The Journal of Transport and Land Use jtlu.org
Vol. 18 No. 1 [2025] pp. 709-732

# Gentrification in motion: Linking urban walkability and connectivity with neighborhood change

**Joseph Gibbons**
San Diego State University
jgibbons@sdsu.edu

**Bruce Appleyard**
San Diego State University
bappleyard@sdsu.edu

**Abstract:** This study explores how different aspects of walkability are associated with residential and retail gentrification in U.S. cities. Using data from the American Community Survey (ACS) and the U.S. Environmental Protection Agency's Smart Locations Dataset (SLD), we examine walkability scores along with their underlying factors including the diversity of amenities, proximity to transit, and intersection density to predict gentrification. The ACS provides detailed demographic, socioeconomic, and housing data at the neighborhood level, enabling analysis of population shifts and economic changes over time. The SLD offers spatial indicators of walkability based on consistent national methodologies, making it a valuable tool for comparing built-environment characteristics across cities. Our findings show that overall walkability and neighborhood amenities are positively associated with both residential and retail gentrification. In addition, higher intersection density is linked to residential gentrification, underscoring the importance of neighborhood connectivity in attracting higher-income residents. These results highlight the complexity of gentrification and the need for more targeted policy interventions that address the various components of walkability and connectivity.

**Keywords:** walkability; retail gentrification; residential gentrification; proximity to transit

**Article history:**
Received: April 28, 2025
Received in revised form: October 27, 2025
Accepted: November 3, 2025
Available online: December 3, 2025

## 1 Introduction

Scholars, activists, and policymakers have increasingly advocated for more walkable city neighborhoods, emphasizing their importance for urban well-being (Ewing et al., 2003; Frank et al., 2004; Frank et al., 2021). When residents can easily walk to various destinations in their local area, they become less reliant on cars. This shift not only leads to better health outcomes, thanks to increased physical activity and reduced stress (Ewing et al., 2003; Fonda et al., 2001; Frank et al., 2021; Larson et al., 2009), but also fosters more social interactions (Felder, 2020; Glover et al., 2022; Leyden, 2003; Lofland, 1998; Lund, 2002). These encounters strengthen community ties, creating a vibrant atmosphere that urbanist Jane Jacobs (1961) described as the "ballet on the street." This lively presence of people engaging with their surroundings enhances the local environment and overall quality of life for residents while promoting sustainability.


https://doi.org/10.5198/jtlu.2025.2717


The *Journal of Transport and Land Use* is the official journal of the World Society for Transport and Land Use (WSTLUR) and is published and sponsored by the University of Minnesota Center for Transportation Studies.

However, the appeal of walkability can, paradoxically, make neighborhoods less affordable. Gentrification, the influx of higher-income residents and investment in previously low-income neighborhoods, often occurs in walkable areas. Gentrifiers frequently cite walkability as a key reason for choosing these neighborhoods (Brown-Saracino, 2009; Hyra, 2017; Martucci, 2024; Tissot, 2015; Zukin, 2010). While gentrification can bring new resources and amenities, it also leads to rising property values and rents, displacing long-time residents who may not have the financial means to remain in place. The nature of this displacement is varied; although scholars debate the extent of physical displacement (Ding et al., 2016; Easton et al., 2020; Sims, 2021), there is a consensus that gentrification can cause "cultural" displacement, making residents feel alienated from their local community (Richardson et al., 2019; Tuttle, 2021). This sense of alienation can discourage residents from utilizing public spaces and amenities (Lubitow et al., 2016; Sullivan, 2014; Sullivan & Shaw, 2011), undermining the benefits of walkable neighborhoods.

Despite concerns about the relationship between gentrification and walkability, there are significant limitations in the existing research. First, there needs to be more studies that directly examine whether walkability predicts gentrification on a national scale. The presence of gentrification in walkable areas alone does not mean that walkability predicts this gentrification, ceteris paribus. Second, while some studies have compared different types of gentrification with walkability, they often only focus on changes in residents or storefronts. This selective focus overlooks the potential interconnectedness of walkability with different forms of gentrification. Finally, walkability is a multifactor condition that includes factors such as proximity to transit, diversity of businesses, and intersection density leading to smaller block sizes. Each element can uniquely influence gentrification, yet they have rarely been studied separately in a single project.

In this study, we address these limitations by utilizing data from the American Community Survey (ACS) (U.S. Census Bureau, 2010; U.S. Census Bureau, 2019) and the EPA Smart Locations Dataset (U.S. Environmental Protection Agency, 2013; U.S. Environmental Protection Agency, 2020) to analyze whether walkability and its components predict gentrification while controlling for other relevant factors. We measure two forms of gentrification: a standard measure of residential gentrification (Ding et al., 2016), and a newly developed practical measure of retail gentrification. This approach allows us to simultaneously compare the predictors of these two types of gentrification across the United States for the first time. Our findings indicate that walkability is a common predictor for both types of gentrification; however, the specific components of walkability that attract gentrification vary depending on the measured type. Understanding these dynamics is crucial for developing policies that promote equitable urban development while mitigating the negative impacts of gentrification.

## 2 Literature

The existing literature presents mixed views on whether walkability predicts gentrification. Much of the classical discussion has focused on gentrification occurring near city centers (Lee et al., 1985; Lipton, 1977; Spain, 1980), where walkability is generally believed to be higher (Adkins et al., 2017; Frank et al., 2021; U.S. Environmental Protection Agency, 2021). However, this perspective has some limitations. While walkability tends to be greater near city centers, these are only some of the areas within a city that exhibit high levels of walkability (Bereitschaft, 2019). Additionally, different downtowns can have varying degrees of dense walkability, influenced by their unique local histories (Abu-Luhgod, 1999). Moreover, factors beyond walkability, such as historical or cultural significance, may also attract prospective gentrifiers to areas near city centers (Brown-Saracino, 2009; Hyra, 2017; Tissot, 2015; Zukin, 2010).

Most studies examining whether walkability predicts neighborhood gentrification have produced mixed results (Bereitschaft, 2019; Chava & Renne, 2022; Li et al., 2015). For instance, a multicity study found that while walkability might not trigger gentrification in areas near transit, it can accelerate the process (Chava & Renne, 2022). A case study of three cities revealed varied links between walkability and housing affordability (Bereitschaft, 2019). However, whether housing is perceived as less affordable in gentrifying areas compared to non-gentrifying areas has been questioned (Gibbons 2020). While several studies have shown a relationship between walkability and higher property values (Pivo & Fisher, 2011; Yencha, 2019), they do not establish a direct causal link between walkability and gentrification. Rather, walkability may shape the location preferences of more affluent in-movers, with rising property values emerging over time through indirect and cumulative processes of neighborhood change (Assis et al., 2024). While the link between walkability and gentrification remains unclear, there is growing evidence that specific elements of walkability are related to gentrification. To better understand these connections, it is essential first to explore the theoretical foundations of gentrification, which will help clarify how these elements may contribute to the gentrification process.

There are two classical theoretical explanations for why gentrification occurs. The first is the supply-side perspective, which highlights the disparity between the realized and potential value of properties in a neighborhood, known as the rent gap (Smith, 1998). The second perspective focuses on the appealing aspects of neighborhoods that attract gentrifiers (Ley, 1996). This framework suggests that gentrifiers often come from generations raised in more homogeneous suburban areas, who have become disenchanted with those environments and are now seeking out more authentic and exciting neighborhoods in central cities (Tissot, 2015).

While residential and retail gentrification each introduce unique physical changes to neighborhoods, they are generally understood to be closely interconnected (Zukin et al., 2016). Both processes are driven by similar forces of supply and demand, although the specific characteristics of these forces can differ (Chapple & Loukaitou-Sideris, 2019; Hackworth & Rekers, 2005; Meltzer & Capperis, 2017; Somashekhar, 2019; Zukin et al., 2016). On the supply side, this involves the gap between the potential value of residential or commercial properties and their current market value. On the demand side, it encompasses the tastes and preferences of gentrifiers for specific stores and amenities in these urban areas. In both frameworks, neighborhood walkability can serve as a significant draw, but understanding its impact requires a closer examination of its specific components.

Walkability is the degree to which a local neighborhood is conducive to walking. Walkability is assessed using indices that consider land use, design features (Tobin et al., 2022). Walkability is typically characterized as proximity to a mixture of amenities, proximity to transit, and intersection density leading to smaller block sizes (Ewing & Cervero, 2010; Tobin et al., 2022; U.S. Environmental Protection Agency, 2021). Proximity to a mixture of amenities refers to the closeness of essential services and facilities, such as grocery stores, schools, parks, healthcare centers, and restaurants. Research shows that residents in neighborhoods close to amenities are more likely to walk to these services and recreational areas rather than drive (Saelens et al., 2003). This convenience improves quality of life by reducing stress and boosting overall mental health (Ewing & Cervero, 2010). Additionally, nearby amenities can stimulate local economic development by increasing foot traffic to businesses (Cutler et al., 1999), encouraging retailers and investors to open shops, restaurants, and entertainment venues (Chapple & Loukaitou-Sideris, 2019; Martucci, 2024; Meltzer & Capperis, 2017).

Among the various walkability components, a mixture of amenities may be gentrification's strongest and most straightforward predictor. A frequently noted demand-side appeal of neighborhoods in the literature is the concentration of a variety of amenities. Gentrifiers often cite the availability of goods and services, such as shops, restaurants, and parks, as key reasons for choosing to live in these neighborhoods (Bridge & Dowling, 2001; Brown-Saracino, 2009; Hackworth & Rekers, 2005; Hyra, 2017; Ley, 1996; Tissot, 2015; Zukin, 2010). These amenities can increase property values as homeowners recognize the opportunity to charge higher rents. This increase in property values often leads to higher tax assessments, further escalating property values. On the supply side, the influx of new stores can attract retailers and developers who see the potential for profit in areas with previously limited options (Chapple & Loukaitou-Sideris, 2019; Hyra, 2017; Meltzer & Capperis, 2017; Zukin et al., 2016).

Proximity to transit refers to how easily residents can access public transportation options such as buses, trains, and subways. Areas with a high concentration of transit stops and routes support walkability by integrating walking with public transport trips (Cervero & Kockelman, 1997; Litman, 2021; Pucher & Renne, 2005). Greater transit density reduces the likelihood of car use, helping to decrease traffic congestion and pollution (Litman, 2021). Proximate transit options are essential for providing mobility to underserved populations, including low-income and elderly residents, thus promoting social equity (Pucher & Renne, 2005).

Gentrification scholars argue the presence of transit enhances a neighborhood's desirability, attracting higher-income residents and encouraging investment in upscale retail and entertainment options. From a demand perspective, neighborhoods near transit are more appealing to potential homebuyers and renters. Being close to transit is thought to increase foot traffic in neighborhoods, as residents prefer using public transportation instead of driving to reach these locations. As we have already discussed, such an increased pedestrian presence is argued to encourage the opening of new shops and restaurants (Chapple & Loukaitou-Sideris, 2019; Martucci, 2024; Meltzer & Capperis, 2017). On the supply side, developers and investors may see opportunities for higher returns on property investments, leading to more upscale housing developments and commercial spaces, which can further drive up costs and contribute to gentrification. Additionally, improved transit can catalyze broader urban renewal projects, including new retail and entertainment spaces (Chapple & Loukaitou-Sideris, 2019; Hyra, 2008, 2012, 2017; Meltzer & Capperis, 2017). However, being “too close” to transit can also deter gentrification due to concerns about noise pollution and congestion (Kilpatrick et al., 2007).

The relationship between proximity to transit and gentrification has been more hotly debated compared to that of other amenities associated with walkability (Zuk et al., 2018). Local communities often express concerns about how new transit infrastructure may affect their ability to remain in their neighborhoods (Jones & Ley, 2016). Residents may fear that new transit options will signal impending gentrification (Lubitow et al., 2016). Reflecting these concerns, various studies have examined gentrification occurring near transit stations (Chapple, 2009; Chava & Renne, 2022). However, empirical studies on whether neighborhoods near transit are more likely to gentrify relative to other parts of a city present mixed results.

On the one hand, a study of 14 cities found that neighborhoods adjacent to rail stations experienced disproportionate increases in property values and educational attainment (Kahn, 2007), both indicators of gentrification (Ding et al., 2016; Freeman, 2005). Similarly, research in New Jersey found that proximity to rail transit predicted home values (Deka, 2017). On the other hand, research in the Bay Area indicated that the connection between transit areas and commercial gentrification only emerged during specific periods, and this gentrification was more prevalent around established transit areas (Zuk et al., 2018). Some studies have suggested that walkability instead predicts the acceleration of an already ongoing gentrification process (Chava & Renne, 2022). A study on rail and bus stops in New York City revealed that the associations between transit proximity and income do not hold when employing more sophisticated statistical models (Barton & Gibbons, 2017). The appeal of transit proximity may also be more limited in some contexts, particularly where automobile use remains dominant among affluent groups (Cervero & Murakami, 2010).

Lastly, the density of smaller, walkable blocks and streets, often measured by intersection density, refers to the number of street intersections within a given area. High intersection density indicates a more connected, grid-like street network. Studies have shown that neighborhoods with higher intersection densities tend to promote more walking (Frank et al., 2005). This type of network shortens travel distances and provides multiple route options, unlike cul-de-sac-based designs (Ewing & Cervero, 2010). Additionally, dense intersections can serve as traffic calming measures, reducing vehicle speeds and making streets safer for pedestrians (Boarnet & Sarmiento, 1998).

Given other factors influencing walkability (Chapple & Loukaitou-Sideris, 2019; Hyra, 2008, 2012, 2017; Meltzer & Capperis, 2017), it is reasonable to suspect that higher intersection density could trigger gentrification. Neighborhoods with numerous streets enhance visibility and access to storefronts, which may have similar effects as improved proximity to transit: attracting more customers and encouraging new businesses. Furthermore, developers may invest in upscale housing and commercial properties in these intersection-rich areas to capitalize on the potential for higher returns, further fueling gentrification. However, this is largely speculation. The extent to which intersection density contributes to gentrification has been understudied. Existing research suggests an inconsistent relationship. For example, one study found that intersection density increases the likelihood of commercial gentrification in San Francisco and decreases in Los Angeles (Chapple & Loukaitou-Sideris, 2017, 2019). Meanwhile, another study in Austin indicated that more sidewalks had only a small association with gentrification (Li et al., 2015).

In summary, existing literature highlights several ways walkability could predict gentrification, primarily through proximity to amenities, proximity to transit, and intersection density. Proximity to amenities enhances residents' quality of life by providing convenient access to essential services, attracting higher-income residents, and encouraging investment in upscale retail and entertainment options. Similarly, proximity to transit increases neighborhood desirability, improving residents' mobility and attracting businesses catering to wealthier consumers. High intersection density contributes to walkability by creating a connected street network that promotes walking and enhances visibility for storefronts, thereby supporting local economic development. Despite these insights, the literature has limitations. Many studies yield mixed results regarding the direct relationship between walkability and gentrification, often focusing on specific geographic contexts or individual components rather than examining their interplay. Also, while walkability is expected to predict both residential and retail gentrification, this has not been directly tested. This study aims to provide a comprehensive analysis of how walkability, and its three elements, influence residential and retail gentrification.

## 3 Hypotheses

Based on the questions raised by the literature, we put forward the following hypotheses. First, we hypothesize that overall walkability predicts gentrification:

H1a. Higher levels of overall walkability in a neighborhood are positively associated with increased residential gentrification.

H1b. Higher levels of overall walkability in a neighborhood are positively associated with increased retail gentrification.

We also separately hypothesize how each component of walkability predicts gentrification. Based on the existing literature, we have reason to suspect that each type of gentrification similarly relates to each walkability component. To this end, we next hypothesized that the local diversity of amenities based on types of retail and entertainment predicts gentrification:

H2a. Greater diversity of amenities positively correlates with neighborhood residential gentrification.

H2b. Greater diversity of amenities positively correlates with neighborhood retail gentrification.

Also, we evaluate whether proximity to transit, the availability of bus and train services, relates to gentrification, hypothesizing:

H3a. Improved proximity to transit is positively related to increased residential gentrification.

H3b. Improved proximity to transit is positively related to increased retail gentrification.

Lastly, we hypothesize that intersection density predicts gentrification:

H4a. Higher intersection density within a neighborhood is positively associated with residential gentrification.

H4b. Higher intersection density within a neighborhood is positively associated with retail gentrification.

We test these hypotheses through analysis which is described in subsequent sections.

## 4 Data

To test our hypotheses, we used 2010 Census tracts as our unit of analysis, as these are commonly employed as neighborhood proxies in gentrification research (Ding et al., 2016; Hwang & Sampson, 2014). Our dependent variable was whether gentrification began in a tract between 2010 and 2019. We utilized two measures to create this variable.

First, we measured residential gentrification using a widely accepted measure based on the ACS (Ding et al., 2016). The ACS provides granular demographic, socioeconomic, and housing data at the neighborhood scale, based on a rolling national survey conducted annually by the U.S. Census Bureau. Unlike the decennial Census, which captures a snapshot every ten years, the ACS offers continuously updated insights through 1-year and 5-year estimates, enabling more timely and detailed analysis of population dynamics and economic trends over time. For this study we use 5-year pooled estimates for 2006-2010 and 2015-2019. To qualify as experiencing residential gentrification, a tract must meet three criteria:

1) Have a median income lower than the primary city median at the start of the intercensal period. We used ACS 2006-2010 data (U.S. Census Bureau, 2010) to identify this time frame.
2) Experience a percentage increase in college-educated residents greater than the primary city median during the intercensal period. This was determined using ACS

2006-2010 and 2015-2019 data (U.S. Census Bureau, 2010; U.S. Census Bureau, 2019).

3) Show an increase in real housing prices (rent or home value) greater than the primary city median increase during the intercensal period. This was also based on the ACS data from step 2.

This measure is effective because the combination of indicators provides a robust assessment of gentrification. Measures with too many criteria can be overly strict, while those with too few may overestimate gentrification (Barton, 2016). It has been validated against other measures of gentrification (Ding et al., 2015).

Second, we developed a measure for retail gentrification since no nationwide measure with accessible data existed. Using the EPA's Smart Location Database, in conjunction with ACS data, we defined retail gentrification as occurring in a tract that meets the following criteria:

1) Have a median income lower than the primary city median at the beginning of the intercensal period.
2) Experience a percentage increase in retail or entertainment jobs greater than the primary city median during the intercensal period. As opposed to the other steps which used ACS data, we used SLD 2013 data for period one and 2020 data for period two (U.S. Environmental Protection Agency, 2013; U.S. Environmental Protection Agency, 2020).
3) Show an increase in real housing prices (rent or home value) greater than the primary city median increase during the intercensal period.

This measure was designed to parallel the residential gentrification measure, focusing on neighborhoods with below-median incomes that see an increase in home values. The critical difference lies in emphasizing retail jobs rather than college-educated residents. Both college education and jobs indicate a shift toward affluence without necessarily signifying it outright.

Our primary predictors were drawn from the EPA's 2013 Walkability Index and its component variables. This index is constructed using data from the EPA's Smart Locations Dataset (SLD), which offers spatial measures of walkability based on standardized national methodologies (U.S. Environmental Protection Agency, 2021). Its consistency across geographies makes it a valuable tool for comparing built environment characteristics among cities. Widely applied in urban planning and policy contexts (Appleyard et al. 2024; Frost et al. 2018), the index supports decision-making related to sustainable development and community health. The walkability index at the uses four key indicators from the SLD. First is street intersection density, a weighted summation of all street intersections, with auto-oriented intersections omitted. A higher score typically suggests a well-connected street network, which could facilitate easier pedestrian movement and access to services. Second, proximity to transit stops is determined by the distance from a population-weighted Census block centroid to the nearest transit stop. This distance suggests what distance in meters the area's population may need to walk or travel to access public transportation. Third, we determined amenities, including employment mix, an entropy score of the gross number of employment types in a block group. Entropy scores range from 0 to 1, with higher values indicating a more even distribution of employment across different sectors (e.g., retail, office, industrial, etc.). The fourth is another method to determine amenities, also an entropy score, in this case the mix of households and employment. A higher score on this value indicates a more even distribution of employment and housing (U.S. Environmental Protection Agency, 2021).

The index, originally calculated at the block group level, was recalculated at the Census tract level by aggregating its component measures, ensuring comparability with other predictors. In aggregating these values, there is the risk of potential biases from over- or under-representing the block groups within the Census tracts they are being aggregated into. To mitigate this issue, we weigh the values that the most relevant factors (population, land area, employment) influence the aggregated metric. Doing so ensures that areas with larger values for the chosen weight contribute proportionally to the final metric. We detail the different weighting strategies used in Table 1. A similar strategy was used for SLD data used in the calculation of Retail gentrification.

**Table 1.** Weighing strategy used for the aggregation of SLD predictors from block to tract

| Variable | Weight | Justification |
|---|---|---|
| Street Intersection Density | ∑(Intersection Density × Total Usable Area) / ∑Total Usable Area | Intersection density measures urban connectivity and accessibility, which are inherently linked to land area (Appleyard et al., 2019). Weighting by total buildable land area (excluding water and other unbuildable terrain) ensures that larger land areas with more intersections contribute proportionally to the overall density calculation. |
| Proximity to Transit Stops | ∑(Proximity to Transit × Total Population) / ∑Total Population | The impact of proximity to transit stops is most relevant to the population served (Ewing & Cervero, 2010). Weighting by total population ensures that denser areas with higher populations influence the aggregated measure more than sparsely populated regions. |
| Households and Employment | ∑(Household and Employment Entropy × Total Employment) / ∑Total Employment | Entropy measures how well-balanced employment and households are within a given area. Weighting by total employed reflects the influence of larger employment centers on the overall balance of jobs and housing. |
| Employment mix | ∑(Employment Entropy × Total Employment) / ∑Total Employment | Like Households and Employment, this measure focuses on employment opportunities. Weighting by total employed ensures that employment-dense areas contribute appropriately to the aggregated value. |
| Jobs Within 45-Minute Auto | ∑(Jobs Accessible × Working-Age Pop.) / ∑Working-Age Pop | Accessibility metrics often target working-age populations, the primary commuting network users (Ewing & Cervero, 2010). Weighting by this group emphasizes the accessibility needs of this group, which is the most relevant demographic for these measures. |

To determine the walkability index score, we break down the values of tracts into quantiles based on each of the above indicators. Based on their quantile position, tracts are ranked on these variables from 1 to 20. These rankings are then weighted and combined to produce a final score on a scale from 1 to 20 (Chapman et al., 2021; U.S. Environmental Protection Agency, 2021).

In addition to these focal predictors, we also utilized data from the ACS and SLD to inform our other controls. We examined contemporary race and ethnicity, specifically the proportions of Black, Hispanic, and Asian residents. These variables account for the influence racial/ethnic composition is thought to have on the chance of gentrification taking place. Large Black concentrations, in particular, have been argued to reduce the chance of gentrification (Gibbons 2023; Hwang and Sampson 2014). Additionally, we included several demographic indicators found in past research to be positively or negatively associated with the onset of gentrification. The positive indicators of gentrification include the proportion of vacant housing, unemployed, older housing stock, and residents aged 60 and up. Negative indicators, meanwhile, include local population density and proportion homeowners (Chapple, 2009; Gibbons, 2023; Hwang, 2015; Hyra et al., 2020). Each of these measures was derived for 2010.

In addition to demographic data, we employed the SLD's distance decay measures to quantifying the number of jobs accessible by auto within a 45-minute travel (U.S. Environmental Protection Agency, 2021). This measure reflects employment opportunities within a 45-minute drive from the center of a Census tract, with the time-decay factor accounting for how travel time impacts proximity. Like the other SLD measures, this needed to be aggregated. We discuss the weighting strategy in Table 1.

Lastly, recognizing the importance of proximity to downtown areas for gentrification (Lee et al., 1985; Lipton, 1977; Spain, 1980), we measured the Euclidean distance of each tract from the central business district (CBD) in miles. This was calculated using centroid coordinates obtained from IPUMS (Schroeder et al., 2025). For the reader's convenience, we have summarized the variables, along with their descriptions and data sources, in Table 2.

**Table 2.** Variable definitions, data sources, and temporal coverage

| Category | Variable | Description | Source | Spatial Scale | Temporal Coverage |
|---|---|---|---|---|---|
| Dependent Variables | Residential Gentrification (Binary) | Tract classified as gentrified if (1) median income < city median in 2010; (2) % college-educated residents increased more than city median between 2010–2019; and (3) real housing values increased more than city median during same period. | U.S. Census Bureau, 2010; U.S. Census Bureau, 2019 | Census Tract | 2010–2019 |
| | Retail Gentrification (Binary) | Tract classified as gentrified if (1) median income < city median in 2010; (2) % change in retail/entertainment jobs > city median between 2013–2020; and (3) real housing values increased more than city median during same period. | U.S. Environmental Protection Agency, 2013; U.S. Environmental Protection Agency, 2020; U.S. Census Bureau, 2010; U.S. Census Bureau, 2019 | Census Tract | 2010–2020 |
| Key Predictors (EPA Walkability Index Components) | Intersection Density | Weighted average street intersection density (intersections per square mile, auto-oriented intersections excluded). Weighted by buildable land area. | U.S. Environmental Protection Agency, 2013 | Block Group (aggregated to Tract) | 2013 |
| | Proximity to Transit | Distance from population-weighted block group centroid to nearest transit stop (meters). Weighted by population to create tract-level measure. | U.S. Environmental Protection Agency, 2013 | Block Group (aggregated to Tract) | 2013 |
| | Employment Mix | Entropy index (0–1) measuring mix of employment types (retail, office, industrial, service, etc.); higher values indicate greater diversity. | U.S. Environmental Protection Agency, 2013 | Block Group (aggregated to Tract) | 2013 |
| | Jobs–Housing Mix | Entropy index (0–1) of jobs-to-households balance within a tract; higher values indicate more even mix. | U.S. Environmental Protection Agency, 2013 | Block Group (aggregated to Tract) | 2013 |
| | Walkability Index (Composite) | Composite score (1–20) combining quantile ranks of the four components above, weighted per EPA methodology. | U.S. Environmental Protection Agency, 2013 | Census Tract | 2013 |
| Additional Built Environment Controls | Job Accessibility by Auto | Weighted number of jobs reachable within a 45-minute auto commute, adjusted for distance decay. | U.S. Environmental Protection Agency, 2013 | Block Group (aggregated to Tract) | 2013 |
| | Distance to Central Business District (CBD) | Euclidean distance from tract centroid to primary city's CBD (miles). | IPUMS NHGIS (Schroeder et al., 2025) | Census Tract | 2010 |
| Demographic Controls | Percent Black Residents | Proportion of tract residents identifying as Black. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| | Percent Hispanic Residents | Proportion of tract residents identifying as Hispanic. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| | Percent Asian Residents | Proportion of tract residents identifying as Asian. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| | Percent Vacant Housing Units | Share of total housing units that are vacant. | U.S. Census Bureau, 2010 | Census Tract | 2010 |

| | | | | |
|---|---|---|---|---|
| Percent Unemployed | Share of the labor force unemployed. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| Percent Owner-Occupied Housing | Share of occupied housing units that are owner-occupied. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| Percent Residents Aged 60 and Over | Share of population aged 60 years and above. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| Percent Housing Units Built Before 1980 | Share of housing stock constructed before 1980. | U.S. Census Bureau, 2010 | Census Tract | 2010 |
| Population Density (2013) | Total population per square mile of buildable land area. | U.S. Census Bureau, 2010 | Census Tract | 2010 |

## 5 Analysis

In this study we conduct a comprehensive analysis to explore the relationship between walkability and gentrification. First, we provide descriptive statistics to outline the socio-economic and demographic characteristics of the Census tracts under examination, highlighting key variables such as racial composition, unemployment rates, and proximity to public transit. Following this, we perform a bivariate analysis to assess the correlation between walkability and both residential and retail gentrification. This will include using GIS to visually assess the overlap of gentrifying neighborhoods and walkability scores. Finally, we conduct multivariate models to estimate whether walkability, and its components, predict residential or retail gentrification with all other relevant controls in place. For this estimation, we use hierarchical linear modeling (HLM) to account for nested data structure of Census tracts within cities. This allows us to control for various confounding factors, enabling us to assess the impact of walkability and its components on the likelihood of both types of gentrification (Luke, 2004).

## 6 Results

First, we describe our data in Table 3. Our analysis reveals that a comparable share of tracts experience both types of gentrification, with 15.9 percent undergoing residential gentrification and 15.4 percent experiencing retail gentrification nationwide. Regarding racial and ethnic demographics, the average tract has a majority White population at 55.2 percent, followed by Hispanic residents at 19.2 percent, Black residents at 16.9 percent, and Asian residents at 5.9 percent. The typical tract is located approximately 4878.64 meters (3.031 miles) from the city center. The average walkability index score is 12.27 out of 20, indicating the average tract has a modest level of walkability. Breaking down the walkability index to its indicators, the average tract contains about 80.093 intersections per square mile. Furthermore, the average distance from the population center within a tract to the nearest public transit stop is about 207.55 meters (about 680 feet). It is important to note that proximity to transit varies substantially by city, with a standard deviation of 243.108, which is greater than the average score. Regarding employment diversity, the average tract has an employment entropy score of 0.547, suggesting moderate diversity in job types. The housing and employment entropy score is 0.558. Additionally, when considering the built environment, we found in the average tract over 176,915.40 jobs proximate within a 45-minute drive.

We examined how the predictors differ in Census tracts experiencing residential and retail gentrification. About 50.1 percent of residential gentrifying tracts overlap with retail gentrifying tracts and 51.5 percent overlap with residential gentrifying tracts. The differences in predictors between gentrifying tracts and all tracts are modest. Walkability scores are slightly higher in gentrifying tracts (12.764 for residential and 12.622 for retail) than the overall score of 12.266. Intersection density is also slightly higher in gentrifying areas (87.654 for residential and 85.282 for retail) than the overall score of 80.093. Gentrifying tracts are more racially/ethnically diverse, with 20.2 percent of Black residents in residential and 20.6 percent in retail gentrifying areas, compared to 16.9 percent overall. They are also slightly more economically disadvantaged, with 6.4 percent unemployment in residential areas and 6.5 percent in retail gentrifying areas, compared to 5.7 percent overall.

**Table 3.** Descriptive values

| | Overall | | Residential Gentrification | | Retail Gentrification | |
|---|---|---|---|---|---|---|
| Statistic | Mean | St. Dev. | Mean | St. Dev. | Mean | St. Dev. |
| Outcomes | | | | | | |
| Residential Gentrification | 0.159 | *0.365* | 1 | *0* | 0.515 | *0.5* |
| Retail Gentrification | 0.154 | *0.361* | 0.501 | *0.5* | 1 | *0* |
| Walkability Index | 12.266 | *3.013* | 12.764 | *2.915* | 12.622 | *2.859* |
| Walkability Index Components | | | | | | |
| Intersection Density | 80.093 | *54.13* | 87.654 | *55.19* | 85.282 | *53.4* |
| Distance from Transit Stop | 208 | *243.108* | 214.791 | *236.25* | 211.542 | *235.397* |
| Employment Type Entropy | 0.55 | *0.206* | 0.559 | *0.205* | 0.553 | *0.202* |
| Household and Employment Entropy | 0.56 | *0.184* | 0.576 | *0.186* | 0.572 | *0.181* |
| Racial Composition | | | | | | |
| Percent White | 0.552 | *0.312* | 0.477 | *0.309* | 0.468 | *0.314* |
| Percent Black | 0.169 | *0.254* | 0.202 | *0.27* | 0.206 | *0.277* |
| Percent Asian | 0.059 | *0.1* | 0.058 | *0.104* | 0.058 | *0.104* |
| Percent Hispanic | 0.192 | *0.233* | 0.233 | *0.257* | 0.24 | *0.262* |
| Percent Unemployed | 0.057 | *0.035* | 0.064 | *0.038* | 0.065 | *0.038* |
| Percent Professional | 0.17 | *0.1* | 0.137 | *0.082* | 0.135 | *0.083* |
| Percent Vacant Households | 0.13 | *0.171* | 0.156 | *0.172* | 0.15 | *0.163* |
| Percent Older Housing | 0.775 | *0.336* | 0.831 | *0.314* | 0.819 | *0.313* |
| Percent Homes Owned | 0.588 | *0.244* | 0.463 | *0.236* | 0.478 | *0.231* |
| Percent Aged 60 and Up | 0.172 | *0.088* | 0.166 | *0.093* | 0.164 | *0.088* |
| Central Business District | 4,878.64 | *5,012.14* | 4,110.84 | *4,216.50* | 4,340.83 | *4,419.82* |
| Population Density | 8,256.51 | *14,510.56* | 10,147.07 | *16,488.63* | 10,484.64 | *18,045.89* |
| Jobs Within 45-Minute Auto | 176,915.40 | *183,063.10* | 193,995.30 | *191,484.60* | 190,187.10 | *190,468.50* |
| Region | | | | | | |
| Northeast | 0.197 | *0.398* | 0.194 | *0.395* | 0.195 | *0.396* |
| Midwest | 0.222 | *0.416* | 0.208 | *0.406* | 0.2 | *0.4* |
| South | 0.315 | *0.465* | 0.326 | *0.469* | 0.335 | *0.472* |
| West | 0.265 | *0.441* | 0.272 | *0.445* | 0.27 | *0.444* |
| | 41,618 | | 6,600 | | 6,418 | |

Next, we more closely examined the relationship between walkability and gentrification. Nationwide, residential and retail gentrification shows a moderate correlation of 0.416, a statistically significant value (*<p 0.050). Figure 1 illustrates this relationship in San Diego, where the overlap between residential and retail gentrifying tracts is extensive, though not exhaustive. Both types of gentrifying areas are primarily located in the southern regions of the city, which are older and more developed, suggesting that walkable neighborhoods are more likely to undergo gentrification. To further investigate this, we visualized the walkability index scores for San Diego in Figure 2. The map confirms that areas with higher walkability scores are predominantly situated in the city's southern parts, reinforcing the likelihood of a link between walkability and gentrification. We turn next to our HLM models to establish whether they are related, all things being equal.

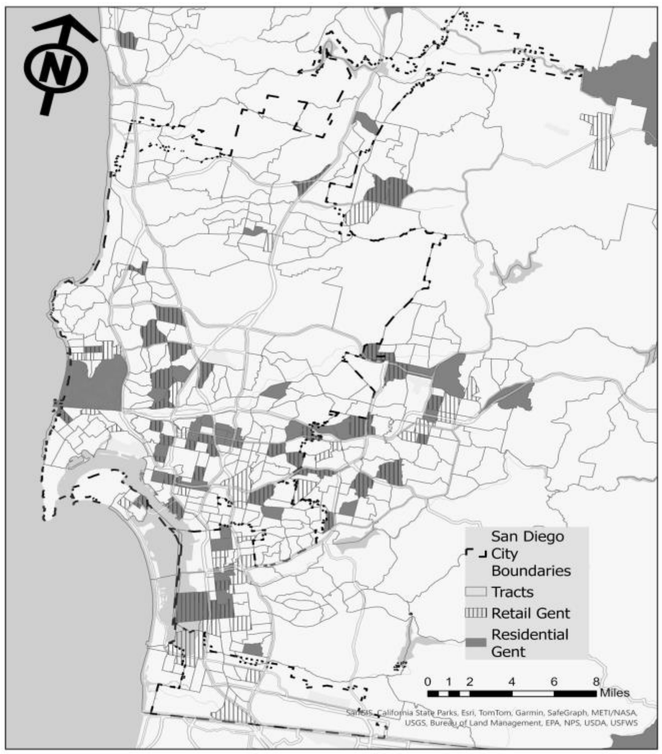


**Figure 1.** Residential gentrification and retail gentrification in San Diego; Sources: 2006–2010 and 2015-2019 ACS (U.S. Census Bureau, 2010; U.S. Census Bureau, 2019), 2013 and 2020 SLD (U.S. Environmental Protection Agency, 2013; U.S. Environmental Protection Agency, 2020)

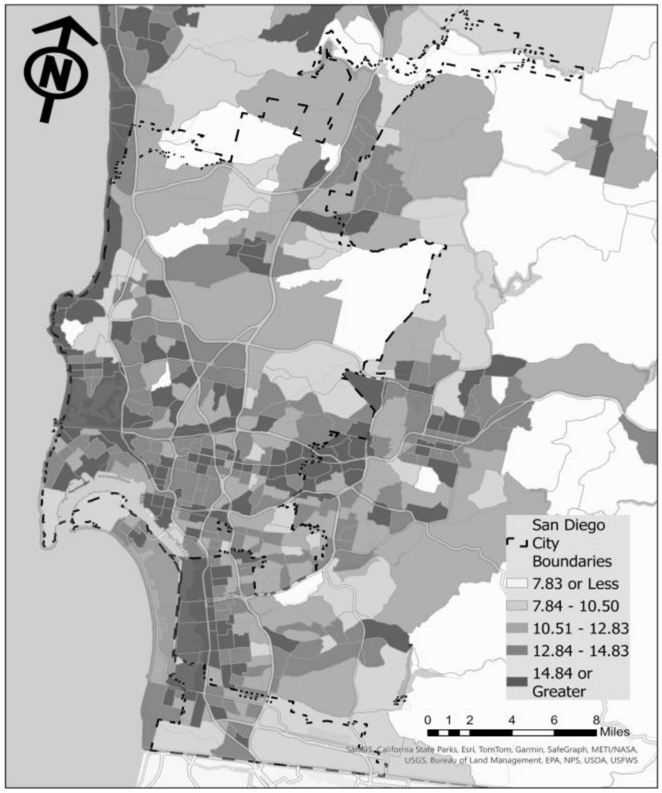


**Figure 2.** Walkability scores in San Diego; Source: SLD (U.S. Environmental Protection Agency, 2013)

Our HLM models, reported in Table 4, show that walkability is positively associated with residential and retail gentrification. Specifically, each point increase in the walkability index raises the likelihood of residential gentrification by 1.7 percent (1-1.017 X 100) and retail gentrification by 1.4 percent. Breaking down the walkability components, we find that intersection density increases the likelihood of residential gentrification, with each additional intersection raising the chance by 0.8 percent. However, it has no significant impact on retail gentrification. Employment entropy also predicts both types of gentrification, with each point raising residential gentrification by 1 percent and retail gentrification by 0.7 percent. The entropy of housing and employment shows no significant relationship with either form of gentrification. Meanwhile, each meter further from transit increases the likelihood of residential gentrification by 0.7 percent and retail gentrification by 0.6 percent. In other words, proximity to transit decreases the chance of gentrification.

When proximity to transit was modeled using distance bands, with tracts within 100 meters as the reference group, the odds of residential gentrification gradually increased with distance from transit. Reported in Table 5, we find that tracts both 200-300 meters and 300-400 meters away from a stop had 0.4 percent higher chance of residential gentrification, respectively. The effect was strongest beyond 500 meters, where tracts showed 0.8 percent greater chance. A similar pattern was found for retail gentrification. Compared to tracts within 100 meters of transit, those 200-300 meters away had 0.7 percent greater chance, those 300-400 meters away had 0.4 percent greater chance, and those more than 500 meters away had 0.5 percent greater chance.

**Table 4.** HLM odds ratios (N = 41,618)

| | Residential Gentrification 1 | Retail Gentrification 2 | Residential Gentrification 3 | Retail Gentrification 4 |
|---|---|---|---|---|
| Walkability Index | 1.017*** | 1.014*** | | |
| | (1.013, 1.020) | (1.010, 1.018) | | |
| Walkability Components | | | | |
| Intersection Density | | | 1.008*** | 1.004 |
| | | | (1.004, 1.012) | (1.000, 1.007) |
| Distance from Transit Stop | | | 1.007*** | 1.006** |
| | | | (1.003, 1.011) | (1.002, 1.009) |
| Employment Type Entropy | | | 1.010*** | 1.007** |
| | | | (1.005, 1.015) | (1.002, 1.012) |
| Household and Employment Entropy | | | 1.002 | 1.004 |
| | | | (0.997, 1.007) | (1.000, 1.009) |
| Racial Composition | | | | |
| Percent Black | 0.989*** | 0.996 | 0.990*** | 0.997 |
| | (0.984, 0.994) | (0.991, 1.001) | (0.985, 0.995) | (0.992, 1.002) |
| Percent Hispanic | 0.993** | 1.002 | 0.993* | 1.002 |
| | (0.987, 0.998) | (0.996, 1.007) | (0.988, 0.999) | (0.997, 1.008) |
| Percent Asian | 1.001 | 1.004* | 1.002 | 1.005* |
| | (0.997, 1.005) | (1.000, 1.008) | (0.997, 1.006) | (1.001, 1.009) |
| Percent Unemployed | 1.001 | 1.007** | 1.001 | 1.007** |
| | (0.997, 1.005) | (1.002, 1.011) | (0.997, 1.005) | (1.003, 1.011) |
| Percent Professional | 0.956*** | 0.959*** | 0.956*** | 0.960*** |
| | (0.951, 0.961) | (0.954, 0.964) | (0.951, 0.961) | (0.955, 0.965) |
| Percent Vacant Households | 1.003 | 0.999 | 1.003 | 0.999 |
| | (0.999, 1.007) | (0.995, 1.003) | (0.999, 1.007) | (0.995, 1.003) |
| Percent Older Housing | 0.993** | 0.993** | 0.994* | 0.995* |
| | (0.988, 0.998) | (0.989, 0.998) | (0.990, 0.999) | (0.990, 1.000) |
| Percent Homes Owned | 0.923*** | 0.939*** | 0.923*** | 0.939*** |
| | (0.918, 0.927) | (0.935, 0.943) | (0.918, 0.927) | (0.935, 0.944) |
| Percent Aged 60 and Up | 1.014*** | 1.009*** | 1.014*** | 1.009*** |
| | (1.010, 1.018) | (1.005, 1.013) | (1.010, 1.018) | (1.005, 1.013) |
| Central Business District | 0.975*** | 0.982*** | 0.975*** | 0.982*** |
| | (0.971, 0.979) | (0.977, 0.986) | (0.971, 0.980) | (0.977, 0.986) |
| Population Density | 0.998 | 1.010*** | 0.998 | 1.010*** |
| | (0.993, 1.003) | (1.004, 1.015) | (0.992, 1.003) | (1.005, 1.016) |
| 45 Minutes from Work | 1.011*** | 0.997 | 1.012*** | 0.998 |
| | (1.004, 1.017) | (0.991, 1.003) | (1.006, 1.019) | (0.992, 1.005) |
| Region (ref. Northeast) | | | | |
| Midwest | 1.013*** | 1.009*** | 1.013*** | 1.009*** |
| | (1.007, 1.018) | (1.004, 1.014) | (1.008, 1.018) | (1.004, 1.014) |
| South | 1.022*** | 1.022*** | 1.021*** | 1.021*** |
| | (1.016, 1.028) | (1.016, 1.027) | (1.015, 1.027) | (1.015, 1.027) |
| West | 1.011*** | 1.011*** | 1.012*** | 1.012*** |
| | (1.006, 1.017) | (1.006, 1.017) | (1.006, 1.017) | (1.006, 1.018) |
| Constant | 1.175*** | 1.170*** | 1.175*** | 1.170*** |
| | (1.170, 1.179) | (1.165, 1.175) | (1.170, 1.179) | (1.165, 1.174) |
| Akaike Inf. Crit. | 31,485.46 | 31,110.48 | 31,527.48 | 31,154.00 |

Note: *<p 0.050. **<p 0.010. ***<p 0.001; all predictors scaled.

Other predictors reveal some differences between types of gentrification, which are summarized in Models 1 and 2 in Table 4. Specifically, the percentage of Black and Hispanic residents is negatively associated with residential gentrification (−1.1 percent and −0.7 percent, respectively) but has no significant relationship with retail gentrification. Unemployment has no significant association with residential gentrification but increases the likelihood of retail gentrification by 0.7 percent. The number of jobs within a 45-minute drive is positively linked to residential gentrification, with a 1.1 percent increase in likelihood for each point, but not to retail gentrification. Other predictors show consistent patterns for both types of gentrification. For instance, distance from the central business district has a negative relationship with both. The share of older adults also influences both types of gentrification. Lastly, neighborhoods in the southern region are more likely to experience both residential and retail gentrification.

**Table 5.** HLM odds ratios dichotomous proximity (N = 41,618)

| | Residential Gentrification | Retail Gentrification |
|---|---|---|
| | 5 | 6 |
| Walkability Components | | |
| Intersection Density | 1.008*** | 1.003 |
| | (1.004, 1.012) | (0.999, 1.007) |
| Employment Type Entropy | 1.010*** | 1.007** |
| | (1.005, 1.015) | (1.002, 1.012) |
| Household and Employment Entropy | 1.002 | 1.005 |
| | (0.997, 1.007) | (1.000, 1.009) |
| Distance from Transit Stop (ref. less than 100 meters) | | |
| 100-200 meters | 1.002 | 1.005* |
| | (0.998, 1.006) | (1.001, 1.009) |
| 200-300 meters | 1.004* | 1.007** |
| | (1.001, 1.008) | (1.003, 1.010) |
| 300-400 meters | 1.004* | 1.004* |
| | (1.000, 1.008) | (1.001, 1.008) |
| 400-500 meters | 1.003 | 1.006** |
| | (0.999, 1.006) | (1.002, 1.009) |
| Greater than 500 meters | 1.008*** | 1.005** |
| | (1.004, 1.012) | (1.002, 1.009) |
| Racial Composition | | |
| Percent Black | 0.990*** | 0.997 |
| | (0.985, 0.995) | (0.992, 1.002) |
| Percent Hispanic | 0.993* | 1.002 |
| | (0.988, 0.998) | (0.997, 1.007) |
| Percent Asian | 1.002 | 1.005* |
| | (0.997, 1.006) | (1.001, 1.009) |
| Percent Unemployed | 1.001 | 1.007** |
| | (0.997, 1.005) | (1.003, 1.011) |
| Percent Professional | 0.956*** | 0.959*** |
| | (0.951, 0.961) | (0.954, 0.964) |
| Percent Vacant Households | 1.003 | 0.999 |
| | (0.999, 1.007) | (0.995, 1.003) |
| Percent Older Housing | 0.994* | 0.994* |
| | (0.989, 0.999) | (0.990, 0.999) |
| Percent Homes Owned | 0.923*** | 0.940*** |
| | (0.918, 0.927) | (0.935, 0.944) |
| Percent Aged 60 and Up | 1.014*** | 1.009*** |
| | (1.010, 1.018) | (1.005, 1.013) |
| Central Business District | 0.975*** | 0.982*** |
| | (0.971, 0.980) | (0.977, 0.986) |
| Population Density | 0.998 | 1.010*** |
| | (0.992, 1.003) | (1.005, 1.015) |
| 45 Minutes from Work | 1.012*** | 0.997 |
| | (1.005, 1.018) | (0.991, 1.003) |
| Region | | |
| Midwest | 1.013*** | 1.009*** |
| | (1.008, 1.018) | (1.004, 1.015) |
| South | 1.022*** | 1.022*** |
| | (1.016, 1.027) | (1.016, 1.028) |
| West | 1.012*** | 1.012*** |
| | (1.006, 1.017) | (1.007, 1.018) |
| Constant | 1.175*** | 1.170*** |
| | (1.170, 1.179) | (1.165, 1.174) |
| Akaike Inf. Crit. | 31,572.810 | 31,194.300 |
| Bayesian Inf. Crit. | 31,797.350 | 31,418.840 |

Note: *<p 0.050. **<p 0.010. ***<p 0.001; all predictors scaled.

## 7 Conclusion

This study examined the relationship between walkability and gentrification, offering insights into how different walkability components influence residential and retail gentrification. Our findings support the first two hypotheses, showing that higher levels of overall walkability are positively associated with residential (H1a) and retail (H1b) gentrification. Neighborhoods with higher walkability scores tend to experience greater gentrification in both types of areas. This supports the idea that walkable neighborhoods, with their improved pedestrian infrastructure and proximity to transit, attract higher-income residents and retail investments (Hyra, 2017; Tissot, 2015). These results highlight the broader appeal of walkability as a key factor in driving neighborhood investment. Subsequent hypotheses reveal a more nuanced relationship between individual walkability components and gentrification.

Our analysis supports the next two hypotheses, showing that greater diversity of amenities positively correlates with residential (H2a) and retail (H2b) gentrification. Neighborhoods with a wider variety of amenities are more likely to experience gentrification, as these services attract higher-income residents and retailers. This aligns with existing literature highlighting the role of mixed-use environments in driving neighborhood change (Leyden, 2003; Zukin, 2010). However, the mix of retail and housing did not yield significant results for either type of gentrification, possibly because the presence of housing and retail in proximity may not translate into higher demand for either. Instead, other factors, such as the quality and proximity of amenities, may play a more critical role in attracting gentrifiers.

Our results did not support the hypothesis that greater public proximity to transit positively relates to residential (H3a) and retail (H3b) gentrification. Both the continuous and categorical proximity measures indicate that tracts immediately adjacent to transit stops experienced less residential and retail gentrification than those slightly farther away. This contradicts expectations that closeness to public transit makes neighborhoods more attractive to gentrifiers seeking ease of commute and employment opportunities (Chapple & Loukaitou-Sideris, 2019; Hyra, 2008, 2012, 2017; Meltzer & Capperis, 2017). However, the negative association may reflect that being “too close” to transit has been seen as unappealing due to noise, congestion, and other environmental disamenities (Kilpatrick et al., 2007). The increasing likelihood of gentrification beyond 100 meters suggests a spatially diffused process, not a point-based effect centered on the transit stop. We suspect that gentrification is spreading to nearby residential areas that offer both transit access and a quieter environment. However, we lack sufficient data to confirm this. Since transit proximity was negatively linked to gentrification and walkability positively linked, neighborhoods most likely to gentrify are those with easy driving access and walkable environments.

The negative association between transit proximity and gentrification observed in this study may reflect limitations in how transit proximity was measured. For instance, due to data restrictions, bus and train stations were not analyzed separately, nor were transit routes examined in detail, factors that could influence the strength and direction of the relationship. Similarly, we were unable to distinguish between walk-to-transit and park-and-ride stations, which may have different associations with neighborhood change. In addition, we lacked information on key transit system characteristics such as service frequency, reliability, and network connectivity, all of which could significantly shape how residents experience and respond to available transit. These findings point to the need for caution in interpreting the role of transit proximity in gentrification, as its effects may be more spatially and contextually variable than the national-level pattern we identified suggests.

We found partial support for our hypotheses regarding intersection density. Higher intersection density was positively associated with residential gentrification (H4a), but not retail gentrification (H4b). Neighborhoods with higher intersection density tend to experience residential gentrification, likely due to more connected and walkable street networks. However, this did not extend to retail gentrification, suggesting that walkability through street connectivity may not be as crucial for retail gentrification as previously thought. This may reflect a more auto-oriented pattern of retail gentrification, where people drive to a walkable area, similar to the experience of a shopping mall, rather than rely on connected street networks. This could also reflect limitations in using intersection density as a proxy for pedestrian accessibility. Either way, these results call for a more nuanced approach to evaluating the connectedness of neighborhoods and its impact on gentrification.

We turn back to the key concern motivating this study: while walkable neighborhoods can enhance a neighborhood's appeal, they may also make them less affordable to the original, often lower-income, residents. Our findings suggest that the impact of walkability on gentrification depends on which component of walkability is being measured. Specifically, neighborhoods with a greater variety of amenities, especially in retail and entertainment, are more likely to experience gentrification. We suspect this is because such amenities attract higher-income residents and draw retailers in, increasing property values and rents. Such diversity of amenities creates a vibrant, attractive environment that appeals to higher-income residents seeking convenience and retailers looking to capitalize on increased foot traffic and demand. On the other hand, proximity to public transit appears less likely to trigger this type of change directly. At the same time, higher intersection density seems to influence residential changes more than retail shifts. Ultimately, mixed-use environments with a blend of amenities are particularly conducive to gentrification, but without policies to protect vulnerable residents, they can lead to increased displacement.

These findings underscore the need for urban planning strategies that carefully balance walkability with affordable housing and displacement protections. Urban development policies should recognize that promoting walkable, mixed-use environments, while beneficial in many respects, can exacerbate displacement if not accompanied by measures to protect vulnerable populations. Efforts to enhance walkability in low-income neighborhoods must be paired with strong anti-displacement safeguards to ensure that these improvements do not inadvertently lead to exclusion or residential turnover. Without such protection, areas that achieve high walkability standards may paradoxically become sites of growing inequality, where the benefits of urban investment bypass the very communities they are meant to serve. Future research should continue to explore the complexities of gentrification, examining how the various components of walkability interact with broader economic, social, and policy factors to influence the gentrification process and its effects on long-time residents.

This study provides a nuanced understanding of gentrification in the US context. Gentrifiers in this setting are more auto-oriented, and relatively transit independent, but still valuing walkability, mixed use, and a respectable degree of regional centrality. While many perceptions of gentrification are that it occurs in the inner city, transit dependent areas, our findings tell a more complex story, including that transit is possibly a weaker prerequisite for gentrification than previously thought. Nevertheless, there remains a preference for walkable, mixed use areas for both residential and retail gentrification, based on the findings associated with the walkability index. For retail gentrification, however, intersection density, often associated with walkability, is not significant, while mixed use through employment entropy is significant.

While our study offers valuable insights into the relationship between walkability and gentrification, several limitations must be acknowledged. First, the cross-sectional nature of our data limits our ability to establish causal relationships between walkability and gentrification. Longitudinal studies would be needed to confirm whether increased walkability leads to gentrification. Additionally, our study focused on Census tracts as the unit of analysis, which may overlook finer-grained neighborhood dynamics. However, such a smaller grained approach would be difficult given the limitations of socio-economic predictors at that scale. Another limitation is that we contextualize walkability as a purely built environment, which overlooks the more social aspects of walkability, not to mention how individuals in neighborhoods perceive walkability (Adkins et al., 2017). A high walkability score does not necessarily correspond to high levels of pedestrian activity. Future research should also consider the potential influence of self-selection, where individuals choose to live in neighborhoods that align with their preferred transportation modes, such as walking, which may mediate the relationship between walkability and gentrification. Furthermore, while we considered a broad range of demographic controls, we did not explore the intersectionality of race and ethnicity underlying gentrification, which could be an important area for future research, especially given the role of race in displacement (Richardson et al., 2019). Additionally, distinguishing between older walkable neighborhoods and those that have recently undergone walkability-oriented interventions could help clarify whether the timing and origin of walkable design influence gentrification patterns differently.

Ultimately, walkability, particularly mixed land uses and proximity to downtown, is strongly associated with both residential and retail gentrification. This finding aligns with earlier studies (Lee et al., 1985; Lipton, 1977; Spain, 1980), but the absence of a strong link to transit suggests a distinct form of gentrification specific to auto-oriented contexts like the United States. These findings contribute to a deeper understanding of the complex dynamics that drive neighborhood change and offer important insights for policymakers aiming to balance the benefits of walkability with the potential risks of gentrification. Further research is needed to explore the causal mechanisms behind these relationships and identify strategies to mitigate displacement while promoting sustainable urban development.

## Author contribution

The authors confirm their contribution to the paper as follows: dataset construction and data analysis: J. Gibbons; data collection: B. Appleyard; manuscript drafting: J. Gibbons and B. Appleyard.

## References


Abu-Luhgod, J. L. (1999). *New York, Chicago, Los Angeles: America's global cities*. University of Minnesota Press.

Adkins, A., Makarewicz, C., Scanze, M., Ingram, M., & Luhr, G. (2017). Contextualizing walkability: Do relationships between built environments and walking vary by socioeconomic context? *Journal of the American Planning Association*, *83*(3), 296–314. https://doi.org/10.1080/01944363.2017.1322527

Appleyard, B., Honey, M., Ewing, R., Brewer, S., Ameli, H., Tian, G., & Kalantari, H. (2024). *Quantification methodology and tool for calculating indirect (TOD/land use) effects/benefits of transit investments*. California Air Resources Board. https://docs.google.com/document/u/1/d/10q0WxdgH8NxwwvL-1gSllpxReIX1vPXQvMTN8JfshFc/edit?usp=sharing&urp=gmail_link&usp=embed_facebook

Appleyard, B. S., Frost, A. R., & Allen, C. (2019). Are all transit stations equal and equitable? Calculating sustainability, livability, health, & equity performance of smart growth & transit-oriented-development (TOD). *Journal of Transport & Health*, *14*, 100584. https://doi.org/10.1016/j.jth.2019.100584

Assis, R. F. D., Felipe Grangeiro Loureiro, C., Figueiredo Sampaio Freitas, C., & Timms, P. (2024). Transport-induced gentrification in Latin America: An urban conflict arising from accessibility improvements. *Transportation Research Part D: Transport and Environment*, *134*, 104352. https://doi.org/10.1016/j.trd.2024.104352

Barton, M. S. (2016). An exploration of the importance of the strategy used to identify gentrification. *Urban Studies*, *53*(1), 92–111. https://doi.org/10.1177/0042098014561723

Barton, M. S., & Gibbons, J. R. (2017). A stop too far: How does public transportation concentration influence neighbourhood median household income? *Urban Studies*, *54*(2), 538–554. https://doi.org/10.1177/0042098015593462

Bereitschaft, B. (2019). Neighborhood walkability and housing affordability among U.S. urban areas. *Urban Science*, *3*(1), 11. https://doi.org/10.3390/urbansci3010011

Boarnet, M. G., & Sarmiento, S. (1998). Can land-use policy really affect travel behaviour? A study of the link between non-work travel and land-use characteristics. *Urban Studies*, *35*(7), 1155–1169. https://doi.org/10.1080/0042098984538

Bridge, G., & Dowling, R. (2001). Microgeographies of retailing and gentrification. *Australian Geographer*, *32*(1), 93–107. https://doi.org/10.1080/00049180020036259

Brown-Saracino, J. (2009). *A neighborhood that never changes: Gentrification, social preservation and the search for authenticity*. University of Chicago Press.

Cervero, R., & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Part D: Transport and Environment*, *2*(3), 199–219. https://doi.org/10.1016/S1361-9209(97)00009-6

Cervero, R., & Murakami, J. (2010). Effects of built environments on vehicle miles traveled: Evidence from 370 US urbanized areas. *Environment and Planning A: Economy and Space*, *42*(2), 400–418. https://doi.org/10.1068/a4236

Chapman, J., Fox, E. H., Bachman, W., Frank, L. D., Thomas, J., & Reyes, A. R. (2021, June). *Smart location database technical documentation and user guide version 3.0*. U.S. Environmental Protection Agency.

Chapple, K. (2009). *Mapping susceptibility to gentrification: The early warning toolkit*. The Center for Community Innovation (CCI).

Chapple, K., & Loukaitou-Sideris, A. (2017). *UTC – Transit oriented development and commercial gentrification: Exploring the linkages* (UC CONNECT). University of California Center for Economic Competitiveness in Transportation.

Chapple, K., & Loukaitou-Sideris, A. (2019). Commercial gentrification and displacement. In *Transit-oriented displacement or community dividends?: Understanding the effects of smarter growth on communities*. MIT Press. https://doi.org/10.7551/mitpress/11300.001.0001

Chava, J., & Renne, J. L. (2022). Transit-induced gentrification or vice versa? A study of neighborhoods around light rail stations from 1970–2010. *Journal of the American Planning Association*, *88*(1), 44–54. https://doi.org/10.1080/01944363.2021.1920453

Cutler, D., Glaeser, E., & Vigdor, J. (1999). The rise and decline of the American ghetto. *Journal of Political Economy*, *107*(3), 455–506. https://doi.org/10.1086/250069

Deka, D. (2017). Benchmarking gentrification near commuter rail stations in New Jersey. *Urban Studies*, *54*(13), 2955–2972. https://doi.org/10.1177/0042098016664830

Ding, L., Hwang, J., & Divringi, E. (2015). *Gentrification and residential mobility in Philadelphia* (Discussion papers). Federal Reserve Bank of Philadelphia.

Ding, L., Hwang, J., & Divringi, E. (2016). Gentrification and residential mobility in Philadelphia. *Regional Science and Urban Economics*, *61*, 38–51. https://doi.org/10.1016/j.regsciurbeco.2016.09.004

Easton, S., Lees, L., Hubbard, P., & Tate, N. (2020). Measuring and mapping displacement: The problem of quantification in the battle against gentrification. *Urban Studies*, *57*(2), 286–306. https://doi.org/10.1177/0042098019851953

Ewing, R., & Cervero, R. (2010). Travel and the built environment: A meta-analysis. *Journal of the American Planning Association*, *76*(3), 265–294. https://doi.org/10.1080/01944361003766766

Ewing, R., Schmid, T., Killingsworth, R., Zlot, A., & Raudenbush, S. (2003). Relationship between urban sprawl and physical activity, obesity, and morbidity. *American Journal of Health Promotion: AJHP*, *18*(1), 47–57. https://doi.org/10.4278/0890-1171-18.1.47

Felder, M. (2020). Strong, weak and invisible ties: A relational perspective on urban coexistence. *Sociology*, *54*(4), 675–692. https://doi.org/10.1177/0038038519895938

Fonda, S. J., Wallace, R. B., & Herzog, A. R. (2001). Changes in driving patterns and worsening depressive symptoms among older adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *56*(6), S343–351. https://doi.org/10.1093/geronb/56.6.s343

Frank, L. D., Andresen, M. A., & Schmid, T. L. (2004). Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine*, *27*(2), 87–96. https://doi.org/10.1016/j.amepre.2004.04.011

Frank, L. D., Appleyard, B. S., Ulmer, J. M., Chapman, J. E., & Fox, E. H. (2021). Comparing walkability methods: Creation of street smart walk score and efficacy of a code-based 3D walkability index. *Journal of Transport & Health*, *21*, 101005. https://doi.org/10.1016/j.jth.2020.101005

Frank, L. D., Schmid, T. L., Sallis, J. F., Chapman, J., & Saelens, B. E. (2005). Linking objectively measured physical activity with objectively measured urban form: Findings from SMARTRAQ. *American Journal of Preventive Medicine*, *28*(2 Suppl 2), 117–125. https://doi.org/10.1016/j.amepre.2004.11.001

Freeman, L. (2005). Displacement or succession?: Residential mobility in gentrifying neighborhoods. *Urban Affairs Review*, *40*(4), 463–491. https://doi.org/10.1177/1078087404273341

Frost, A. R., Appleyard, B., Gibbons, J. R., & Ryan, S. (2018). Quantifying the sustainability, livability, and equity performance of urban and suburban places in California. *Transportation Research Record: Journal of the Transportation Research Board*, *2672*(3), 036119811879138. https://doi.org/10.1177/0361198118791382

Gibbons, J. (2023). Examining the long-term influence of New Deal era redlining on contemporary gentrification. *Urban Studies*, *60*(14), 2816–2834. https://doi.org/10.1177/00420980231160469
Gibbons, J. R. (2020). Measuring gentrification's association with perceived housing unaffordability: A Philadelphia case study. *Housing Policy Debate*, 31(2), 306–325. https://doi.org/10.1080/10511482.2020.1810097
Glover, T. D., Todd, J., & Moyer, L. (2022). Neighborhood walking and social connectedness. *Frontiers in Sports and Active Living*, *4*, 825224. https://doi.org/10.3389/fspor.2022.825224
Hackworth, J., & Rekers, J. (2005). Ethnic packaging and gentrification: The case of four neighborhoods in Toronto. *Urban Affairs Review*, *41*(2), 211–236. https://doi.org/10.1177/1078087405280859
Hwang, J. (2015). Gentrification in changing cities: Immigration, new diversity, and racial inequality in neighborhood renewal. *The ANNALS of the American Academy of Political and Social Science*, *660*(1), 319–340. https://doi.org/10.1177/0002716215579823
Hwang, J., & Sampson, R. J. (2014). Divergent pathways of gentrification: Racial inequality and the social order of renewal in Chicago neighborhoods. *American Sociological Review*, *79*(4), 726–751. https://doi.org/10.1177/0003122414535774
Hyra, D. S. (2008). *The new urban renewal: The economic transformation of Harlem and Bronzeville*. University of Chicago Press.
Hyra, D. S. (2012). Conceptualizing the new urban renewal: Comparing the past to the present. *Urban Affairs Review*, *48*(4), 498–527. https://doi.org/10.1177/1078087411434905
Hyra, D. S. (2017). *Race, class, and politics in the cappuccino city*. University of Chicago Press.
Hyra, D. S., Fullilove, M., Moulden, D., & Silva, K. (2020). *Contextualizing gentrification chaos: The rise of the fifth wave* (Working papers). Metropolitan Policy Center. https://www.american.edu/spa/metro-policy/upload/contextualizing-gentrification-chaos.pdf
Jacobs, J. (1961). *The death and life of great American cities*. Random House.
Jones, C. E., & Ley, D. (2016). Transit-oriented development and gentrification along Metro Vancouver's low-income SkyTrain corridor. *Canadian Geographies/Géographies Canadiennes*, *60*(1), 9–22. https://doi.org/10.1111/cag.12256
Kahn, M. E. (2007). Gentrification trends in new transit-oriented communities: Evidence from 14 cities that expanded and built rail transit systems. *Real Estate Economics*, *35*(2), 155–182. https://doi.org/10.1111/j.1540-6229.2007.00186.x
Kilpatrick, J. A., Throupe, R., Carruthers, J. I., & Krause, A. (2007). *The impact of transit corridors on residential property values* (SSRN scholarly paper No. 1030006). https://papers.ssrn.com/abstract=1030006
Larson, N. I., Story, M. T., & Nelson, M. C. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, *36*(1), 74–81.e10. https://doi.org/10.1016/j.amepre.2008.09.025
Lee, B. A., Spain, D., & Umberson, D. J. (1985). Neighborhood revitalization and racial change: The case of Washington, D.C. *Demography*, *22*(4), 581. https://doi.org/10.2307/2061589
Ley, D. (1996). *The new middle class and the remaking of the central city*. Oxford University Press.
Leyden, K. M. (2003). Social capital and the built environment: The importance of walkable neighborhoods. *American Journal of Public Health*, *93*(9), 1546–1551.

Li, W., Joh, K., Lee, C., Kim, J.-H., Park, H., & Woo, A. (2015). Assessing benefits of neighborhood walkability to single-family property values: A spatial hedonic study in Austin, Texas. *Journal of Planning Education and Research*, *35*(4), 471–488. https://doi.org/10.1177/0739456X15591055

Lipton, S. G. (1977). Evidence of central city revival. *Journal of the American Institute of Planners*, *43*(2), 136–147. https://doi.org/10.1080/01944367708977771

Litman, T. (2021). *Transportation affordability: Evaluation and improvement strategies*. Victoria Transport Policy Institute.

Lofland, L. H. (1998). *The public realm: Exploring the city's quintessential social territory*. Routledge. https://doi.org/10.4324/9781315134352

Lubitow, A., Zinschlag, B., & Rochester, N. (2016). Plans for pavement or for people? The politics of bike lanes on the 'Paseo Boricua' in Chicago, Illinois. *Urban Studies*, *53*(12), 2637–2653. https://doi.org/10.1177/0042098015592823

Luke, D. A. (2004). *Multilevel modeling* (2nd ed). SAGE Publications.

Lund, H. (2002). Pedestrian environments and sense of community. *Journal of Planning Education and Research*, *21*(3), 301–312. https://doi.org/10.1177/0739456X0202100307

Martucci, S. (2024). *There was nothing there: Williamsburg, the gentrification of a Brooklyn neighborhood*. NYU Press.

Meltzer, R., & Capperis, S. (2017). Neighbourhood differences in retail turnover: Evidence from New York City. *Urban Studies*, *54*(13), 3022–3057. https://doi.org/10.1177/0042098016661268

Pivo, G., & Fisher, J. D. (2011). The walkability premium in commercial real estate investments. *Real Estate Economics*, *39*(2), 185–219. https://doi.org/10.1111/j.1540-6229.2010.00296.x

Pucher, J., & Renne, J. L. (2005). Rural mobility and mode choice: Evidence from the 2001 National Household Travel Survey. *Transportation*, *32*(2), 165–186. https://doi.org/10.1007/s11116-004-5508-3

Richardson, J., Mitchell, B., & Franco, J. (2019). *Shifting neighborhoods: Gentrification and cultural displacement in American cities*. NCRC.

Saelens, B. E., Sallis, J. F., Black, J. B., & Chen, D. (2003). Neighborhood-based differences in physical activity: An environment scale evaluation. *American Journal of Public Health*, *93*(9), 1552–1558. https://doi.org/10.2105/ajph.93.9.1552

Schroeder, J., Van Riper, D., Manson, S., Knowles, K., Kugler, T., Roberts, F., & Ruggles, S. (2025). *IPUMS National Historical Geographic Information System: Version 20.0* [Dataset]. IPUMS. http://doi.org/10.18128/D050.V20.0

Sims, J. R. (2021). Measuring the effect of gentrification on displacement: Multifamily housing and eviction in Wisconsin's Madison urban region. *Housing Policy Debate*, *31*(3–5), 736–731. https://doi.org/10.1080/10511482.2021.1871931

Smith, N. (1998). Gentrification. In W. van Vliet (Ed.), *The encyclopedia of housing* (pp. 198–199). Taylor & Francis.

Somashekhar, M. (2019). Racial inequality between gentrifiers: How the race of gentrifiers affects retail development in gentrifying neighborhoods. *City & Community*, *19*(4). https://doi.org/10.1111/cico.12421

Spain, D. (1980). Indicators of urban revitalization: Racial and socioeconomic changes in central-city housing. In S. B. Laska & D. Spain (Eds.), *Back to the city: Issues in neighborhood renovation* (pp. 27–41). Elsevier.

Sullivan, D. M. (2014). From food desert to food mirage: Race, social class, and food shopping in a gentrifying neighborhood. *Advances in Applied Sociology*, *04*(01), 30–35. https://doi.org/10.4236/aasoci.2014.41006

Sullivan, D. M., & Shaw, S. C. (2011). Retail gentrification and race: The case of Alberta Street in Portland, Oregon. *Urban Affairs Review*, *47*(3), 413–432. https://doi.org/10.1177/1078087410393472

Tissot, S. (2015). *Good neighbors: Gentrifying diversity in Boston's South End* (D. Broder & C. Romatowski, Trans.). Verso.

Tobin, M., Hajna, S., Orychock, K., Ross, N., DeVries, M., Villeneuve, P. J., Frank, L. D., McCormack, G. R., Wasfi, R., Steinmetz-Wood, M., Gilliland, J., Booth, G. L., Winters, M., Kestens, Y., Manaugh, K., Rainham, D., Gauvin, L., Widener, M. J., Muhajarine, N., Luan, H., Fuller, D. (2022). Rethinking walkability and developing a conceptual definition of active living environments to guide research and practice. *BMC Public Health*, *22*(1), 450. https://doi.org/10.1186/s12889-022-12747-3

Tuttle, S. (2021). Place attachment and alienation from place: Cultural displacement in gentrifying ethnic enclaves. *Critical Sociology*, *48*(3), 089692052110293. https://doi.org/10.1177/08969205211029363

U.S. Census Bureau. (2010). *American Community Survey 5-year estimates (2006–2010)*. U.S. Census Bureau. https://www.census.gov/programs-surveys/acs

U.S. Census Bureau. (2019). *American Community Survey 5-year estimates (2015–2019)*. U.S. Census Bureau. https://www.census.gov/programs-surveys/acs

U.S. Environmental Protection Agency. (2013). *EPA Smart Location Database (2013)*. U.S. Environmental Protection Agency. https://www.epa.gov/smartgrowth/smart-location-mapping

U.S. Environmental Protection Agency. (2020). *EPA Smart Location Database (2020)*. U.S. Environmental Protection Agency. https://www.epa.gov/smartgrowth/smart-location-mapping

U.S. Environmental Protection Agency. (2021). *National walkability index: Methodology and user guide*. https://www.epa.gov/sites/default/files/2021-06/documents/national_walkability_index_methodology_and_user_guide_june2021.pdf

Yencha, C. (2019). Valuing walkability: New evidence from computer vision methods. *Transportation Research Part A: Policy and Practice*, *130*, 689–709. https://doi.org/10.1016/j.tra.2019.09.053

Zuk, M., Bierbaum, A. H., Chapple, K., Gorska, K., & Loukaitou-Sideris, A. (2018). Gentrification, displacement, and the role of public investment. *Journal of Planning Literature*, *33*(1), 31–44. https://doi.org/10.1177/0885412217716439

Zukin, S. (2010). *Naked city: The death and life of authentic urban places*. Oxford University Press.

Zukin, S., Kasinitz, P., & Chen, X. (2016). *Global cities, local streets: Everyday diversity from New York to Shanghai*. Routledge.