization movement was further bolstered by anti-discriminatory job and housing policies that effectively provided opportunity for a much more socioeconomically diverse suburban homeowner. This period is marked by continued suburban sprawl and disinvestment into the urban core, except as a whole, was now operating irrespective of racial composition, family structure, and economic standing. Between 1970 and 2010, black suburbanites rose from 3.5 to 15 million, representing 39 percent of all African Americans. This period also shows radical shifts in household structure away from idealized representations of the suburban family headed by a married couple with children, as households *not* containing a married couple with kids represented 75% of suburban homes (Nicolaides and Wiese, 2017). Home ownership trends between 1990 and 2016 show an increasingly diverse US homeowner. Over this time period, Asian and Hispanic home ownership each grew by over 200 percent, respectively, while black ownership increased a more modest 39 percent (Harvard 2018).

The current state of US housing faces concerns of a large unaffordability crisis and persistent threads of unequal growth. Since 2000, several factors have made homeownership increasingly expensive and difficult to attain including skilled labor shortages, increased building material costs, limited vacant land, and restrictive zoning[[5]](#footnote-5). More recently, however, low interest rates have largely offset the barriers to entry, at least for certain demographics. 2017 saw 1.1 million new homeowners, marking the first increase in home ownership rates in 13 years. A closer look at historical trends in home ownership rates shows a widening gap between white and black home ownership. As of 2017, the white homeownership rate was 72.3 percent, while black rates were only 43.1 percent. Over the previous 30 years, Asian, Hispanic, and White homeownership rates grew by 7.1, 5.7, and 3.6 percentage points, respectively, while black ownership rates decreased by 2.7 percentage points (Harvard 2018). The financial importance of homeownership cannot be understated; the median net worth of homeowners ($231,400) is 46 times that of renter households ($5,000) (Harvard 2018). In addition to owner-renter household wealth polarization, racial divides are sizeable with the median white household wealth ($162,800) ten times higher than black households ($16,300) and eight times higher than Hispanic households ($21,400) (Harvard, 2018).

Rental housing comprises 36.1 percent of all US households, with considerably higher proportions in urban areas. The availability of low-cost rental units has shrunk substantially, underpinning the affordability crisis that is especially burdened by renters. This pressure has been mounting from both production sides as developers fail to construct affordable units along with substantial losses of existing units. 60 percent of low-cost rental housing available in 1985 was lost by 2013 due to demolitions, conversions, or upgrading (Hudson Institute, from Harvard). At present, only 35 affordable units are available to every 100 extremely low-income renters. A National Low Income Housing Coalition (date) study suggests a nation-wide deficit of over 7 million affordable units. 24 percent of renters faced cost-burdens in 1960 compared to 47 percent by 2016 (Harvard). Correspondingly, inflation-adjusted rent prices rose 61 percent while median renter income’s increased only a modest 5 percent. Affordability barriers affect more than the renters. More than 38 million homes spend more than 30 percent of their gross incomes on housing. These cost-burdens are shared disproportionately by minority households; 45 percent of black households are cost-burdened compared to 27 percent of white households (Harvard, 2018).

## Government Role

### Federal

Many federal and city-specific policies are aimed to counteract the negative externalities associated with gentrification. The Federal Department of Housing and Urban Development (HUD) aims to provide financial relief to low-income residents by means of rental assistance programs (Low Income Housing Tax Credit, and housing vouchers), home ownership incentives, and land use initiatives (inclusionary zoning regulations, and smart growth initiatives). The Federal government’s strategy towards affordable housing has undergone a fundamental shift since its inception in the 1930’s from government subsidized apartment buildings or housing projects towards housing vouchers and tax incentives that encourage private construction and maintenance of affordable housing. Publicly maintained housing occupants currently number less than one million- its lowest population since 1972 (Harvard). Public housing has been viewed by many as a failure, serving to concentrate poverty, reduce opportunity and affiliated with drug use, violence, and underperforming education.

Currently, the majority of federal housing assistance policies take the form of housing vouchers that provide rental subsidies to nearly 2.2 million households. Recipients of the housing voucher program may find housing in the private market and contribute 30 percent of their adjusted income towards rent, with the federal government funding the difference. Housing vouchers conceptually provide much needed residential mobility for low-income households, allowing them to find private housing options in locations with greater opportunity and help to decentralize high-poverty areas. Longitudinal studies using control groups, demonstrate that the program has achieved some measureable success in improving neighborhood quality based on poverty percentages. However, this benefit is almost entirely gained by individuals in public housing or the highest poverty locations (Gubits et al 2009). This program also carries long wait times compared to the relatively short (60 -120 days) period in which voucher holders are responsible to find eligible housing. This problem is compounded by discriminatory practices by landlords in their refusal to accept Section 8 housing vouchers.

Federal housing policies have largely been unable to keep pace with the need for affordable housing. The number of households receiving federal housing assistance has remained relatively consistent since 2005 despite a 24 percent growth in low-income households (Kingsley 2017). Only one in four very low-income renters benefitted from government subsidies aimed at reducing the proportion of householder income dedicated to housing.

The Trump administration and Director Ben Carson’s stated goal for the program is “focused on moving more people toward self-sufficiency through reforming rental assistance programs and moving aging public housing to more sustainable platforms.” (Ben Carson’s Twitter). This goal is reflected in the 2019 proposed budget proposal seeks $39.2 billion in discretionary HUD funding, an 18.3% percent cut from 2017. The 2019 budget also proposes 11.2% decrease across federal rental assistance programs. HUD calls for a complete reform and defunding of the Public Housing Capital Fund (PHCA) program, tasked with funding developments, repairs, and modernizations of public housing authorities despite the current projected backlog of $40 billion (roughly the equivalent of the entire HUD fiscal yearly budget. The suggested reform will shift the financial burden to states, local governments, and low-income renters. The budget emphasizes state, local, and private investment as avenues for more efficient, affordable housing, but strips many of the most flexible housing and community development programs that local governments implement. These programs include

Challenges:

Despite their growing numbers, only about one in four very lowincome renters benefited from subsidies to close the gap between market rents and what they could afford to pay. Homeownership rates among young adults today are even lower than in 1988, and the share of cost-burdened renters is significantly higher. Soaring housing costs are largely to blame, with the national median rent rising 20 percent faster than overall inflation in 1990– 2016 and the median home price 41 percent faster. Along with soaring housing costs, weak income growth among low- and moderate-income households has also contributed to affordability pressures. The real median income of households in the bottom quartile increased only 3 percent between 1988 and 2016, while the median income among young adults in the key 25–34 year-old age group was up just 5 percent. Meanwhile, gross domestic product per capita, a measure of total economic gains, increased some 52 percent in 1988–2017. If incomes had kept pace more broadly with the economy’s growth over the past 30 years, they would have easily matched the rise in housing costs—underscoring how income inequality has helped to fuel today’s housing affordability challenges.

But even if successful, these efforts will not produce decent, affordable homes for the millions of households that simply cannot pay enough to cover the costs of producing that housing. For these families and individuals, there will always be a need for public subsidies. The federal government’s failure to respond adequately to this large and growing challenge puts millions of households at risk of housing instability and the threats it poses to basic health and safety. Many state and local governments are doing their part to expand assistance, but a more robust federal response is essential to any meaningful progress in combatting the nation’s housing affordability crisis.

### Local

Federal programs alone are largely inadequate to cities and suffer from uncertain funding[[6]](#footnote-6) as well as well as a backlog of application

Policy recommendations to combat displacement were put forth in a highly publicized work “Displacement: How to Fight It” (Hartman et al 1982). Anti-displacement policies focus on both housing and social protections to limit displacement and use both preventative and reactionary strategies to stabilize neighborhoods. Preventative housing measures aim to ensure the supply of affordable housing through rent control ordinances, housing trusts, and inclusionary zoning, while social protections include just cause eviction and landlord harassment policies. Reactionary protections may include a combination of vacancy controls, one-for-one housing replacement, relocation benefits, and the tenants right of first refusal (Zuk ppt)

For their part, many state and local governments are finding new ways to leverage and supplement federal funds to spur development of below-market-rate housing. These strategies include raising new revenues through bond issuances, real estate transfer taxes, and linkage fees, as well as using their regulatory powers to either incentivize or mandate inclusion of affordable units in new market-rate developments. However, state and local initiatives are generally modest in scale.

## Identifying Gentrification

Federal funding uncertainties have pushed cities and local governments to do more with less. With limited resources available, cities have employed different methodological approaches for identifying disinvested areas of a city that may be susceptible to gentrification and displacement (Chapple 2009; Bates 2013; Williams, Galster, and Verma 2013; Snow, Pettit, and Turner 2003). These analyses, termed early warning systems, use data-driven approaches to spur informed government interventions, prevent displacement, and promote inclusive revitalization (Chapple and Zuk 2016; K. Pettit 2016).

Early warning systems have been in use for nearly 40 years, with the first generation typically attempting to identify predictive variables of susceptibility and aggregating them to obtain a susceptibility score or index to assign neighborhood typologies and identify areas that are at risk of gentrification and displacement (ie. +1 if tract is above a regional median value) (Chapple and Zuk 2016).[1](#bookmark1) City officials and stakeholders commend early warning system tools have helped address community concerns, bring perspective to ongoing projects, and promote dialogue with a wide variety of stakeholders. Specific successes are evident in the San Francisco Bay Area where city officials use a web-based, interactive tool to improve anti-displacement policies, with one councilmember stating “*[I use the site] to assist in writing public policy for the city. . . It is very valuable and useful.*” Similarly, the online tool is used by developers to report on the displacement potential of all new projects— a requirement of zoning controls in San Francisco (Chapple and Zuk 2016).

Use of Early warning systems and function of government in gentrification.

The latest generation of gentrification and displacement early warning systems benefit from open data initiatives[2](#bookmark0) along with the increased emphasis on “smart city” applications (Chapple and Zuk 2016). The availability of higher quality public data has primed the field of predictive gentrification, which has largely underutilized robust statistical and machine learning techniques to make reliable forecasts of neighborhood change. Chappelle (2016) discusses the reluctance of past researchers to systematically validate their predictive models while Greene and Petit (2016) call for “*more researchers working in different types of cities to learn more about precursors and signals of neighborhood revitalization or decline*.”

Moved from sporadic process in 70s to systematic and widespread increasing in both magnitude and complexity

As we have seen over the previous 40 years gentrification is neither temporary nor is it exclusive to the United States. The phenomena has manifested in cities around the world including London, Sydney, Berlin, and Singapore (Need citations). The re-urbanization of post-industrial cities across the United States can be seen a microcosm of a global trend, with 68% of world population expected to live in urban areas by 2050 (UN 2018). As unchecked developers compete for limited space near the urban center, gentrification can be expected to persist as a side effect of laisez-faire policy.

## Nashville

The 2016 Nashville metro area population totaled over 660,000, the 24th largest incorporated city inthe United States (United States Census Bureau / American FactFinder 2010). Despite a fast population

growth (100 new residents per day) and anecdotal accounts of gentrification (Haruch 2014; Larsson 2017), Nashville has been omitted from a robust analysis of neighborhood change. Nashville has quickly become a destination city for transplants and companies alike. Big-name companies including Amazon recently announced plans to build an operations center in Nashville. Financial companies are increasingly eyeing Nashville, citing the low cost of real estate, taxes, labor, and utilities. Nashville ranked second in a study of 40 US cities financial industry (Boyd from article).

While stable in most of the 75 metro areas surveyed by the Census Bureau, renter shares in several of the more affordable markets of the South fell in 2016–2017, including the Columbia (SC), Nashville,

This research project focusing on Nashville, Tennessee will: 1) Use local and national datasets to characterize the current socio-economic landscape of Nashville; 2) Use a variety of modeling techniques to distinguish and predict the most at-risk areas for ongoing and future gentrification; and 3) Present an interactive resource to display these findings to policy-makers and community stakeholders. The analysis will emphasize reproducibility with scripted workflows to allow performance tracking and updates well into the future.

## Methods-

Data and Analytic Strategy

The data for this study come from the Neighborhood Change Database (NCDB), provided by GeoLytics, Inc. The NCDB normalizes U.S. census data from the 1970, 1980,1990, and 2000 censuses to the same spatial extent as tracts used in the 2000 census. Data from all four census years for many variables can thus be compared, since the effective geographic boundaries for census tracts remain constant (to the extent possible) throughout the time span. Except for average house value, which remains denominated in dollars, absolute frequencies in the census data are converted into proportions.^^

### Scope

This report focuses on Davidson County, Tennessee. The urban center of Nashville is located approximately in the center of the county. Census Tracts were used as the primary unit of analysis for reporting. 161 census tracts comprise the study area of Davidson County, Tennessee (figure 1). Census tracts are nested within county boundaries with populations of approximately 4,000 residents. Tracts were delineated by the U.S. Census Bureau to provide relatively stable boundaries used in the statistical analysis and comparison of Census data across time (Bureau 2015). City planners regularly appropriate “neighborhood” boundaries that are roughly in line with Census tract boundaries (Geography 2018). However, for communication purposes, these tracts can be apportioned to more locally identifiable boundaries using neighborhood Association boundaries provided by the Nashville Open Data Portal as well as Zillow.

As mentioned before, Census data at the tract level will provide a number of the variables considered in this study. American Community Survey data is used to represent the years 2010 – 2016. Census tract boundaries have changed over time. To account for this the Geolytics Neighborhood Change Database (2005) will be used to provide historical census data prior to 2010 that is apportioned to 2010 census tracts.

Differences between ACS and Decennial Survey

### Building Permits

Other data sources include building permits issued by local government. A permit database is provided

by nashville.data.gov through an open data portal (Metro Codes Department 2018). This dataset contains

building permits dating from 2013 to present and is updated daily. The building permit database provides the location of the permit, permit type (Demolition, Residential-New, Commercial-New, Residential-Rehab, Commercial-Rehab, etc.), and the construction cost associated with the permit. This detailed dataset can be used to gain insights into capital investment types believed to accompany patterns of gentrification and neighborhood change.

### Cadastral Data

Davidson County Cadastral data was compiled and standardized to 2016 inflation adjusted dollars.

This dataset provides snapshots in time of property values based on home sales. It also provides information on housing characteristics including lot size, number of bedrooms, square footage of homes, and a qualitative field for building quality. Cadastral data provides the finest resolution of housing price variability and will play an important role in validating predictive model results.

Park data filtered to before 2010

### Feature Engineering

Feature engineering of variables to be used in the predictive gentrification models will comprise significant

Effort in this research. Endogenous gentrification theory-based variables will be included, which suggest

Low-value housing tracts adjacent to high-value tracts have a high probability of gentrifying as housing demand spills over to these tracts and in-movers preferentially value living next to wealthier neighborhoods (Guerrieri, Hartley, and Hurst 2010). Endogenous gentrification can be captured in spatially lagged variables that represent the average of the median home price of tracts surrounding a given tract(Steif et al. 2017). Additionally temporally lagged variable are included to account for trends.

### Tools

In alignment with reproducible research principles, all data cleaning, restructuring, and statistical analyses were conducted in R with the supplemental code submitted in the final work product. Several open-source R libraries were critical for carrying out the analyses in this paper including tidycensus, stats, randomForest, xgboost and dplyr, among others (Walker 2018; R Core Team 2017; Liaw and Wiener 2002; Chen et al. 2018; Wickham et al. 2017). Spatial statistics such as hot spot analysis, outlier analysis, and geographically weighted regression were also conducted using the ArcPy scripting interface in ArcGIS. ArcGIS Online is used to communicate the results of the study in an interactive and approachable interface. The web page can be shared by URL and viewed on any internet browser or mobile device.

Methods

Defining Gentrification

Principle Component Analysis

Principal Component Analysis (PCA) was identified as a candidate for this study due to the large number of variables of interest and their correlation. PCA is a statistical procedure for reducing dimensionality while retaining the maximum information via orthogonal transformations of correlated and uncorrelated variables called principal components. PCA identifies a linear combination of variables that explain the maximum variance of the dataset. Removing the optimal first variance, it begins to find a second linear combination that explain the remaining variance in the data and so on.

This work borrows from climate research by calculating socio-economic anomalies that are simply

Results

Conclusion?

Early gentrification literature primarily focused exclusively on either the macro-economic supply side or individual demand-side preferences of in-movers that contribute to gentrification. Today there remains disagreement between the role of flows of people versus flows of capital. Proponents of the supply-side explanation of gentrification focus on two axioms founded on individual preferences. The first describes the aesthetic values and urban lifestyle’s desired by in-movers (creative class).

1. Laska and Spain published in 1980 about the back to the city movement [↑](#footnote-ref-1)
2. At the time of Laska and Spain’s writing there was little evidence to believe this was the case stating “*which at this point admittedly represents only a trickle of migrants back from the suburbs*” [↑](#footnote-ref-2)
3. The results of this study are national, likely masking significant heterogeneity between cities. Other problems [↑](#footnote-ref-3)
4. [↑](#footnote-ref-4)
5. NIMBY [↑](#footnote-ref-5)
6. President Trump cut the Department of Housing and Urban Development budget by 14% [↑](#footnote-ref-6)