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Mapping Gentrification: A Methodology for Measuring Neighborhood Change

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Abstract

The effects of gentrification are well studied, with varied findings. Studies debating and nuancing gentrification's effects have subsequently entailed variation on how the phenomena should be defined. The variance in definitions can create different calculations and potentially muddy findings on its effects. Having a well-defined methodology for calculating gentrification is essential to ensuring a deeper understanding of the phenomena and its effects. This article seeks to establish such a methodology that relies exclusively on publicly available data. This article overviews the definitions used in several peer-reviewed articles to identify 12 different methods for calculating gentrification. The authors created an interactive tool that classifies census tracts as gentrifying (<https://ogilani.shinyapps.io/Gentrification/>), nongentrifying, and nongentrifiable in metropolitan areas in the United States. Through a case study of

Abstract (continued)

Pittsburgh, the authors offer insights into which definition of gentrification best fits a qualitative understanding of the city. This article leaves readers with a methodology and tool for defining and mapping gentrification across the United States, making it easy to compare the results across different definitions. This tool and application offer a way for researchers, activists, and policymakers to compare various definitions in a particular geography to ensure consistent findings in studies across the United States.

Introduction

Gentrification has become an integral concept for understanding neighborhood change and exclusion in the United States. Although a general agreement on gentrification exists conceptually, how it is measured varies. Glass (1989) defined gentrification as elevating the economic status of the neighborhood's population and changing the "social character" or culture found within that neighborhood. Since then, researchers have debated how gentrification should be measured, but the same general idea is consistent throughout most definitions of gentrification. Conceptually, gentrification is understood as an influx of (White) residents with a higher socioeconomic status than the incumbent residents reshaping low-income, typically central city, neighborhoods (Barton, 2016; Mujahid et al., 2019; Zuk et al., 2018). Currently, several variations of the definition of gentrification center on economic status, whereas others argue for a focus on the influx of a cultural, creative class. Although they all funnel down to the same idea, the variance can have methodological implications for study outcomes that are not well understood.

The debate on the qualitative definition of gentrification has led to different measures and quantitative definitions of gentrification. Furthermore, the operationalization of different concepts, such as an increase in home values, is not agreed on, which is problematic. It is difficult to compare events linked to gentrification in cities and the potential effects of gentrification if the methodology for classification is not consistent. These differences in classification have caused a large variation in the number and location of areas classified as gentrifying, with minimal overlap between methods of classification (Barton, 2016; Mujahid et al., 2019). In other words, different methods for defining and operationalizing gentrification can lead to different results, not only in how many neighborhoods in a particular area are deemed to be gentrifying but also in the neighborhoods where gentrification is believed to occur.

This study aims to further investigate this issue by looking at the resulting areas of Pittsburgh, Pennsylvania, that are deemed gentrifying based on different variations of the most commonly used method for categorizing gentrification, the Freeman method (Freeman, 2005). In 2019, the National Community Reinvestment Coalition (NCRC) released a study conducted from 2000 to 2013. Through the 13-year period, 20 percent of the tracts in Pittsburgh gentrified, making it the eighth most gentrified city in the country as of 2013 (Richardson, Mitchell, and Franco, 2019). This article investigates the varying definitions of gentrification and applies them to the city of Pittsburgh. It is exemplary of a mid-sized city with little formal research on gentrification.

Gentrification is both an economic and cultural phenomenon, and how much to emphasize income in the calculation relative to educational attainment and other, less numeric, more subjective markers of cultural class contribute to this variation. Although the Freeman method is generally agreed on, few works take a larger examination of the methodology of calculating the qualifiers. This article seeks to remedy that gap by offering different variables for each of Freeman's categories and an interactive tool that researchers, activists, and policymakers can use to compare various definitions in a particular geography to ensure consistent findings in studies across the United States.

Measuring Gentrification in the Social Sciences

Gentrification is a phenomenon that tracks with a returning middle-class interest in inner city spaces that were previously disinvested via processes of deindustrialization and White flight (Clay, 1979). Despite the variance in defining and calculating gentrification, it is widely agreed that the prevalence of gentrification in the United States is rising because low rents attract the middle class (Ellen and Ding, 2016). Hwang and Lin (2016) note that changes in public policy, technology, demographics, socioeconomic factors, and housing supply all contribute to the growing prevalence.

Importance of Accurately Detecting Gentrification

Both retail and commercial changes can be indicators that low-income neighborhoods are undergoing change, and oftentimes, these same signs are what draw middle-class individuals to become residents in these neighborhoods (Brown-Saracino, 2004). These new amenities correlate with an increase in property values (including rent prices), White residents, and middle-class community members, which can make it difficult for the incumbent community members and businesses to stay in the neighborhood (Cunningham and Houston, 2012; Zukin, 2009). Koebel (2002) found that large amounts of change in neighborhoods were tied to both property and location characteristics. Gentrification leads to the revitalization of communities through reinvestment. However, as new residents move into the neighborhood, the changes can reinforce already existing patterns of segregation and inequality.

Gentrification is also linked to historical patterns of residential segregation (Freeman, 2005; Pattillo, 2008; Powell and Spencer, 2002; Wilson and Taub, 2006). Residential segregation often ties to redlining, which is the spatial discrimination against residents of a center city (Zenou and Boccoard, 2000). When the cost for workers to maintain employment in center city areas is high, it results in segregated areas within the city by race (Zenou and Boccoard, 2000). When the cost for workers to maintain employment in center city areas is low, it results in a city that is segregated by employment status (Zenou and Boccoard, 2000). Between 1980 and 2010, the proportion of higher-income households in higher-income tracts doubled from 9 to 18 percent, whereas the proportion of lower-income households in lower-income tracts went from 23 to 25 percent during the same period (Fry and Taylor, 2012). In metropolitan areas, income inequality affected neighborhood income segregation the most, where the top quantile experienced much higher compensation, and the bottom quantile experienced an inadequate number of job opportunities (Reardon and Bischoff, 2011; Watson, 2009). Not only are jobs affected, but schools can be affected as well.

Schools in the United States continue to be highly segregated in nature, primarily caused by residential segregation along lines of race and income (Rivkin, 1994).

Gentrification has also been linked to the displacement of lower income residents (Grier and Grier, 1978). Residents moving into gentrifying neighborhoods have higher educational attainment, higher incomes, and are more likely to be White than the residents that have historically lived in the area. Consequently, characteristics of residents moving from gentrifying neighborhoods are more commonly non-White renters with lower income (Zuk et al., 2018). However, studies contradict each other when debating whether or not gentrification causes displacement (Zuk et al., 2018.). Vigdor, Massey, and Rivlin (2002) found that the housing turnover rates were larger in neighborhoods that were classified as gentrifying. Freeman and Braconi (2004) found that poor households in gentrifying neighborhoods were less likely to move than poor households in nongentrifying neighborhoods (Freeman 2005; Freeman and Braconi, 2004). Some of this discrepancy could be due to variations in operationalizing a definition of gentrification.

When displacement occurs, it affects minority groups the most. Based on data from 2000 to 2013, the NCRC reported that for gentrifying tracts in the United States, displacement of ethnic minorities was commonplace (Richardson, Mitchell, and Franco, 2019). Studies found there was less movement of poor households in gentrifying areas but the pressure became too much for the households, forcing them to move (Zuk et al., 2018).

If and when displacement occurs, it ultimately means the poorest do not benefit from the gentrification-driven neighborhood revitalization. The displacement also produces negative outcomes. Danley and Weaver (2018) found that in gentrifying cities, exclusion in daily activities and spaces are precursors to the displacement that coincides with gentrification. In addition, the fear of displacement that results from gentrification can lead to resistance to development that could affect the neighborhood in a positive way (Danley and Weaver, 2018). Gentrification can affect the allocation and maintenance of a community's resources and the community's social cohesion (Stanley, 2003). This decline in cohesion may occur, in part, due to the displacement of integral members of the community's support system and social networks (Mujahid et al., 2019).

Given the potential for gentrification to exacerbate inequality, drive displacement of low-income and racial minorities, and disrupt social cohesion, a clear understanding of gentrification and how to track it is essential. Researchers have been working on developing early warning systems for changes in neighborhoods, including changes associated with gentrification (Chapple and Zuk, 2016). The overarching idea is that through tracking community characteristics like investment, disinvestment, and population flow, policymakers can intervene to mitigate the changing patterns in the community before it is too late (Snow, Pettit, and Turner, 2003). In the 1980s, researchers developed early warning systems for gentrification and displacement that used different factors to determine which patterns most commonly indicated changing neighborhoods (Chapple and Zuk, 2016). Some early warning systems for community revitalization include monitoring changes in housing sales, racial shifts, and an influx of amenities to the area (Ellen and Ding, 2016). These changes can increase the level of exclusion in the neighborhood toward incumbent residents. Although the nuances and complexities are many in the relationship between displacement and gentrification, methodological consistency on calculating gentrification is essential for a clear

and generalizable picture. Before being able to predict the effects of gentrification, including displacement in an area, gentrification must be defined and that definition operationalized.

Varied Methods for Classifying Gentrification

Variations and inconsistencies in calculating gentrification have practical consequences. In response to NCRC's "Shifting Neighborhoods" report (Richardson, Mitchell, and Franco, 2019), the *Pittsburgh City Paper*, a local Pittsburgh newspaper, talked about the discrepancies between the study's findings and residents' experiences who observed gentrification in the city (Deto, 2019). They specifically mentioned NCRC not classifying East Liberty as gentrified, which was surprising due to the high volume of African-American displacement and change in the area. In 2020, the *Pittsburgh City Paper* detailed the displacement of a Lawrenceville resident. The article described Lawrenceville as "what was once known as an enclave is now known for its lively restaurant scene, hip bars, and trendy boutique" (Deto, 2020). The article also discussed the displacement experienced across Lawrenceville and how most of the incumbent residents' wages are not enough to retain their homes, especially if they are on Section 8. This study's definitions of gentrification encompass Lawrenceville in its entirety (Lower, Central, and Upper), which match what those who live in the city fighting the change describe.

Given the ongoing debates in Pittsburgh, this city serves as an excellent case to better understand this tool and its policy utility. Methodologically, how scholars define gentrification can lead to subtle differences in which neighborhoods are labeled and how well that matches the lived experience of those places. Varying the methodology for labeling areas as gentrifying is key to robust studies and understandings of urban change across the United States.

This project formulates methods of measurement for gentrification throughout, built on the definitions Freeman (2005) established, which selected three criteria a neighborhood must meet to be gentrifiable (that is, has the potential for gentrification): (1) central city neighborhoods; (2) consisting of low-income households; and (3) households previously experienced disinvestment. Freeman (2005) operationalized criterion two by determining whether the median household income in a neighborhood was at or below the median household income for the metropolitan area in which the neighborhood belonged. Criterion three was met if the proportion of new housing within the past 2 decades in that neighborhood was lower than the proportion of new housing in the corresponding metropolitan area. If areas did not meet these criteria, they were nongentrifiable.

The following must occur for an area to undergo gentrification: (1) an influx in affluence associated with the neighborhood and (2) an increase in investment in the neighborhood. Criterion one was measured by looking at the educational attainment level within the neighborhood. Education is an indicator of class standing, and an increase in class is often tied to gentrification. Education was used in place of income because it highlights the difference between individuals who live within the neighborhood whose income increases and those who are moving into the neighborhood who may play a part in increasing the overall class standing of that neighborhood. Criterion one required a neighborhood to have an observed increase in educational attainment that is greater than or equal to that of the greater metropolitan area. Criterion two was measured using housing

prices to represent investment in an area. Therefore, criterion two was met for a neighborhood if the real housing prices in that neighborhood increased during the period of analysis.

Ding, Hwang, and Divringi (2016) defined gentrification using American Community Survey (ACS) and U.S. Census Bureau data. Similar to the second criterion under potential for gentrification in Freeman's article (2005), Ding, Hwang, and Divringi (2016) defined a tract as *gentrifiable* if it had "a median household income at or below the citywide median at the beginning of the period of analysis." A tract was defined as *gentrifying* if it was *gentrifiable* at the beginning of the period of analysis and if the median percentage increase in residents with a college education and in gross rent or home value was above the citywide median percentage increase (Ding, Hwang, and Divringi, 2016). These stipulations cover criteria one and two under Freeman's (2005) process of gentrification requirements. Ding, Hwang, and Divringi (2016) chose to use home value *or* gross rent rather than home value *and* gross rent, because changes in the two different types of residencies do not necessarily coincide. However, both account for affordability. They defined a tract to be nongentrifying if the tract was determined to be *gentrifiable* but did not *gentrify* during the period of analysis.

Operationalizing a Gentrification Classification

Freeman's (2005) definition of gentrification is widely used and applied, but nuances exist in how it is operationalized. This study's definitions vary in how each of Freeman's (2005) criteria can be operationalized using publicly available data. A variety of variables are publicly available that one could use to assess Freeman's (2005) criteria for determining areas' gentrification statuses. Further, Ding, Hwang, and Divringi's (2016) analysis requires only one criterion be met rather than all. These seemingly subtle differentiations create different results. This study created 12 different definitions of gentrification that operationalize the criteria differently. They all draw from publicly available data to determine if areas within a selected metropolitan region are *gentrifying*.

This project specifies five variables indicative of gentrification according to the literature. It uses ACS data and defines "neighborhood" as census tracts. The variables included to operationalize Freeman's (2005) definition are (1) median household income, (2) median home value, (3) median rent, (4) vacancy rate, and (5) educational attainment. Median household income was used both as a variable for the classification of *gentrifiable* and for some of the definitions of *gentrifying*. Exhibit 1 details how each of these five variables are operationalized.

Exhibit 1

Operationalization of Each Variable to Classify Tracts

Variable	Criteria for Gentrification	Variable Name (2010 and 2019 ACS)
Median household income	This variable is used in two ways. First, it classifies tracts as <i>gentrifiable</i> or <i>nongentrifiable</i> . A tract is considered nongentrifiable if it is already above the citywide median income at the beginning of the analysis period (2010); else it is <i>gentrifiable</i> . Second, <i>gentrifiable</i> tracts are <i>gentrifying</i> if they experience a percentage increase in household income during the 10-year period (2010–19) that was more than the calculated citywide percentage increase during the same period.	S1901_C01_012E
Median home value	If a tract’s percentage increase for home value is higher than the citywide median percentage increase in home value.	S2506_C01_009E
Gross rent	If a tract’s percentage increase for rent cost is higher than the citywide median percentage increase in rent cost.	B25064_001E
Vacancy rate	If a tract’s percentage decrease in proportion of vacant residencies is higher than the citywide median percentage decrease in vacant residencies.	B25002_003E
Educational attainment	If a tract’s proportion of people aged 25 and older with a bachelor’s degree or higher went from below the city average to higher during the 10-year period.	2010: S1501_C01_015E 2019: calculated using S1501_C01_015E and S1501_C01_006E

ACS = American Community Survey.

Source: Authors

The analysis period for this project was the 10 years from 2010 to 2019. The tool uses ACS 5-year estimates rather than the 3- and 1-year estimates, because the 3-year estimates had been discontinued, and the 1-year estimates were not offered for the Pittsburgh area at the tract level. The ACS data for 2010 and 2019 were retrieved using the R package *tidycensus* (Walker and Herman, 2023).

Each definition of gentrification uses a combination of the variables related to educational attainment, home value, rent cost, income, and vacancy. Data from 2010 were used to determine whether a tract was *gentrifiable* or not, and changes from 2010 to 2019 were used to determine whether *gentrifiable* tracts were *gentrifying* over this duration.

For every definition, a tract must first meet the requirement of being *gentrifiable*. The tract’s median household income must be below the citywide median household income at the beginning of the analysis period (2010). If a tract meets this initial condition, then it is *gentrifiable*. If it is already above the citywide median income, it is considered *nongentrifiable*. Exhibit 2 outlines each definition’s requirements for a *gentrifiable* census tract to subsequently be classified as *gentrifying*, and exhibit 3 provides a summary of the variables that were included in each of the 12 definitions.

Exhibit 2

Criteria for Each Definition

#	Description	Requirement
1	Freeman (2005) method with home value	A tract's percentage increase in median home value is above the percentage increase in citywide median home value at end of period, AND a tract's percentage increase in college educated residents is above the citywide percentage increase in college educated residents.
2	Freeman (2005) method with rent	A tract's percentage increase in median gross rent is above the percentage increase in citywide median gross rents, AND a tract's percentage increase in college educated residents is above the citywide percentage increase in college educated residents.
3	Freeman (2005) method with rent and home value	All criteria for definitions 1 and 2 must be met.
4	Freeman (2005) method with home value and vacancy	All criteria for definition 1 must be met, AND the tract's percentage decrease in vacancy is above the citywide percentage decrease in vacancy.
5	Freeman (2005) method with rent and vacancy	All criteria for definition 2 must be met, AND the tract's percentage decrease in vacancy is above the citywide percentage decrease in vacancy.
6	Freeman (2005) method with rent, home value, and vacancy	All criteria for definition 3 must be met, AND the tract's percentage decrease in vacancy is above the citywide percentage decrease in vacancy.
7	Freeman (2005) method with home value and income	All criteria for definition 1 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.
8	Freeman (2005) method with rent and income	All the criteria for definition 2 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.
9	Freeman (2005) method with rent, home value, and income	All the criteria for definition 3 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.
10	Freeman (2005) method with home value, vacancy, and income	All the criteria for definition 4 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.
11	Freeman (2005) method with rent, vacancy, and income	All the criteria for definition 5 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.
12	Freeman (2005) method with rent and home value, vacancy, and income	All the criteria for definition 6 must be met, AND the tract's percentage increase in median household income is above the citywide percentage increase in median household income.

Source: Authors

Exhibit 3

Criteria Included for Each Definition

Definitions:	Gentrifiable	Home Value	Rent	Education	Vacancy	Income
1	X	X		X		
2	X		X	X		
3	X	X	X	X		
4	X	X		X	X	
5	X		X	X	X	
6	X	X	X	X	X	
7	X	X		X		X
8	X		X	X		X
9	X	X	X	X		X
10	X	X		X	X	X
11	X		X	X	X	X
12	X	X	X	X	X	X

Note: A tract is considered gentrifying if it was gentrifiable at the beginning of the analysis period and met ALL criteria selected for that definition.

Source: Authors

Recall that all definitions required that the proportion of residents with a bachelor’s degree or higher be greater than the citywide median proportion of residents with a bachelor’s degree or higher. All the definitions also required that the tracts be *gentrifiable*, that is, that the median household income for that tract in 2010 was less than the citywide median household income in 2010 (start of the analysis period). Beyond that, definitions 1 through 3 look at the percentage increases in home value, rent, and both home value and rent, respectively. Definitions 4 through 6 respectively build on definitions 1 through 3 by additionally assessing whether the percentage increase in proportion of vacant homes was less than the percentage increase in the citywide proportion of vacancy. Definitions 7 through 9 respectively build on definitions 1 through 3 by additionally examining whether the percentage increase in median household income is greater than the citywide percentage increase in median household income. Finally, definitions 10 through 12 respectively build on definitions 1 through 3 by assessing changes in both vacancy and median household income, as definitions 4 through 6 and 7 through 9 separately assess. This tool allows users to map gentrification for any metropolitan region in the United States using all 12 definitions. Each definition applies a unique combination of five publicly available variables. Users can download the data to use outside the application. The authors use this tool for Pittsburgh to better understand its implications, and the remainder of the article discusses this application.

Case Study: Pittsburgh

The authors chose Pittsburgh as the case study city because it showed an interesting phenomenon when comparing the NCRC study results with conventional wisdom within the community. According to the *Pittsburgh City Paper*, NCRC lists Bloomfield, Downtown, Garfield, Lawrenceville, Polish Hill, sections of the North Side, and Mount Washington as areas of Pittsburgh that experienced gentrification. However, the study did not note East Liberty as a gentrified area of the

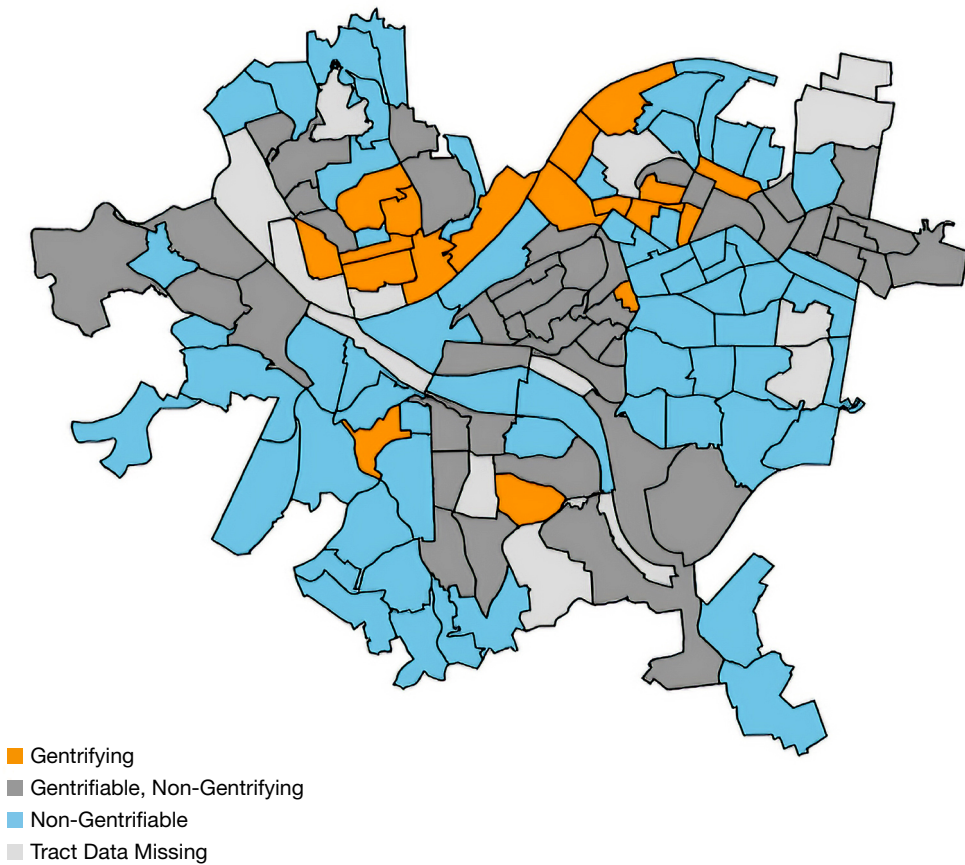
city, which is inconsistent with popular belief among Pittsburgh residents (Deto, 2019; Richardson, Mitchell, and Franco, 2019).

The authors tested the 12 definitions for Pittsburgh to exemplify the utility of the tool for understudied but rapidly changing cities in the United States. This analysis explores the advantages and disadvantages of each definition. Exhibit 4 displays the study area.

Exhibit 4

Definition 1 Map of Pittsburgh

Definition 1 Pittsburgh Area 2019



Source: Created using the authors' app, available here: <https://ogilani.shinyapps.io/Gentrification/>

Results

Exhibit 5 illustrates the breakdown of tracts considered to be gentrifying based on the various definitions. The rows correspond to all the different tracts found to be gentrifying in at least one of the definitions. The columns correspond to the different definitions. Across each row, the definitions in which the tract is identified as gentrifying have an “X” under that particular definition. The tracts found to be gentrifying based on all 12 definitions were 603, 809, 903, and 2406, corresponding to the neighborhoods of Lower Lawrenceville, Bloomfield, East Liberty, and Troy Hill, respectively. It is important to note that in some instances multiple tracts have the same neighborhood name, whereas in others, a tract is split across multiple neighborhoods. Among all tracts identified by at least one definition, tract 409 (South Oakland) appears in the fewest definitions (one). Exhibit 5 shows a more detailed breakdown of the definitions and their corresponding gentrifying tracts.

Exhibit 5

Tracts That Were Gentrifying in Pittsburgh According to Each Definition

Tracts	Neighborhoods	Definition												Frequency of Inclusion
		1	2	3	4	5	6	7	8	9	10	11	12	
404	North Oakland	X						X			X			3
406	Central Oakland		X		X	X								3
409	South Oakland		X											1
603	Lower Lawrenceville	X	X	X	X	X	X	X	X	X	X	X	X	12
807	Friendship	X	X	X				X	X	X				6
809	Bloomfield	X	X	X	X	X	X	X	X	X	X	X	X	12
901	Central Lawrenceville	X	X	X				X	X	X				6
903	Bloomfield	X	X	X	X	X	X	X	X	X	X	X	X	12
1011	Upper Lawrenceville	X	X	X				X	X	X				6
1017	Garfield	X						X			X			3
1113	East Liberty	X						X						2
1114	Garfield		X						X					2
1915	Mount Washington	X						X			X			3
2107	Manchester	X	X	X				X	X	X				6
2206	Central Northside	X	X	X				X	X	X				6
2406	Troy Hill	X	X	X	X	X	X	X	X	X	X	X	X	12
2509	Fineview	X	X	X	X	X	X				X			7
2614	Perry South	X						X						2
5617	Mount Oliver Neighborhood	X	X	X				X	X	X				6
5627	Allegheny Center, Allegheny West	X	X	X				X	X	X				6
5630	Chartiers City, Fairywood, Windgap		X						X					2
5632	East Allegheny, North Shore	X	X	X				X	X	X				6

Source: Authors

Discussion

After additional qualitative research, the authors determined definition 9 to be most representative of the reality for gentrification in Pittsburgh and consulted Nick Cotter from the Pittsburgh Neighborhood Project, a project that investigates Pittsburgh neighborhoods and the segregation (racial and economic) that still affects the city. Cotter believed that definitions 1 through 6 were good displays of market pressure but not necessarily gentrification. He also opposed the use of vacancy rates as a measure of gentrification in Pittsburgh specifically because somewhere between 70,000 and 80,000 individuals out of the population of 300,000 are students who are highly mobile by nature. Definition 9 considers both home value and rent, which were also thought to be important. This definition does not exclude any type of resident in the city because it represents both homeowners and renters. The authors chose to use home value *and* rent, as opposed to the broader home value *or* rent, because the gentrification phenomenon encompasses both home value and rent increasing rapidly. Altogether, the most important aspects of an area to investigate in defining gentrification in Pittsburgh are educational attainment, home value, rent, and income.

The tracts that were identified to be gentrifying by definition 9 were 603 (Lower Lawrenceville), 807 (Friendship), 809 (Bloomfield), 901 (Central Lawrenceville), 903 (Bloomfield), 1011 (Upper Lawrenceville), 2107 (Manchester), 2206 (Central Northside), 2406 (Troy Hill), 5617 (Mount Oliver), 5627 (Allegheny Center/West), 5630 (Chartiers City, Fairywood, Windgap), and 5632 (East Allegheny, North Shore). It is common that many more *gentrifiable* tracts exist than *gentrifying* tracts, because gentrification is not the rule, rather a special case. The gentrifying areas definition 9 identifies are the areas in which people who are familiar with Pittsburgh would also expect to identify as gentrifying during this period. These areas gained the most news coverage and drew the most attention with displacement or as “up and coming” or “hot spot” in Pittsburgh (exhibit 6).

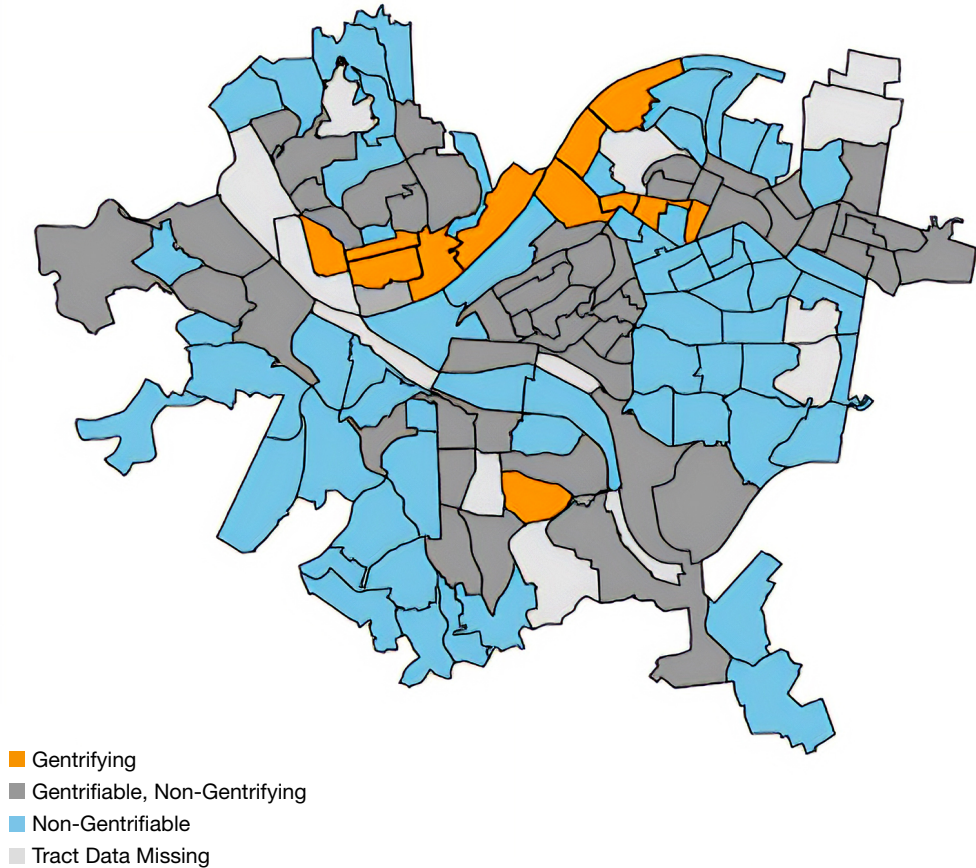
In 2017, The Takeaway podcast series from WNYC Studios on the change in Pittsburgh due to gentrification titled “A Tale of Two Cities” explained that historic homes from the steel town are gone, with buildings being renovated into lofts near the river and the new and trendy eateries and high rises taking over areas (Asante, 2017). These areas were historically African-American locations like East Liberty. The segment discussed the pressure of rising housing prices and stagnant wages and how, from the viewpoint of a lifelong Pittsburgh resident, the atmosphere has changed, and the character of Pittsburgh had started to dwindle by comparison with how it used to be (Asante, 2017).

The Land & Power podcast series, released in 2020, explained changes from the perspective of the residents and a true story of displacement in Pittsburgh due to the eviction of Penn Plaza in East Liberty. It detailed the various stages of eviction due to the gentrifying area over the course of decades, and it talked about the effect that it had on an entire building of residents and the rest of the community. Uprooting many of these senior citizens left them feeling like they no longer had a support system and that their network had been dismantled (Krauss, 2020).

Exhibit 6

Definition 9 Map of Pittsburgh

Definition 9 Pittsburgh Area



Source: Created using the authors' app, available here: <https://ogilani.shinyapps.io/Gentrification/>

Conclusion

This analysis of Pittsburgh reveals several strengths and limitations of the tool.¹ After looking at the literature, a strength of this study is that the authors were able to establish multiple definitions of gentrification and to create dynamic maps for the Pittsburgh area based on these various definitions. The authors were able to capture what appears to be the largest areas in Pittsburgh experiencing change due to gentrification. In addition, unlike the National Community Reinvestment Coalition report, East Liberty was identified as a gentrifying neighborhood in this

¹ Available at <https://ogilani.shinyapps.io/Gentrification/>.

study (Richardson, Mitchell, and Franco, 2019). Furthermore, this analysis can be easily replicated for other cities in the United States using this tool.

This tool has utility in future research and also for policymakers. Users can match it to the ground reality they experience. It can help better identify the factors in specific locales that are most important for driving gentrification. In other words, this tool can help better confirm that a neighborhood is gentrifying, even if it comes up only on some of the definitions.

This study also has limitations. First, it would have been preferable to use Census Bureau data over ACS data. However, the 2020 Census uses different tract boundaries. Changing tract boundaries between the decennial census surveys restricts this type of analysis to 10-year periods. In addition, given the transient population, Pittsburgh may be unique, which would mean that the ideal definition for Pittsburgh may not apply everywhere. However, this study is easily replicable, which means that others can see which definitions apply best to a city of interest. Last, the Freeman (2005) criteria did include households previously experiencing disinvestment. The authors were unable to use this criterion because they were unable to find a publicly available data source that provided the necessary information at the census tract level.

Further research should investigate how different definitions of gentrification apply to different gentrifying areas. The tool and operationalizations of variables gave insights into Pittsburgh, but it is important to determine whether or not it is true for other gentrifying areas, especially due to the fact that every city has its own challenges and differences. For example, definition 9 did not include vacancy rates due to the high proportion of college students in the city, but it might be productive and beneficial to include vacancy rates for an area that potentially does not have such a high population of students. Here, the authors developed several variations of the same definitions that can be applied to and checked in different areas of concern. Further work could be done to investigate the dynamic progression of gentrification by looking at the change on a year-by-year basis or the overlap of years. However, gentrification is a slow process, and it is not likely that much change would be seen year to year.

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