Spatial Demography (2021) 9:341–373
https://doi.org/10.1007/s40980-021-00093-8

Racial/Ethnic Residential Segregation, Socioeconomic Inequality, and Job Accessibility by Public Transportation Networks in the United States

Kathryn Freeman Anderson[1] · **Joseph Galaskiewicz**[2]

Accepted: 4 July 2021 / Published online: 6 August 2021

Abstract

This paper examines the access that neighborhoods have to jobs via public transit, if it varies by race/ethnicity, and what difference it makes in terms of socioeconomic outcomes. Decades of research has argued that important sites of employment are often not located in or are inaccessible to racial/ethnic minority neighborhoods. Here, we examine this proposition and take into account how public transit may play into this process. On the one hand, public transit as a public good may have the power to overcome the liabilities of place. If we can build transportation systems that give all neighborhoods comparable access to jobs, part of the spatial mismatch problem may be corrected. On the other hand, if public transit is built in such a way that certain racial/ethnic groups are benefiting, but not others, access alone is not enough to achieve parity. Using the 2013–2017 American Community Survey and the 2017 Access Across America Transit study, we examine how neighborhood racial/ethnic composition is related to job accessibility and socioeconomic outcomes at the block group level for 49 of the 50 largest metropolitan areas in the United States. We find that Black and Latino neighborhoods have access to fewer jobs via public transit, and that they also have lower median household income and a higher unemployment rate, net of access to jobs. Access to more jobs via mass transit is related to higher incomes in White block group clusters, but has no impact on household incomes in Black and Latino clusters. This suggests that public transit as implemented serves to aggravate existing inequalities and is not currently acting as a policy tool to ameliorate inequality.

Keywords Segregation · Race/ethnicity · Inequality · Job accessibility · Public transit

✉ Kathryn Freeman Anderson
kateanderson@uh.edu

[1] Department of Sociology, University of Houston, 3551 Cullen Blvd, PGH Building, Room 450, Houston, TX 77204-3012, USA

[2] School of Sociology, University of Arizona, Tucson, AZ, USA

1 Introduction

This paper examines whether public transportation systems help to overcome the disadvantages that Blacks and Latinos who live in segregated neighborhoods endure, or whether they exacerbate racial/ethnic inequalities. Previous research has linked racial/ethnic residential segregation to a number of poor life outcomes and social inequalities for racial/ethnic minority residents of those areas. In particular, this work has demonstrated how residential segregation contributes to lower levels of employment, opportunities for socioeconomic advancement, and depressed wages (Charles, 2003; Kain, 1968; Massey, 2020; Massey & Denton, 1993; Wilson, 1996). A long-standing explanation for these patterns comes from the spatial mismatch tradition, which highlights how employers locate away from Black segregated areas (Holzer, 1991; Kain, 1968; Wilson, 1996), and thus jobs are less accessible to people of color.

One way to address this problem is to create public transportation systems that could more efficiently link people who live in racial/ethnic segregated areas to potential employers. Public transportation systems are expected to serve many different ends, e.g., promote compact development, reduce automobile usage, create accessible urban space, public safety, ensure mobility for the elderly and disabled, etc.[1] Indeed, increasing access to jobs for people of color may be an afterthought. Public transportation systems have the potential to reduce racial inequality in urban labor markets. From the planning perspective, public transit is often painted as a public good that can level the playing field (Ewing & Cervero, 2010; Karner & Niemeier, 2013). From a more critical race stratification perspective, public transit, just like many other spatial resources, may benefit some but not others, and thus contribute to existing inequalities and fail to level the playing field for people of color living in segregated neighborhoods (Martens et al., 2012; Sharkey, 2013).

There is a legacy of public transportation systems funneling residents from White neighborhoods to central business districts, and recent transit-oriented development in many cities has largely benefited affluent Whites. As such, we expect that public transit lines are laid out to give predominantly White rather than Black or Latino neighborhoods not only better access to jobs, but to produce more favorable socioeconomic outcomes for residents of White neighborhoods. We posit two research questions in an attempt to understand better these perspectives. First, to what extent do neighborhoods in U.S. metropolitan areas realize the public good benefits of public transit (in our study measured as the number of jobs accessible within 30 min via public transit) and does this vary by neighborhoods' racial and ethnic composition? Second, is neighborhood job accessibility by public transit related to socioeconomic outcomes, e.g., median household income and unemployment rates, and does this depend on the racial and ethnic composition of the area? We test these relationships in a quantitative study of block groups in 49 of the 50 largest metropolitan statistical areas (MSA) in the U.S.

[1] National Association of City Transportation Officials. 2021. "Transit Street Design Guide: Key Principles." https://nacto.org/publication/transit-street-design-guide/introduction/principles/.

2 Theoretical Framework and Literature Review

2.1 Spatial Capital, Spatial Inequality, and the Spatial Mismatch Hypothesis

The spatial organization of metropolitan areas, i.e., residents' and organizations' spatial positions in the urban system, as well as residents' transportation resources, can yield advantages or disadvantages to certain residents. Marcus (2010) said that actors have s*patial capital* to the extent to which they have the ability to effectively and efficiently access diverse elements in the urbanized area that provide them benefit. In other words, spatial capital typically refers to the ability to move quickly and with minimum cost from one place to another and successfully achieve one's ends. Many geographers focus on the physical positioning of actors in the urban landscape, where jobs and amenities are located, and the various routes and means people use to get around. Indeed, there is an extensive literature on the accessibility of different groups as they go about their day-to-day business (Anderson & Galaskiewicz, 2021). The focus is on how far people travel in a given day, what mode of transportation they use, and how frequently they take trips. Those that have ready access should benefit more whether it is buying groceries for less, getting medical attention in an emergency, or finding a job. This result is what Logan (2012) labels *spatial inequality*, or the unequal access or exposure by different population subgroups to valued resources in their community.

The spatial mismatch hypothesis has focused mostly on this type of spatial capital, or lack thereof. Scholars argue that differences in Black-White earnings and employment are partly due to the distance between where Black residents live (e.g., in central cities) and the location of new job opportunities in the suburbs. There was considerable research on the spatial mismatch hypothesis in the 1980s and 1990s, and there are excellent review articles that summarize the state of the field (Holzer, 1991; Ihlanfeldt, 1992; Ihlanfeldt & Sjoquist, 1998; Kain, 1992; Preston & McLafferty, 1999). From these literature reviews, we learn that some studies found much longer travel times for Black residents than for Whites (Gabriel & Rosenthal, 1996; McLafferty & Preston, 2019), while other studies found shorter or no difference in travel times (Taylor & Ong, 1995). Some have found that transportation access, not spatial proximity, matters more for employment (Grengs, 2010; Ong & Miller, 2005). The literature provides a wealth of nuance and additional information through the use of different samples, geographic areas, and methodological approaches (Holloway, 1996; Kasarda & Ting, 1996; McLafferty & Preston, 1997, 2019; Raphael, 1998; Weinberg, 2004; Hellerstein et al., 2008; Delbosc & Currie, 2011; Preston & McLafferty, 2016; Newbold et al., 2017). However, the central theme of the spatial mismatch hypothesis is that people of color lack access to jobs, regardless of whether the focus is on job growth in the suburbs, racial/ethnic segregation in the inner city, or the lack of transportation for inner city residents to where jobs are located (Kain, 1992). Nonetheless, it is unlikely that one would see differences in socioeconomic conditions within Black and Latino neighborhoods completely disappear even if all neighborhoods had equal access to all jobs. Not all jobs are equally available for all residents given differences in human capital across racial/

ethnic groups and the role of racism and discrimination in labor market opportunities and occupational mobility.

The race stratification perspective argues that part of the problem is that transportation systems were built with the idea of moving Whites to ideal employment opportunities, but ignored the needs of Black and Latino workers. How so? It may be that the legacy of discrimination in the layout of transit systems persists or that new forms of public transit are driven by gentrification, which benefits Whites disproportionately. If so, then transit systems are contributing to the spatial capital of those living in White neighborhoods and not benefiting people of color living in segregated neighborhoods.

The research questions of this paper articulated above are modest and focus on access to jobs via the public transportation system and neighborhood outcomes. We recognize that walking, biking, and driving are also options for traveling to work, with driving being the modal form of transportation for work commutes in the U.S. We focus on public transit, because people of color are more dependent on public transit than Whites (U.S. Census Bureau, 2008–2012).

2.2 Literature on Urban Transit Systems and Inequality

At the root of the spatial mismatch theory is the importance of place and spatial proximity. Drawing on spatial capital theory, that value may come from being in close proximity, or by overcoming barriers to access through efficient transportation options. Previous work has focused on the role of public transit in particular as a public good, which may allow for greater accessibility absent the need to maintain the expense of a private vehicle. Such work has empirically demonstrated the role of transportation networks in understanding accessibility to resources across space (Cao et al., 2007; Ewing & Cervero, 2010; Kawabata & Shen, 2007). Furthermore, other government actions, such as efficient planning and multi-use zoning can help position both people and needed amenities and employers within reasonable distance (Duany et al., 2000; Ewing & Cervero, 2010; Jacobs, 1961). In this study, we utilize a measure of public transit that examines job accessibility in particular, or specifically the number of jobs available by public transit, e.g., bus, subway, elevated trains, light rail, etc., and within a 30 min commute time (details below).

Moreover, we examine how accessibility to jobs via public transit relates to socioeconomic outcomes for communities, by examining block group-level household income and the unemployment rate. Presumably, from a public goods perspective, increased access to opportunities, especially through public transit, could weaken the relationship between neighborhood composition and socioeconomic outcomes. However, we know little empirically about how these variables relate to one another, and certainly many other factors affect socioeconomic outcomes as well. The geography and planning literatures note that many studies do not directly factor in race or neighborhood-level racial dynamics (Karner & Niemeier, 2013). In the transportation geography literature, which largely focuses on ridership and travel patterns, much work has been conducted in terms of accessibility for other social variables, such as socioeconomic status or gender. However, within this work, relatively little

attention has been paid to race/ethnicity or residential segregation (Akar et al., 2016; Kwan, 1999a, 1999b; Manaugh et al., 2010; McCray & Brais, 2007). The limited extant work tends to focus on individual-level race rather than area-level patterns of segregation.

From the planning perspective, public transit should serve as a public good and should be race neutral. Essentially, if people can move cheaply and efficiently throughout the metropolitan area, then the impact of their local area (such as segregation) may matter less (Ewing & Cervero, 2010). Previous work has demonstrated important benefits public transportation systems by way of employment, improved salaries, and bumps in home values, especially when in close proximity to especially desirable transportation lines, such as rail (Baum-Snow & Kahn, 2000; Covington, 2018; Sanchez, 2002, 2008, 1999). As it relates to race specifically, Title VI of the Civil Rights Act of 1964 stipulates that public agencies, which includes urban planning and transportation authorities, cannot discriminate on the basis of race (Karner & Niemeier, 2013; Larson, 2018). The presumed benefits of public transit hinge on the idea that these goods are distributed evenly across communities.

In contrast, the place stratification perspective (Logan, 1978) argues that public transit is a good that disproportionately benefits certain communities over others, which may in turn have the effect of strengthening or contributing to existing inequalities. That is, the very way transportation systems are built give neighborhoods access to certain kinds of jobs but not others, and the former benefit Whites disproportionately. This is intentionally discriminatory as political actors develop certain places in a manner than advantages Whites and marginalizes others. Work in this tradition has demonstrated how local developers, city planners, and government agencies prioritize certain parts of the city, typically by race and class, to receive key public amenities, including public transit (Logan, 1978; Logan & Molotch, 1987; Sharkey, 2013; Trounstine, 2018). Specifically as it relates to segregation, Trounstine (2018) details how racist political actors designed and developed cities in a manner that was intended to stratify places by race. As a result, instead of being built as an evenly distributed public serving good, urban developers and agencies developed many transportation systems in a manner so as to benefit and provide greater access to White and wealthy communities.

The urban planning community has acknowledged this limitation of transportation systems, referring to this as *transport disadvantage* as a distinct form of social exclusion and calling for efforts to achieve equity in transportation options (Jones & Lucas, 2012; Lucas, 2012; Martens et al., 2012). For example, urban research on the growth of suburban development demonstrated how the hub and spoke system of many public transit and highway systems were designed to carry residents to and from the mostly White suburbs to create access to jobs in the Central Business District (CBD), rather than circulating residents within the city to amenities and employment (Duany et al., 2000; Jackson, 1985; Leinberger, 2008; Sharkey, 2013). In the post-industrial era, as many low skilled jobs were relocated out of the inner city, these systems were often not redesigned to move inner city residents to these new sites of employment, leading to the spatial mismatch discussed above (Duany et al., 2000; Holzer et al., 2003; Jackson, 1985; Sanchez, 2002).

More recently in certain locales, the building of new transit lines is a strategy to attract more affluent White residents to gentrifying inner city neighborhoods (Padeiro et al., 2019). Through gentrification, many highly accessible inner-city neighborhoods have displaced their traditional residents in favor of younger middle class residents who have seen improvements to these systems with the changing demographics (Grengs, 2001; Lubitow et al., 2017; McKenzie, 2013). Both qualitative and quantitative work has found empirical evidence for these patterns. For instance, case studies of Oakland (Golub et al., 2013) and Portland (Goodling et al., 2015) have shown how over time developers and local agencies engineered the transportation systems in these cities to disproportionately serve White and affluent areas. In some cases, this was because they were initially designed with better access to such areas, and also the presence of desirable transit lines through communities drove up real estate prices and restructured the composition of those communities. Quantitative studies have found similar evidence that lower income and racial/ethnic minority segregated areas now have poorer access to public transit (Bereitschaft, 2017; Grengs, 2001; Lee et al., 2017; McKenzie, 2013; Vojnovic et al., 2014). Moreover, not all groups use transportation systems in the same manner. According to Census figures, Black and Latino populations are more likely to rely on public transit and walking for their daily work commutes, as compared to Whites, who are more likely to utilize a private vehicle (U.S. Census Bureau, 2008–2012). Thus, these inequalities in the distribution of public transit are especially likely to impact people of color who rely more on public transit.

There has been less empirical work on socioeconomic outcomes across communities as this study will examine. Most of this work is focused on a single city, or if more inclusive of multiple cities, is at the metropolitan or city level of analysis. The findings are somewhat mixed as a result. For example, in a study of metropolitan areas across the U.S., Sanchez (2002), found that public transit accessibility reduced inequalities in the urban wage distribution. A single city study of commute times and transportation in Houston found that improved commute times were related to a small reduction of racial differences in earnings in the city (Myers & Saunders, 1996). Similarly, Covington (2018) found that more efficient automobile and public transportation systems decreased disparities by race in the unemployment rate across metropolitan areas. Another study by Sanchez (1999) found a similar pattern for Portland and Atlanta. However, another recent study found that across several large metropolitan areas, job accessibility by driving, walking, and public transit had a nuanced relationship to socioeconomic outcomes (Galaskiewicz et al., 2021). Black segregation and better access to jobs were both related to higher Black/White income inequality across metropolitan areas. In areas with poor transportation systems, the effect of segregation strengthened, while in less segregated areas Black/White income inequality increased in areas with better access to jobs (Galaskiewicz et al., 2021). Given these limited and mixed empirical findings, here we examine the relationship between residential segregation, job accessibility by public transit, and two socioeconomic outcomes, household income and the unemployment rate.

2.3 Hypotheses

Our aim is to extend and refine our understanding of the spatial mismatch hypothesis by including an analysis of public transportation systems. To address our first research question on neighborhoods and job accessibility, we seek to integrate ideas from the public transit as a public good perspective and the race stratification perspective. For instance, it is not only people's human capital and the location of jobs, but also how and if people are able to efficiently access opportunities for employment, potentially through the public transportation system, that matters. Thus, persisting patterns of racial/ethnic inequality across the metropolitan landscape are due in part to the inferior public transit that is characteristic of racial/ethnic minority neighborhoods. Both the public goods and race stratification perspectives would suggest this. This gives rise to Hypothesis 1.

H1 *Residents of predominantly Black or Latino areas of the city are able to access fewer jobs through public transit than predominantly White areas.*

H2 and H3 explore the role that access to jobs has on neighborhoods' socioeconomic outcomes from the perspective of race stratification theory and address our second research question. The theory argues that even if non-Whites had the same access to jobs as Whites, inequality would persist. That is, if we control for the access which neighborhoods have to jobs, disparities in socioeconomic outcomes will not change. If the jobs being accessed are not ideal for Black and Hispanic residents living in segregated areas to match their human capital due to the legacy of racism, and racial discrimination continues to bar racial/ethnic minorities from certain job opportunities, just having access to more jobs will not be enough to overcome racial/ethnic inequities. Specifically, we examine median household income and the unemployment rate as indicators of possible socioeconomic outcomes. This leads us to our second hypothesis:

H2 *The effect of neighborhood racial/ethnic composition on socioeconomic returns will not change once we control for the area's access to jobs via public transit.*

A more subtle version of race stratification theory is that transportation systems are constructed so as to benefit Whites and not non-Whites. That is, Whites get a better return on having efficient transportation networks connecting their neighborhoods to jobs than non-Whites. By this they mean that the jobs accessed by Whites results in higher socio-economic rewards, because they funnel folks from White neighborhoods to jobs that match their human capital. In contrast, the jobs accessed by non-Whites do not produce the same benefits as for Whites, because they funnel folks from non-White neighborhoods to jobs that do not match their human capital. Further, racial/ethnic minorities are more likely to experience labor market discrimination even when the position matches their human capital. That is, there is no difference in the socio-economic outcomes of non-Whites living is neighborhoods with better or worse access to jobs, for Whites there is. In other words, transit networks

that can access more jobs produce greater economic returns in White neighborhoods than in Black or Latino neighborhoods. H3 is our final hypothesis:

H3 *In predominantly White neighborhoods, greater job accessibility by public transit will be associated with higher incomes and low unemployment, while in predominantly Black or Latino neighborhoods, job accessibility by public transit will be unrelated to household incomes or unemployment rates*.

3 Data and Methods

To test these hypotheses, we examine these patterns in a study at the block group and metropolitan area levels in 49 of the 50 largest cities. We detail our data and methodological considerations here.

3.1 Data

We use two main data sources. The first is a 2017 study of public transportation networks called Access Across America: Transit 2017 Data from the Accessibility Observatory research group at the University of Minnesota Center for Transportation Studies (Owen & Murphy, 2018). This data source includes scores on job accessibility by public transit for all Census blocks in 49 of the 50 largest by population metropolitan statistical areas [as defined by the Office of Management and Budget (OMB)] in the United States. Memphis did not have complete transportation data, and therefore we excluded it.

We paired these data with socio-demographic data from the 2013–2017 American Community Survey (ACS) five-year estimates at the block group level and the metropolitan-level. Because the ACS, unlike the full decennial Census, relies on a sample survey, they only release the data for a small unit of analysis, like the block group, in five-year intervals to have data that could be representative at such a small scale. All of the socio-demographic variables come from this data source.

3.2 Dependent Variables

To address the two research questions outlined above, we include three dependent variables, all measured at the block group level. First, in reference to the first research question on job accessibility, we include a score from the Access Across America dataset on *job accessibility by public transit networks*. The data on jobs comes from the U.S. Census Longitudinal Employer-Household Dynamics (LEHD) 2015 Origin-Destination Employment Statistics (LODES), and they paired this with data on the public transportation system maps and travel times, factoring in local congestion. The score then reflects the number of jobs accessible within 30 min commute time via public transit from the geographic centroid of the block. For each Census block in the United States, they calculated travel time to all other blocks within 60 km for each departure time at 1-min intervals, from 7 to 9 am on

weekdays. They then averaged all of these scores over the 7am to 9am period to derive a count of jobs accessible within 30 min commute time.[2] The original data source, Access Across America, provided these scores for each block in 49 of 50 of the largest metropolitan areas. However, given the limited Census data availability at the block level, we averaged these scores to the block group level. Thus, the measure reflects the average (from the block to the block group) number of jobs accessible within 30 min commute time via the public transportation network. We use this score as the dependent variable in the first set of analyses, and as the key independent variable in the second set of analyses with socioeconomic indicators as the dependent variables.

For this second portion of the study, we utilize two measures to examine the area-level socioeconomic status. These are both measured at the block group level and come from the 2013–2017 ACS data. The first is *median household income*, which reflects the median level of income in households across the block group. It would have been optimal to also include this score as divided by racial groups to estimate inequalities in incomes by group. However, at the block group level (as well as at other small geographic units of analysis like the Census tract or zip code), there was an extremely high level of missing data when divided by group, and the margins of error are large. Thus, to more accurately capture neighborhood-level income differences, we use this global measure. This is fitting with the arguments laid out above as we expect that the negative associations of racial/ethnic minority segregation represent a "place effect." The second socioeconomic dependent variable we examine is the *unemployment rate*, or the percent of people without a job who are in the labor market, which is also measured at the block group. This is also a global score, not divided by racial group, for the same problems of data representativeness mentioned above.

3.3 Independent and Control Variables

First, the main substantive variables for analysis are a set of racial/ethnic clustering scores meant to serve as an indicator of which areas of a metropolitan area include disproportionately high numbers of a certain group. Typically, we think of segregation in the aggregate, and most of the established segregation scores measure segregation at large geographic unit of analysis, like the county or metropolitan area (Massey & Denton, 1988). In practice, though, there are many ways that we could measure segregation depending on the geographic scope and conceptual approach. Since our unit of analysis is a small geographic unit (the block group), we are primarily interested in understanding which areas within a metropolitan area are communities subject to segregation in that they are clustered spatially by high

[2] We recognize that other time frames could be relevant to this analysis, and that it would be optimal to test other time frames as a robustness check for the analysis presented here. However, the 30 min interval was the only time frame at the block group level available from the Access Across America study. Further, from the ACS data at the metropolitan-level, the median commute time for all of the included metropolitan areas ranged from 21.2 to 34.6 suggesting that the 30 min time frame is reasonable.

concentrations of one group. We can think of this as clustering by racial/ethnic composition in neighborhoods.

Most work aimed at measuring segregation at this level uses a composition score, such as the percent of a group in an area. Segregation is not just composition, though, and previous work has demonstrated that segregation has multiple dimensions (Massey & Denton, 1988). Composition scores also fail to take into account geographic proximity, which has received growing attention in the field (Reardon & O'Sullivan, 2004; Roberto, 2018). This is a noted limitation of quantitative studies on the consequences of segregation (Yang et al., 2020). For this analysis, we use a score that accounts for two dimensions of segregation, concentration and clustering. The score is measured using the following formula:

$$C_i = x_i \sum_{j=1, j \neq i}^{n} w_{ij} x_j$$

where x_i is the variable for feature i, x_j is the variable for feature j, and w_{ij} is the spatial weight between features i and j (Anderson, 2017). In this case, a feature is the block group, and the spatial weight comes from a first-order queen contiguity matrix. Broadly, the formula reflects the product of the percent of a group in a certain area multiplied by the average percent of that group in its neighbors (row standardized). This leads to a theoretical range of 0 to 10,000, where a score of 10,000 would mean that a block group has 100% of the group of interest, as well as all of its bordering block groups. In this analysis, we include three scores: a *clustering measure for percent Black* (non-Latino), a *clustering measure for percent Latino* (of any race), and a *clustering measure for percent White*. We also group-mean centered each of these scores to the metropolitan level in multi-level analysis. There are rather substantial area-level differences in the relative percentages of a group across metropolitan areas. For example, the Latino population of the United States is highly concentrated in several states on the U.S.-Mexico border. We did not want the analysis to simply reflect those differences in a manner that would ignore the relative clustering of a group in a given metropolitan area. Thus, the scores used are relative to the metropolitan-level, which is an approach used in previous work examining neighborhoods (Sampson et al., 1997).

To illustrate this measure using well-known neighborhoods as examples, Block Group 1 of Census Tract 380100 in Chicago has a score of 6547.75 for the Black clustering score, which is a high score for a measure whose upper bound is 8855.06. This block group, located in a famously Black segregated South Side of Chicago has a racial composition of 94% Black, while all of its geographically adjacent neighbors also have percentages for Black composition above 91%. Chicago is an area that has a large Black population, but these numbers indicate a high degree of concentration that is above what is typical of the Chicago area. In another example, Block Group 2 of Tract 012200 on the Upper East Side of New York City has a White clustering score of 4982.60. The block group has a White composition score of 92.6%, and all of its geographically adjacent neighbors have percent White scores from 84 to

93%, indicating a high degree of White concentration and clustering, especially for a diverse city like New York City.

We also include several control variables at the block group level. Across all models, we include a control for *population density*, which is the population of the block group divided by the area in miles. Given that we could reasonably assume that more populated and more densely populated areas would have more jobs, this is an important control and is included in all models. Similarly, we also include a control variable for the *percent of households who do not own a private vehicle*. This is to control for the extent to which people in a given area are reliant on public transit, or at least do not have access to a private vehicle, as this may vary considerably across different cities, as well as areas within a city. In the set of models predicting job accessibility by public transit, we also include two controls for socioeconomic and human capital characteristics: *percent in poverty*, or the percentage of the population living below the federal poverty line in the block group, and *percent bachelor's degree*, which reflects the percentage of the people in the population with a bachelor's degree or higher. We do not include these in the second set of models, as the dependent variable is also an indicator of socioeconomic status, and all of these variables are too collinear.

Additionally, we include a series of metropolitan-level control variables to account for differences across metropolitan areas in the infrastructure, local economy, and commuting. In the first set of models predicting the number of jobs available by public transit, we include several variables to account for the local commuting environment. These include the *average number of jobs available by 30 min on public transit* for the entire metropolitan area, the *natural log of the population* of the metropolitan area, and *median commute time*. We also include the metropolitan-level of segregation as measured by the *isolation index* to control for the overall level of segregation in the metropolitan area, and the *percent of the population living below the federal poverty line*. For the isolation index, we used measures computed by group as calculated by the American Communities Project at Brown University (Logan & Stults, 2011) based on the 2010 full decennial Census. The measure included in each model depends on the group in question in the model. In the models examining Black clustering at the block group, we include the Black isolation index, in the models examining Latino clustering, we include the Latino isolation index, and in the models examining White clustering, we include the White isolation index.

Moreover, in the two sets of analyses examining area-level socioeconomic outcomes, we also include several metropolitan-level control variables on the local economy and income distribution. These include *median household income* and the *unemployment rate* in each of those sets of models respectively, the percentage of the employed population who are employed in the *financial sector*, the percentage of the employed in *professional occupations*, and the *Gini coefficient* for income inequality. We also include the respective isolation indices described above. The descriptive statistics for all variables used are in Table 1.

Table 1 Descriptive statistics for variables used in statistical models

Variable name	Mean	SD	Range	Description
Block group dependent variables				
Job accessibility	47,345.35	190,981.80	0–2,590,348	Average number of jobs accessible within 30 min commute via public transit
Median HH income	73,300.44	40,181.49	2499–250,001	Median household income
Unemployment rate	4.40	3.97	0–57.17	Unemployment rate
Block group independent variables				
% Black clustering	−5.35	1795.87	−2388.51 to 8855.06	Clustering measure of percent Black
% Latino clustering	−0.10	1366.47	−3785.87 to 8756.14	Clustering measure of percent Latino
% White clustering	−7.70	2661.79	−7357.54 to 7277.26	Clustering measure of percent White
Population density	10,137.11	21,515.81	0.11–512,853.60	Population per square mile
% No car	2.19	3.79	0–78.81	Percent of households with no car
% in Poverty	13.69	13.67	0–100	Percent of population below the federal poverty line
% Bachelor's or higher	34.99	22.36	0–100	Percent college educated or higher
Metropolitan independent variables				
Black Isolation Index	41.32	18.63	2.86–69.96	Black isolation index
Latino Isolation Index	32.40	15.93	1.81–65.21	Latino isolation index
White Isolation Index	71.75	10.11	47.65–90.60	White isolation index
Jobs by transit	45,024.46	65,764.31	4238–204,745	Average number of jobs accessible within 30 min commute via public transit (MSA)
Log population	15.27	0.80	13.93–16.75	Natural log of population of MSA
Median commute time	27.84	3.78	21.2–34.6	Median commute time to work
% in Poverty	13.79	2.15	8.4–17.4	Percent of MSA living below the federal poverty line
Median HH income	57,001.54	9122.98	43,547–84,523	Median household income
Unemployment rate	10.95	2.09	7.7–17	Unemployment rate
% Finance jobs	7.85	1.32	5–11	% of working population employed in finance occupations
% Professional jobs	12.46	2.28	8.7 to 20.2	% of working population employed in professional services
Gini coefficient	0.46	0.02	0.42 to 0.50	Gini coefficient of income inequality

N = 48,836. Data come from the 2017 Access Across America Transit Study, and the 2013–2017 American Community Survey (ACS)

3.4 Methods

We present all three sets of results in a series of hierarchical linear regression models to account for both block-group level variables, as well as to control for differences across metropolitan areas.[3] However, because the level 1 unit of analysis is the block group, a rather small spatial unit of analysis, spatial autocorrelation presents a substantial problem. The LaGrange Multiplier statistics indicate that there is significant spatial autocorrelation in the models using the full sample (Anselin et al., 2004). At present, no multi-level modeling strategy exists to contend with significant spatial autocorrelation at level 1 where the level 1 units are geographic units of analysis, though methods to account for spatial dependencies in geographic units at level 2 (typically individuals nested within geographic areas) have been developed and applied in the literature (O'Connell, 2015; Savitz & Raudenbush, 2009).[4] To contend with this, but also to be able to model the results using a multilevel structure, we took a random sample of 50% of the block groups.[5] This also had the effect of dropping two of the metropolitan areas from our analysis, Richmond, VA and Birmingham, AL, which were the two least populous MSAs.

We present the results in three sets to address the two research questions above. We also separate the results by the group clustering scores so as to not conflate the racial/ethnic groups, as measured by Black, Latino, and White clustering. First, using job accessibility by public transit as the dependent variable (Table 2), we estimate two sets of models, one with just the clustering score (measuring neighborhood segregation), population density, and the percent of people with no car, and another with the block group-level and metropolitan-level controls included. In groups of models, predicting median household income (Table 3) and the unemployment rate (Table 4), we estimate three sets of models, one with just the clustering score and all controls included, a second with the average number of jobs accessible by public transportation networks included, and a final model with an interaction term between the clustering scores and the job accessibility score.

4 Results

First, turning to the results in Table 2, we test Hypothesis 1 by examining whether or not racial/ethnic residential clustering is related to job accessibility via public transportation networks. We find that both Black and Latino clustering at the block group level are significant and negatively related to job accessibility via public transit, and

[3] Because both the average number of jobs and median household income are two positively skewed continuous variables, we also estimated all of these same models (in Tables 2 and 3) using multi-level gamma regression, as a check on this choice of modeling strategy. The results are virtually the same, with only minor differences in the effect sizes.

[4] We also estimated all of the same models without the metropolitan variables included using a series of spatial error models. The conclusions from those results are essentially the same as those presented here with only minor differences in the size of coefficients across all models.

[5] As a check on this choice, we also estimated the same set of models using different percentage sizes from the original sample, as well as multiple sample draws from the original data set. While we found some minor differences in the size of the effects across all models, the conclusions remain unchanged.

White clustering has a significant and positive effect on job accessibility via public transit. All of these effects hold even when accounting for population density and the percentage of households without a car. These coefficients are somewhat attenuated when including the controls at both levels, including job accessibility and segregation scores at the metropolitan level.

The coefficients for Black and Latino clustering are significant and negative, meaning that as the concentration and clustering of these two groups in an area increases, the average number of jobs accessible within 30 min on public transit decreases. For a discussion of the variable effects, we multiplied the coefficients in the table (which are unstandardized regression coefficients) by their standard deviations in order to x-standardize them for the ease of interpretation and comparability given that the scale of each of the clustering scores is so different.[6] This way, their relative effect sizes can be easily compared. In the case of Black clustering, from the adjusted model in column two, every one standard deviation increase in Black clustering, centered around its mean, the average number of jobs is predicted to decrease by 4741.10 jobs. This same figure is somewhat larger at a decrease of 8455.72 jobs for Latino clustering. Moreover, the coefficients for White clustering display the opposite pattern where a one standard deviation increase in White clustering, centered around its mean, is related to a 6500.09 increase in the average number of jobs accessible by public transit. These are sizable coefficients, implying that racial clustering at the block group level appears to meaningfully pattern access to jobs by public transit. This lends strong support for Hypothesis 1.

To test Hypotheses 2 and 3 we see if racial/ethnic clustering and access to jobs via public transit are related to socioeconomic outcomes at the block group level. In Table 3, we examine median household income as the dependent variable, include the measure for job accessibility (Average Jobs) as a covariate, and include an interaction between clustering and job accessibility. Just looking at the effects for Black and Latino clustering across all the models (columns 1 and 4), we find that they are both significant and negatively related to household income. Specifically, as Black and Latino clustering increase, area-level median household income decreases. More substantively using x-standardized scores here for the ease of interpretation, a one standard deviation increase in Black clustering, centered around its mean, is related to a $11,008.36 decrease in median household income.[6] This same amount is $10,238.96 for a standard deviation increase in Latino clustering in the first model. Again, the opposite is the case for White clustering (column 7). In this case, a one standard deviation increase in White clustering, centered around its mean, is related to a $17,953.77 increase in median household income, which is a rather sizable amount.

Moreover, job accessibility by public transit is independently related to median household income in the expected direction, such that an increase in the average number of jobs accessible by public transit is related to an increase in median household income at the block group (columns 2, 5, and 8). Of note, though, is that the

[6] For the standardized coefficients discussed here, the coefficient in the table was multiplied by 1795.87 for Black clustering, 1366.47 for Latino clustering, and 2661.79 for White clustering.

Table 2 Coefficients and (standard errors) from hierarchical linear models of the average number of jobs accessible by public transit

Variable name	Black clustering		Latino clustering		White clustering	
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Block group variables						
Black clustering	−6.861***	−2.640***				
	(0.380)	(0.399)				
Latino clustering			−14.897***	−6.188***		
			(0.500)	(0.529)		
White clustering					6.811***	2.442***
					(0.259)	(0.302)
Population density	4.535***	4.414***	4.731***	4.500***	4.719***	4.468***
	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)	(0.037)
% No car	11,798.770***	11,779.950***	11,068.980***	11,479.820***	11,589.400***	11,677.900***
	(192.477)	(186.820)	(189.680)	(185.141)	(190.183)	(185.147)
% in Poverty		927.419***		891.538***		1000.179***
		(58.300)		(56.472)		(60.296)
% Bachelor's degree		1923.582***		1831.607***		1876.459***
		(34.991)		(36.204)		(36.012)
Metropolitan variables						
Jobs by transit		0.218***		0.191***		0.183***
		(0.029)		(0.026)		(0.027)
Log population		−2766.788		736.201		−2436.396
		(2517.358)		(2525.471)		(2393.924)
Median commute time		780.948		930.639		1552.416**
		(532.593)		(499.516)		(524.521)
Isolation Index[a]		116.647*		−229.887***		316.590***
		(46.598)		(61.890)		(83.499)

Table 2 (continued)

Variable name	Black clustering		Latino clustering		White clustering	
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
% in Poverty		−1462.143***		−794.818		−1016.401*
		(419.170)		(426.841)		(409.785)
AIC	1,302,074	1,299,060	1,301,521	1,298,961	1,301,715	1,299,031
BIC	1,302,127	1,299,174	1,301,574	1,299,075	1,301,768	1,299,145

N = 48,836. Data come from the 2013–2017 American Community Survey, and the 2017 Access Across America: Transit 2017 Data

[a]The isolation index included here differs for each model. The first set includes the Black isolation index, the second includes the Latino isolation index, and the third includes the White isolation index. *p < 0.05, **p < 0.01, ***p < 0.001 (two-tailed)

Table 3 Coefficients and (standard errors) from hierarchical linear models of median household income

Variable name	Black clustering			Latino clustering			White clustering		
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Block group variables									
Black clustering	−6.123***	−5.897***	−5.398***						
	(0.090)	(0.089)	(0.101)						
Latino clustering				−7.493***	−7.045***	−6.533***			
				(0.120)	(0.120)	(0.129)			
White clustering							6.745***	6.574***	6.286***
							(0.057)	(0.057)	(0.059)
Population density	−0.361***	−0.509***	−0.500***	−0.270***	−0.413***	−0.384***	−0.177***	−0.295***	−0.275***
	(0.009)	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.008)	(0.009)	(0.009)
% No car	−116.220*	−504.781***	−515.969***	−672.503***	−1006.731***	−1056.005***	−275.546***	−567.538***	−681.038***
	(45.601)	(46.868)	(46.824)	(45.511)	(46.701)	(46.868)	(41.697)	(42.970)	(43.236)
Average jobs		0.033***	0.026***		0.030***	0.021***		0.025***	0.019***
		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)
Black*Jobs[a]			−0.011***						
			(0.001)						
Latino*Jobs[a]						−0.013***			
						(0.001)			
White*Jobs[a]									0.006***
									(0.000)
Metropolitan variables									
Median HH income	1.506***	1.483***	1.497***	1.481***	1.466***	1.474***	1.443***	1.430***	1.445***
	(0.081)	(0.079)	(0.080)	(0.088)	(0.087)	(0.087)	(0.084)	(0.084)	(0.084)
% Finance jobs	139.032	56.377	75.075	127.095	59.968	87.833	−26.625	−67.519	−53.659
	(338.199)	(329.036)	(331.788)	(366.843)	(366.018)	(365.567)	(364.336)	(365.672)	(363.272)

Table 3 (continued)

Variable name	Black clustering			Latino clustering			White clustering		
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
% Professional jobs	340.152	359.062	330.091	450.769	451.815	436.158	636.051	626.358	598.611
	(311.924)	(303.357)	(305.959)	(341.031)	(340.286)	(339.861)	(337.037)	(338.346)	(336.107)
Gini coefficient	191,011.5***	185,627.5***	187,570.0***	138,277.8***	129,706.0***	131,700.4***	125,892.9***	120,032.2***	124,774.6***
	(27,870.790)	(27,080.560)	(27,326.250)	(30,827.770)	(30,767.600)	(30,729.340)	(28,064.320)	(28,183.650)	(27,995.310)
Isolation Index[b]	−85.343***	−90.916***	−86.173***	7.299	15.781	15.759	41.690	31.082	41.666
	(24.075)	(23.399)	(23.611)	(31.391)	(31.327)	(31.288)	(47.511)	(47.708)	(47.392)
AIC	1,161,420	1,160,471	1,160,358	1,162,107	1,161,331	1,161,217	1,153,501	1,152,856	1,152,503
BIC	1,161,517	1,160,577	1,160,472	1,162,203	1,161,436	1,161,331	1,153,598	1,152,961	1,152,618

N = 48,836. Data come from the 2013–2017 American Community Survey, and the 2017 Access Across America: Transit 2017 Data.

[a]Coefficient and standard error multiplied by 1000 for the ease of presentation

[b]The isolation index included here differs for each model. The first set includes the Black isolation index, the second includes the Latino isolation index, and the third includes the White isolation index. *p < 0.05, **p < 0.01, ***p < 0.001 (two-tailed)

inclusion of this variable does little to reduce the size of the coefficients for racial/ethnic clustering, implying that job accessibility by public transit does not appear to substantially reduce the relationship between block group racial patterning and income. This supports Hypothesis 2 and the race stratification perspective that race/ethnic differences are not due to public transit access to jobs alone.

In columns 3, 6, and 9, we include the interaction terms, clustering by average jobs accessible by public transit. This is our test of Hypothesis 3. The linear effects of the clustering variables and jobs accessibility do not change much. However, the interaction between job accessibility and the two scores for Black and Latino clustering are significant and negative, whereas it is significant and positive for White clustering. As Black and Latino clustering increase, the effects of access to jobs on household income weakens, while as White clustering increases, the effects of access to jobs on household income strengthens. Thus, there appears to be strong support for Hypothesis 3.

These results are easier to understand from the graphs presented in Figs. 1, 2 and 3, which have the average number of jobs accessible by public transit on the x-axis, and separate lines for the mean level of group clustering and one standard deviation above and below the mean. Figure 1 presents the graph of the interaction between Black clustering and job accessibility, Fig. 2 presents the graph of the interaction for Latino clustering, and Fig. 3 the graph of the interaction for White clustering. The general pattern is the same for both Black and Latino clustering. As job accessibility by public transit increases, median household income only increases for block groups where Black/Latino clustering is one standard deviation lower than average, and the line is flat where Black and Latino clustering is high, implying that

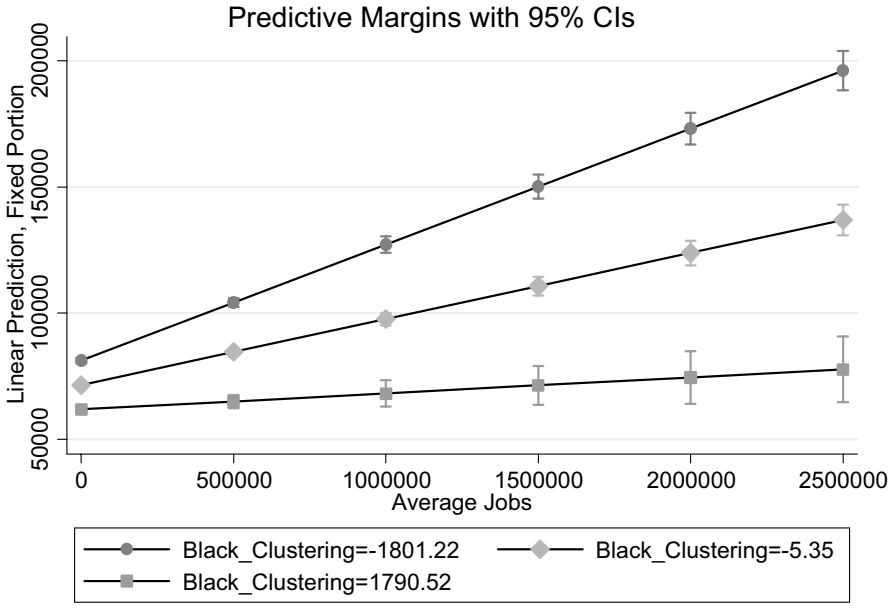

Fig. 1 Graph of the interaction between Black clustering and job accessibility by public transit with median household income

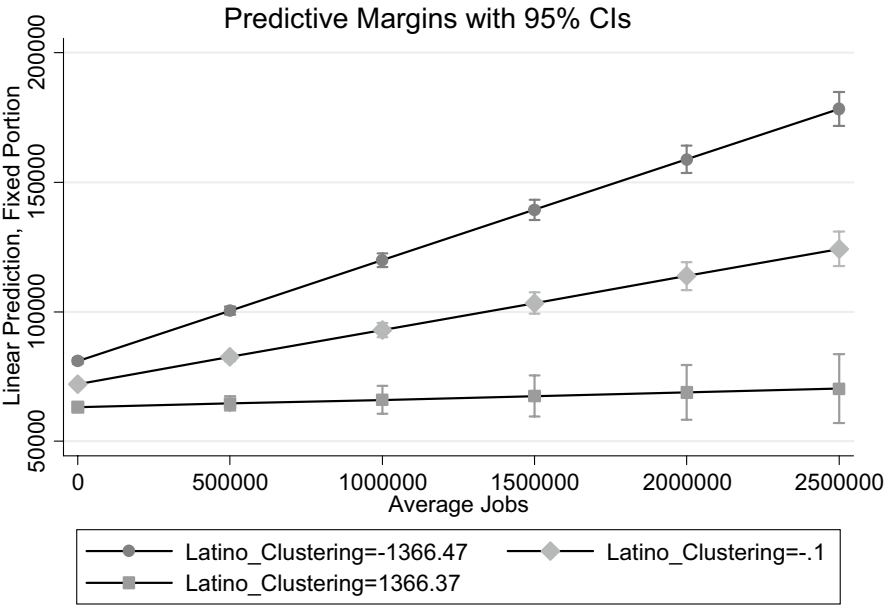

Fig. 2 Graph of the interaction between Latino clustering and job accessibility by public transit with median household income

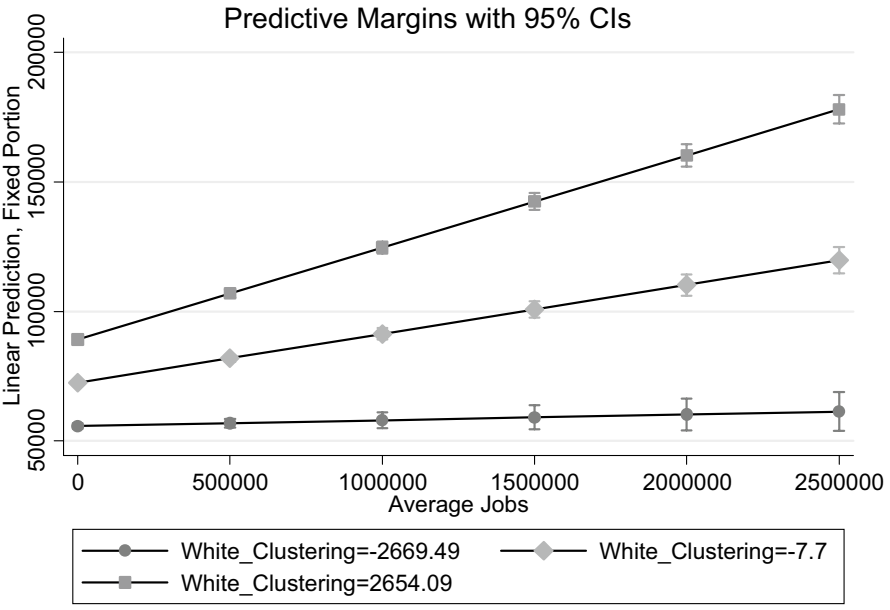

Fig. 3 Graph of the interaction between White clustering and job accessibility by public transit with median household income

Table 4 Coefficients and (standard errors) from hierarchical linear models of the unemployment rate

Variable name	Black clustering			Latino clustering			White clustering		
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Block group variables									
Black clustering[a]	0.791***	0.784***	0.790***						
	(0.009)	(0.009)	(0.011)						
Latino clustering[a]				0.276***	0.254***	0.218***			
				(0.013)	(0.013)	(0.014)			
White clustering[a]							−0.530***	−0.525***	−0.523***
							(0.006)	(0.006)	(0.007)
Population density[a]	0.013***	0.018***	0.018***	0.011***	0.018***	0.016***	−0.001	0.003*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
% No car	−0.022***	−0.009	−0.009	0.039***	0.056***	0.059***	0.013**	0.022***	0.023***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Average jobs[a]		−0.001***	−0.001***		−0.001***	−0.001***		−0.001***	−0.001***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Black*Jobs[b]			−0.000						
			(0.000)						
Latino*Jobs[b]						0.001***			
						(0.000)			
White*Jobs[b]									−0.000
									(0.000)
Metropolitan variables									
Unemployment rate	0.235***	0.233***	0.233***	0.234***	0.233***	0.234***	0.231***	0.231***	0.231***
	(0.028)	(0.028)	(0.028)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
% Finance jobs	−0.069	−0.067	−0.066	−0.074	−0.070	−0.072	−0.067	−0.066	−0.066
	(0.044)	(0.044)	(0.044)	(0.053)	(0.053)	(0.053)	(0.055)	(0.055)	(0.055)

Table 4 (continued)

Variable name	Black clustering			Latino clustering			White clustering		
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
% Professional jobs	−0.039	−0.038	−0.038	−0.052	−0.050	−0.051	−0.050	−0.048	−0.049
	(0.025)	(0.025)	(0.025)	(0.031)	(0.031)	(0.031)	(0.034)	(0.034)	(0.034)
Gini coefficient	−0.116	0.015	0.030	6.300	6.647	6.554	7.407	7.542	7.509
	(3.614)	(3.613)	(3.621)	(4.390)	(4.405)	(4.391)	(4.152)	(4.163)	(4.158)
Isolation Index[c]	0.014***	0.014***	0.014***	−0.003	−0.003	−0.003	0.001	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)
AIC	264,686.4	264,598.8	264,596.9	271,049.6	270,891.6	270,843.5	265,022.1	264,980.8	264,978.4
BIC	264,783.1	264,704.4	264,702.4	271,146.4	270,997.2	270,949.0	265,118.8	265,086.4	265,084.0

N = 48,836. Data come from the 2013–2017 American Community Survey, and the 2017 Access Across America: Transit 2017 Data

[a]Coefficient and standard error multiplied by 1000 for the ease of presentation

[b]Coefficient and standard error multiplied by 100,000 for the ease of presentation

[c]The isolation index included here differs for each model. The first set includes the Black isolation index, the second includes the Latino isolation index, and the third includes the White isolation index. *p < 0.05, **p < 0.01, ***p < 0.001 (two-tailed)

these areas do not receive the same benefits of job accessibility. Thus, where Black and Latino segregation is low, i.e., predominantly White neighborhoods, job accessibility yields high returns. As we would now expect, the opposite is the case for White clustering as shown in Fig. 3. Where White clustering is low, i.e., minority clustering is high, the relationship between job accessibility by public transit and median household income is weak (presumably because these are areas with higher populations of Blacks and Latinos), but has a strong and positive relationship where White clustering is high. Essentially, White clustered areas get more return on their access to jobs, whereas access in minority areas makes little difference. This supports Hypothesis 3.

We also examined these relationships in terms of the unemployment rate at the block group. These results can be found in Table 4. In columns 1 and 4 we see that both Black and Latino clustering is significant and positively related to the unemployment rate at the block group level, meaning that the higher the degree of Black and Latino clustering in an area is related to a higher unemployment rate. Again, for the ease of discussion here, we x-standardize them. For instance, for every one standard deviation increase in Black clustering, centered around its mean, is related to a 1.421 increase in the unemployment rate.[6] Given that the national average unemployment rate throughout the ACS period ranged between 4.5–7.4%, an increase of 1.4 is fairly substantial. This same change for Latino clustering is somewhat lower at 0.377 in the first model. In the case of White clustering (column 7), the relationship is significant and negative. Specifically, for every standard deviation

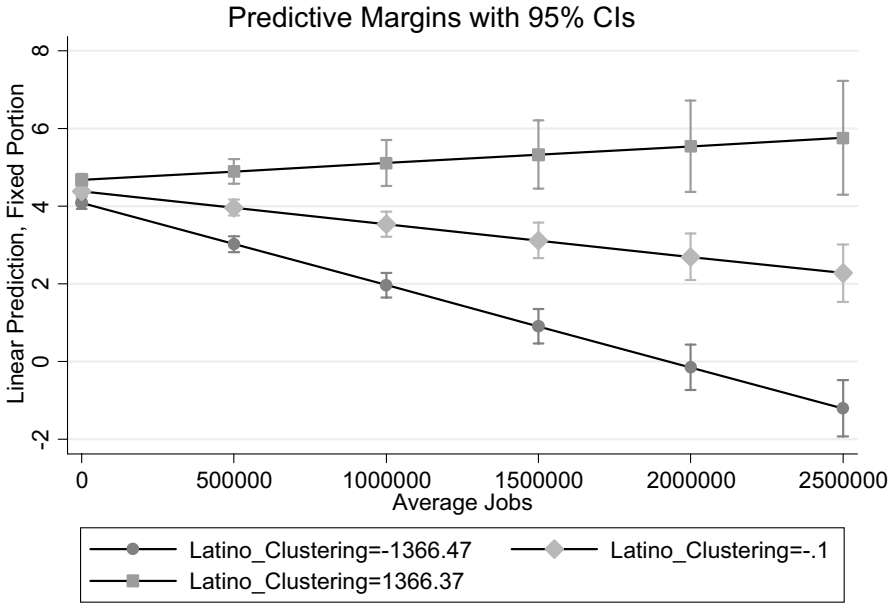

Fig. 4 Graph of the Interaction between Latino clustering and job accessibility by public transit with the unemployment rate

change in White clustering, centered around its mean, is related to 1.411 decrease in the unemployment rate, indicating that the greater degree of concentration and clustering of Whites, the lower the unemployment rate.

Moreover, in all cases we find that average job accessibility by public transit was related to a decrease in the unemployment rate, meaning that the more jobs that were available within 30 min of travel on public transit, the lower unemployment in that block group (columns 2, 5, and 8). Once again, though, this variable does not appear to mitigate the relationship between the clustering scores and the unemployment rate. Those coefficients are all only slightly smaller. Thus, Hypothesis 2 is confirmed.

Looking at columns 3, 6, and 9, we added the interaction term for clustering and access to jobs. The interaction is not significant in the case of Black clustering or White clustering, but significant and positive in the case of Latino clustering. The former finding suggests that public transit access to jobs has an independent effect on unemployment—it lowers it—but this does not differ as neighborhoods become more or less Black or White. This disconfirms Hypothesis 3. However, the finding for Latinos again shows support for Hypothesis 3 because the return on access to jobs is greater in areas that are non-Latino. We present a graph of this significant interaction for Latino clustering in Fig. 4. We find that job accessibility by public transit is related to a lower unemployment rate where Latino clustering is low, but has a relatively flat relationship where Latino clustering is high. Again, this supports Hypothesis 3. The return on access to jobs is less in Latino neighborhoods than non-Latino areas.

4.1 Robustness Checks

As a check on some of our methodological choices, we also specified these models in other ways to confirm that the results hold. First, one of the limitations of the data is that the median household income and unemployment rates used here represent the global measures instead of divided by racial group. However, these metrics by race are missing for a large proportion of the block groups, especially for those areas that are more segregated, or have a large percentage of a given group in an area. The ACS will only release the data at a small unit of analysis if there is a large enough sample size to be representative. For highly segregated block groups, or areas with a high percentage of just one group, it would be difficult to have representative data for other groups who are not the dominant group in the area. To address this, we also ran a sub-analysis on the block groups that were predominantly one group, as defined by the population being at 60% or more of a given group (Black, Latino, or White).[7] The results bear out in the same manner as suggested by the interaction terms. In predominantly Black block groups, the greater the average jobs accessible by public transit, the lower the median household income and the lower the

[7] We found the same pattern of relationships when using a threshold of 70% and 80% as well. However, using these higher thresholds substantially reduced the sample sizes, especially for the Latino model.

unemployment rate. In predominantly Latino tracts, the greater the average jobs accessible by public transit, the lower the median household income, and in the case of the unemployment rate, the variable was not significant. In predominantly White block groups, the greater the number of jobs accessible by public transit, the greater the median household income, and the lower the unemployment rate.

A second consideration is that the clustering measures for segregation only take into account one group at a time at the exclusion of other types of racial admixtures. Moreover, theoretically, the converse of Black, Latino, or White clustering would not be the clustering of another group in space, but rather integrated residential spaces that include more than one group. However, the measures used here fail to capture this level of nuance by focusing on one group at a time and ignoring the role of integration. Practically, though, few places in U.S. urban areas are integrated. As additional analyses, we also estimated similar models described in the paragraph above, but by selecting on racial mixing in residential space. We selected on areas that were at least 30% White and 30% Black for Black-White integrated areas, at least 30% White and 30% Latino for Latino-White integrated areas, and places that were at least 30% Black and 30% Latino for Black-Latino integrated areas. For the Black-White and Latino-White integrated areas, few coefficients were significant, especially as it relates to the main variables of interest. Here, only the number of jobs accessible by public transit was significant and positively related to median household income for Black-White and Latino-White integrated neighborhoods. This variable was not significant for unemployment in any model. The lack of significant coefficients is somewhat of a reflection of the small number of locations that are actually integrated. For example, for Black-White integrated areas, the sample sizes reduces to 7% of the sample with only 3,363 block groups that fit this description. This number is somewhat larger for Latino-White integrated spaces with a sample size of 9,105. Moreover, for mixed neighborhoods among people of color, or Black-Latino integration, the coefficient for the average number of jobs accessible by public transit on median household income is significant and negative, similar to the results found above for Black and Latino clustering separately.

5 Discussion and Conclusions

The goal of this study is to examine the relationship between racial/ethnic residential clustering, job accessibility by public transit, and how these two variables relate to area-level socioeconomic outcomes, specifically income and unemployment. We attempt to adjudicate between competing perspectives on public transit. On the one hand, the public goods perspective argues that public transit has the potential to level racial inequalities in access to employment or other amenities across an urban area (Ewing & Cervero, 2010; Sanchez, 2002). That is, the lower household income and higher unemployment rates in Black and Latino neighborhoods could be due to their lack of access to job sites. If these areas had public transit comparable to White neighborhoods, differences in earnings and unemployment rates might be mitigated. At the same time, we are sensitive to scholars who took a race stratification approach. They argue that even though Black and Latino neighborhoods have access

to fewer jobs via public transportation networks, the jobs that these systems gave access to serve the interests primarily of White workers not Black or Latino workers.

Our purpose is to draw on the recent work on transportation inequalities in the geography and transit literature to shed some light on the enduring effects of residential segregation on differences in Black/Latino/White household incomes and employment. Tying our discussion back to the spatial mismatch hypothesis, we argue that it is doubtful that public transportation systems can overcome the disadvantages that people of color in segregated neighborhoods experience with respect to socioeconomic outcomes. Reducing inequality is not the only purpose of designing transit systems, and from the place stratification perspective, the value of transportation systems has been questioned. We agree that they are often not built in ways to ensure access to all or access to well-paying jobs that are options for residents in Black/Latino neighborhoods (Goodling et al., 2015; Sharkey, 2013). In fact, rather than having a positive or even just a neutral effect on job access for Blacks and Latinos, we suggest that traditionally transit systems were built to benefit residents in White neighborhoods and more recently to further White gentrification. Access to jobs via public transit in White neighborhoods should not only be better than in Black or Latino neighborhoods but socioeconomic returns on access to jobs for Whites should be greater. Thus, differentials in spatial capital of Whites, Blacks, and Latinos may be exacerbated by the design of public transportation system.

Our empirics showed that both Black and Latino clustering are related to poorer job accessibility by public transit at the block group level, meaning that the higher the degree of Black and Latino population in an area, the fewer the jobs that are available within 30 min via public transit lines. The opposite is the case for White clustering. This provides support for Hypothesis 1 and meets the expectations of both the public good and place stratification perspectives. This would indicate that public transportation systems are not equally serving neighborhoods, either through extant public transit lines or their ability to efficiently link those communities to key sites of employment. This is fitting with some previous literature, which has shown racial disparities in access and ridership on public transit lines, especially in certain cities (Golub et al., 2013; Goodling et al., 2015; Lee et al., 2017; McKenzie, 2013; Vojnovic et al., 2014).

Furthermore, we find that both racial clustering and access to jobs are related to socioeconomic outcomes at the area-level. We address two such outcomes, median household income and the unemployment rate, both measured at the block group level. As previous research has found, both Black and Latino clustering are related to lower median household income, indicating that where minority segregation is high, area-level incomes are lower. The converse is the case for White segregation, where a higher degree of concentration and clustering for Whites is related to substantially higher incomes. The same is the case for the block group-level unemployment rate, but in the opposite direction, meaning that where minority segregation is high, the unemployment rate is also correspondingly higher and where White segregation is high, the unemployment rate is lower. This is fitting with the previous literature on the economic consequence of segregation, which finds that more highly segregated minority areas, especially Black segregation, experience poor socioeconomic outcomes (Massey, 2020; Wang, 2008).

We also found that a neighborhood's accessibility to jobs by public transit was positively associated with median household income and negatively associated with the unemployment rate. This means that better job accessibility relates to better socioeconomic outcomes for the area. This corresponds to the literature on the topic, which has shown positive impacts of the public transportation system (Ewing & Cervero, 2010; Sanchez, 1999). However, we also found that when controlling for job accessibility, the effect of race and ethnicity on socioeconomic outcomes did not change. This supports Hypothesis 2 and the race stratification perspective. Equal access does not insure equal socioeconomic outcomes.

Beyond the main effects, when interacting these variables, we find results that diverge from much of the limited research on the topic. Consistent with the place stratification perspective, Hypothesis 3 predicted that a higher degree of minority segregation in an area weakens the positive relationship between job accessibility and median household income and strengthens the same association in the presence of White clustering. In the case of median household income, we found a negative interaction with Black and Latino clustering (separately) and job accessibility by public transit, and a positive interaction for White clustering. This is support for Hypothesis 3. We find a similar pattern for the unemployment rate, but in this case, the interaction term is only significant for Latino clustering. While the lack of an interaction for Black and White neighborhoods does not support Hypothesis 3, the results for Latinos do.

As it relates to unemployment, it is not clear why this same pattern does not apply to Black or White segregation, but there may be more at stake when trying to understand unemployment specifically in Black communities. Black males in particular have by far the highest unemployment rate when broken out by group and have documented experiences with employer discrimination (Wilson, 1996). Mass incarceration also contributes to employment outcomes, especially for Black men (Alexander, 2012; Chetty et al., 2019; Pager & Quillian, 2005). Also, residents of certain neighborhoods have negative socioeconomic experiences just because they are from a neighborhood where many marginalized people live (Wilson, 1996). Therefore, there may be other important factors that contribute to employment outcomes for Black segregated areas that are not well captured here in the same manner that it does for household incomes. Thus, the results provide more insight into the case of racial income inequality rather than employment inequality.

In addition to the finding that Black and Latino areas are less likely to be able to reach jobs via public transit than Whites, what jobs are available appear to do less for those neighborhoods when compared to White areas in terms of socioeconomic outcomes. Job accessibility in Black and Latino neighborhoods does not appear to produce the same returns on socio-economic outcomes as it does for White areas. This suggests something beyond simply an unequal distribution of transportation resources on the part of urban planning, but rather it suggests that the transportation systems are built in such a way that they give White neighborhoods access to jobs that produce positive socioeconomic outcomes, but public transit linking Black and Latino neighborhoods to more jobs do not. Moreover, the benefits of infrastructure, or lack thereof are not limited to socioeconomic outcomes. In the same manner that it can link an individual to access to jobs, it is also related to other economic

and social opportunities such as schools, job rich clusters, transportation and efficient transportation routes, social capital, parks, police protection, robust commercial institutions, etc., which may also be related to lower earnings and higher unemployment.

What are the mechanisms behind this? In the theory section we argued that deleterious effects of urban transit systems on neighborhoods of color has two components. It is well-established that traditionally public transportation systems were built to funnel white collar workers from outlying White neighborhoods to downtown employment sites. Thus, there may very well be a legacy effect. More recently light rail and bus systems have been built linking inner city neighborhoods to employment in the Central Business District (CBD) in the process of these neighborhoods becoming gentrified. The planning literature refers to this as transit-oriented development. These rail and bus systems run through White middle class neighborhoods, which give residents cheap and speedy transportation to the CBD. The professional, technical, and managerial jobs to which Whites are traveling to pay well and are secure. They also provide access to venues that can enhance residents' social and cultural capital. If minority segregated neighborhoods are able to access these systems, the service jobs they are able to go to are lower paying and less secure. Therefore, having access to more jobs—many of which they cannot take advantage of and those they can are less lucrative—has little effect on their income or employment chances. Ironically, this suggests that people's fates are not changed when they move into areas that have better transportation, but rather that public transit improves once better off, White residents are gentrifying a community. While some research finds clear evidence of this particularly in Western cities, there is enough evidence to the contrary that we cannot claim that all transit systems function in this way (Padeiro et al., 2019).

In summary, these results are somewhat different from previous work on the topic, which has found beneficial effects of the public transportation system on Black-White wage inequality (Myers & Saunders, 1996; Sanchez, 2002, 2008) and the gap in unemployment statistics across metropolitan areas (Covington, 2018; Sanchez, 1999). Our study extends these findings to a more refined level of analysis at the block group, includes several dimensions of segregation, including both block group-level and metropolitan-level analyses, and provides more insight to the case of public transit in particular. Our analysis also allows us to examine how these processes play out differently for different kinds of neighborhoods. Black and Latino neighborhoods have low accessibility to public transit, which is fitting with the place stratification perspective. Beyond that, they are less likely to benefit from the jobs that are accessible to them via public transit in terms of the block group-level socioeconomic outcomes, income in particular. Even in areas with access to jobs equal to White areas, racial and ethnic communities do not get the same return on their access as Whites. Thus, we observe a double disadvantage for these neighborhoods, and provide support that these are marginalized places beyond the infrastructure available to them.

The study has several important limitations. First, while the analysis combines several robust datasets, we cannot examine these patterns over time in a longitudinal fashion. The transportation data are only available over a short time frame (2014–2017). We use the most recent year available in the data, but it would be

optimal to measure these infrastructure changes over a multi-decade period and combine that with data on changing demographics and changing socioeconomic outcomes in the population, especially as public transit projects are often fairly slow in development. Without longitudinal data, endogeneity is a concern particularly when describing an area's return on their access to jobs. Indeed, areas with high incomes and low unemployment may be those areas in which cities invest more in public transit. This is an important consideration for future work. Second, as noted above, while we examine two area-level socioeconomic outcomes, we were not able to differentiate these by group. It would be ideal to additionally examine the racial gap in these two outcomes as the dependent variables. However, at the block group level (or any other small geographic unit), this is simply not possible. Due to missing data from representativeness, we would have to eliminate the vast majority of block groups to examine group differences. Also, even where available, these measures suffer from large margins of error in the ACS data. Third, we only examine these outcomes using a data set that includes 49 of the 50 largest metropolitan areas due to limitations from the use of a secondary data source for our variable on job accessibility by public transit. Therefore, we can only really generalize these findings to larger American cities, and not to all urban sites in the U.S. While some other studies were more inclusive of metropolitan areas (Covington, 2018; Sanchez, 2002), we are limited in this fashion. Finally, we do not take into account that in different metropolitan areas there are different kinds of employment opportunities that are located in different places. Researchers who test the spatial mismatch hypothesis emphasize that the location of jobs vis-à-vis residents matter (Ihlanfeldt & Sjoquist, 1998). That is, the number of jobs that someone can access in 30 min via public transit is a function of not only the design of the network, but the location of jobs.

Despite its limitations, the findings from the paper have important policy implications. While investments in public transit appear to be race neutral and indeed are serving multiple policy ends, in fact, neighborhoods that are predominantly White have better access to jobs from public transit. This may result in higher incomes or lower unemployment or areas that have better transit attract people with higher incomes or lower unemployment rates. If that is the intent of city planners, then they have succeeded. However, there is a social cost when investments in White areas are at the expense of minority areas. If city governments want to address seriously the problem of urban inequality, investments in transit have to be race *positive,* improving facilities located in Black and Latino communities to improve access to well-paying jobs that they can work at. The agenda of city planners has to change. Although it is already required that for state and federal funding bodies to provide social impact statements, this process needs to be equitably reinforced and racial/ethnic inequality taken into consideration. That is, to get money to build these systems cities need to show how they will improve access to jobs for people of color. Ideally, investments in local infrastructure will result in clean air, less congestion, fewer automobiles, and better access to jobs and amenities for all urban residents.

Acknowledgements The authors presented this paper at the annual meeting of the American Association of Geographers in 2020. The authors would like to thank Victoria Sisk for her help in finding some key citations for this manuscript.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Akar, G., Chen, N., & Gordon, S. I. (2016). Influence of neighborhood types on trip distances: Spatial error models for Central Ohio. *International Journal of Sustainable Transportation, 10*(3), 284–293. https://doi.org/10.1080/15568318.2014.903447

Alexander, M. (2012). *The new jim crow: Mass incarceration in the age of colorblindness*. New York: The New Press.

Anderson, K. F. (2017). Racial residential segregation and the distribution of health-related organizations in urban neighborhoods. *Social Problems, 64*(2), 256–276. https://doi.org/10.1093/socpro/spw058

Anderson, K. F., & Galaskiewicz, J. (2021). Racial/ethnic residential segregation and urban spatial networks. In Z. Neal & C. Rozenblat (Eds.), *Handbook on cities and networks*. Camberley, Surrey: Edward Elgar Publishing.

Anselin, L., Florax, R. J. G. M., & Rey, S. J. (2004). *Advances in spatial econometrics: Methodology, tools and applications*. Springer.

Baum-Snow, N., & Kahn, M. E. (2000). The effects of new public projects to expand urban rail transit. *Journal of Public Economics, 77*(2), 241–263. https://doi.org/10.1016/S0047-2727(99)00085-7

Bereitschaft, B. (2017). Equity in neighbourhood walkability? A comparative analysis of three large U.S. cities. *Local Environment, 22*(7), 859–879. https://doi.org/10.1080/13549839.2017.1297390

Cao, X., Mokhtarian, P. L., & Handy, S. L. (2007). Do changes in neighborhood characteristics lead to changes in travel behavior? A structural equations modeling approach. *Transportation, 34*(5), 535–556. https://doi.org/10.1007/s11116-007-9132-x

Charles, C. Z. (2003). The dynamics of racial residential segregation. *Annual Review of Sociology, 29*, 167–207. https://doi.org/10.1146/annurev.soc.29.010202.100002

Chetty, R., Hendren, N., Jones, M. R., & Porter, S. R. (2019). Race and economic opportunity in the United States: An intergenerational perspective. *The Quarterly Journal of Economics, 135*(2), 711–783. https://doi.org/10.1093/qje/qjz042

Covington, K. L. (2018). Overcoming spatial mismatch: The opportunities and limits of transit mode in addressing the Black-White unemployment gap. *City & Community, 17*(1), 211–235. https://doi.org/10.1111/cico.12278

Delbosc, A., & Currie, G. (2011). Using Lorenz curves to assess public transport equity. *Journal of Transport Geography, 19*, 1252–1259.

Duany, A., Plater-Zyberk, E., & Speck, J. (2000). *Suburban nation: The rise of sprawl and the decline of the American Dream*. North Point Press.

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

Gabriel, S. A., & Rosenthal, S. S. (1996). Commutes, neighborhood effects, and earnings: An analysis of racial discrimination and compensating differentials. *Journal of Urban Economics, 40*(1), 61–83.

Galaskiewicz, J., Anderson, K. F., & Thompson-Dyck, K. (2021). Minority-White income inequality across metropolitan areas: The role of racial/ethnic residential segregation and transportation networks. *Journal of Urban Affairs, 43*, 16–39. https://doi.org/10.1080/07352166.2019.1660581

Golub, A., Marcantonio, R. A., & Sanchez, T. W. (2013). Race, space, and struggles for mobility: Transportation impacts on African Americans in Oakland and the East Bay. *Urban Geography, 34*(5), 699–728. https://doi.org/10.1080/02723638.2013.778598

Goodling, E., Green, J., & McClintock, N. (2015). Uneven development of the sustainable city: Shifting capital in Portland, Oregon. *Urban Geography, 36*(4), 504–527. https://doi.org/10.1080/02723638.2015.1010791

Grengs, J. (2001). Does public transit counteract the segregation of carless households? Measuring spatial patterns of accessibility. *Transportation Research Record, 1753*(1), 3–10. https://doi.org/10.3141/1753-01

Grengs, J. (2010). Job accessibility and the modal mismatch in Detroit. *Journal of Transport Geography, 18*, 42–54.

Hellerstein, J. K., Neumark, D., & McInerney, M. (2008). Spatial mismatch or racial mismatch? *Journal of Urban Economics, 64*, 464–479.

Holloway, S. R. (1996). Job accessibility and male teenage employment, 1980–1990: The declining significance of space? *The Professional Geographer, 48*(4), 445–458. https://doi.org/10.1111/j.0033-0124.1996.00445.x

Holzer, H. J. (1991). The spatial mismatch hypothesis: What has the evidence shown? *Urban Studies, 28*(1), 105–122. https://doi.org/10.1080/00420989120080071

Holzer, H. J., Quigley, J. M., & Raphael, S. (2003). Public transit and the spatial distribution of minority employment: Evidence from a natural experiment. *Journal of Policy Analysis and Management, 22*(3), 415–441.

Ihlanfeldt, K. R. (1992). *Job accessibility and the employment and school enrollment of teenagers*. W. E. Upjohn Institute for Employment Research.

Ihlanfeldt, K. R., & Sjoquist, D. L. (1998). The spatial mismatch hypothesis: A review of recent studies and their implications for welfare reform. *Housing Policy Debate, 9*(4), 849–892.

Jackson, K. T. (1985). *Crabgrass frontier: The suburbanization of the United States*. Oxford University Press.

Jacobs, J. (1961). *The death and life of great American cities*. Random House.

Jones, P., & Lucas, K. (2012). The social consequences of transport decision-making: Clarifying concepts, synthesising knowledge and assessing implications. *Journal of Transport Geography, 21*, 4–16. https://doi.org/10.1016/j.jtrangeo.2012.01.012

Kain, J. F. (1968). Housing segregation, Negro employment, and metropolitan decentralization. *Quarterly Journal of Economics, 82*(2), 175–197.

Kain, J. F. (1992). The spatial mismatch hypothesis: Three decades later. *Housing Policy Debate, 3*(2), 371–460. https://doi.org/10.1080/10511482.1992.9521100

Karner, A., & Niemeier, D. (2013). Civil rights guidance and equity analysis methods for regional transportation plans: A critical review of literature and practice. *Journal of Transport Geography, 33*, 126–134. https://doi.org/10.1016/j.jtrangeo.2013.09.017

Kasarda, J. D., & Ting, K. (1996). Joblessness and poverty in America's central cities: Causes and policy prescriptions. *Housing Policy Debate, 7*(2), 387–419.

Kawabata, M., & Shen, Q. (2007). Commuting inequality between cars and public transit: The case of the San Francisco Bay Area, 1990–2000. *Urban Studies, 44*(9), 1759–1780. https://doi.org/10.1080/00420980701426616

Kwan, M.-P. (1999a). Gender and individual access to urban opportunities: A study using space-time measures. *Professional Geographer, 51*(2), 210. https://doi.org/10.1111/0033-0124.00158

Kwan, M.-P. (1999b). Gender, the home-work link, and space-time patterns of nonemployment activities. *Economic Geography, 75*(4), 370–394. https://doi.org/10.2307/144477

Larson, S. J. (2018). Examining the efficacy of title VI social equity analysis: A comparative case study of transit access and neighborhood segregation outcomes over time. *Public Integrity, 20*(4), 344–357. https://doi.org/10.1080/10999922.2018.1441595

Lee, J., Vojnovic, I., & Grady, S. C. (2017). The 'transportation disadvantaged': Urban form, gender and automobile versus non-automobile travel in the Detroit region. *Urban Studies, 55*(11), 2470–2498. https://doi.org/10.1177/0042098017730521

Leinberger, C. B. (2008). *The option of urbanism: Investing in a new American dream*. Island Press.

Logan, J. R. (1978). Growth, politics, and the stratification of places. *American Journal of Sociology, 84*(2), 404–416.

Logan, J. R. (2012). Making a place for space: Spatial thinking in social science. *Annual Review of Sociology, 38*, 507–524. https://doi.org/10.2307/23254607

Logan, J. R., & Molotch, H. L. (1987). *Urban fortunes: The political economy of place*. University of California Press.

Logan, J. R. & Stults, B. (2011). The persistence of segregation in the Metropolis: New findings from the 2010 census. Census Brief prepared for Project US2010. http://www.s4.brown.edu/us2010.

Lubitow, A., Rainer, J., & Bassett, S. (2017). Exclusion and vulnerability on public transit: Experiences of transit dependent riders in Portland, Oregon. *Mobilities, 12*(6), 924–937. https://doi.org/10.1080/17450101.2016.1253816

Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy, 20*, 105–113. https://doi.org/10.1016/j.tranpol.2012.01.013

Manaugh, K., Miranda-Moreno, L. F., & El-Geneidy, A. M. (2010). The effect of neighbourhood characteristics, accessibility, home–work location, and demographics on commuting distances. *Transportation, 37*(4), 627–646. https://doi.org/10.1007/s11116-010-9275-z

Marcus, L. (2010). Spatial capital: A proposal for an extension of space syntax into a more general urban morphology. *The Journal of Space Syntax, 1*(1), 30–40.

Martens, K., Golub, A., & Robinson, G. (2012). A justice-theoretic approach to the distribution of transportation benefits: Implications for transportation planning practice in the United States. *Transportation Research Part a: Policy and Practice, 46*(4), 684–695. https://doi.org/10.1016/j.tra.2012.01.004

Massey, D. S. (2020). Still the Linchpin: Segregation and stratification in the USA. *Race and Social Problems, 12*(1), 1–12. https://doi.org/10.1007/s12552-019-09280-1

Massey, D. S., & Denton, N. A. (1988). The dimensions of residential segregation. *Social Forces, 67*(2), 281–315. https://doi.org/10.2307/2579183

Massey, D. S., & Denton, N. A. (1993). *American apartheid: Segregation and the making of the underclass*. Harvard University Press.

McCray, T., & Brais, N. (2007). Exploring the role of transportation in fostering social exclusion: The use of GIS to support qualitative data. *Networks and Spatial Economics, 7*(4), 397–412. https://doi.org/10.1007/s11067-007-9031-x

McKenzie, B. S. (2013). Neighborhood access to transit by race, ethnicity, and poverty in Portland, OR. *City & Community, 12*(2), 134–155. https://doi.org/10.1111/cico.12022

McLafferty, S., & Preston, V. (1997). Gender, race and the determinants of commuting: New York in 1990. *Uban Geography, 18*, 192–202.

McLafferty, S., & Preston, V. (2019). Who has long commutes to low wage jobs? Gender, race, and access to work in the New York region. *Urban Geography, 40*(9), 1270–1290. https://doi.org/10.1080/02723638.2019.1577091

Myers, S. L., Jr., & Saunders, L. (1996). The effect of commute time on racial earnings inequality: A case study of the Houston metropolitan statistical area. *Applied Economics, 28*(10), 1339–1343.

Newbold, B. K., Scott, D. M., & Burke, C. (2017). Immigrant status and commute distance: An exploratory study based on the greater golden horseshoe. *Transportation, 44*, 181–198.

O'Connell, H. A. (2015). Where there's smoke: Cigarette use, social acceptability, and spatial approaches to multilevel modeling. *Social Science & Medicine, 140*, 18–26. https://doi.org/10.1016/j.socscimed.2015.06.025

Ong, P. M., & Miller, D. (2005). Spatial and transportation mismatch in Los Angeles. *Journal of Planning Education and Research, 25*, 43–56. https://doi.org/10.1177/0739456X04270244

Owen, A., & Murphy, B. (2018). Access across America: Transit 2017. Center for Transportation Studies, University of Minnesota. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/199920.

Padeiro, M., Louro, A., & Marques de Costa, N. (2019). Transit-oriented development and gentrification: A systematic review. *Transport Reviews, 39*(6), 733–754. https://doi.org/10.1080/01441647.2019.1649316

Pager, D., & Quillian, L. (2005). Walking the talk? What employers say versus what they do. *American Sociological Review, 70*(3), 355–380.

Preston, V., & McLafferty, S. (1999). Spatial mismatch research in the 1990s: Progress and potential. *Papers in Regional Science, 78*, 387–402.

Preston, V., & McLafferty, S. (2016). Revisiting gender, race, and commuting in New York. *Annals of the American Association of Geographers, 106*(2), 300–310. https://doi.org/10.1080/00045608.2015.1113118

Raphael, S. (1998). The spatial mismatch hypothesis and Black youth joblessness: Evidence from the San Francisco Bay Area. *Journal of Urban Economics, 43*, 79–111.

Reardon, S. F., & O'Sullivan, D. (2004). Measures of spatial segregation. *Sociological Methodology, 34*, 121–162.

Roberto, E. (2018). The spatial proximity and connectivity method for measuring and analyzing residential segregation. *Sociological Methodology, 48*(1), 182–224. https://doi.org/10.1177/0081175018796871

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science, 277*(5328), 918–924. https://doi.org/10.1126/science.277.5328.918

Sanchez, T. W. (1999). The connection between public transit and employment: The cases of Portland and Atlanta. *Journal of the American Planning Association, 65*(3), 284–296. https://doi.org/10.1080/01944369908976058

Sanchez, T. W. (2002). The impact of public transport on US metropolitan wage inequality. *Urban Studies, 39*(3), 423–436. https://doi.org/10.1080/00420980220112766

Sanchez, T. W. (2008). Poverty, policy, and public transportation. *Transportation Research Part a: Policy and Practice, 42*(5), 833–841. https://doi.org/10.1016/j.tra.2008.01.011

Savitz, N. V., & Raudenbush, S. W. (2009). 5. Exploiting spatial dependence to improve measurement of neighborhood social processes. *Sociological Methodology, 39*(1), 151–183. https://doi.org/10.1111/j.1467-9531.2009.01221.x

Sharkey, P. (2013). *Stuck in place: Urban neighborhoods and the end of progress toward racial equality*. University of Chicago Press.

Taylor, D. B., & Ong, P. M. (1995). Spatial mismatch or automobile mismatch? An examination of race, residence and commuting in U.S. metropolitan areas. *Urban Studies, 32*(9), 1453–1473.

Trounstine, J. (2018). *Segregation by design: Local politics and inequality in American cities*. Cambridge University Press.

U.S. Census Bureau, American Community Survey 2008–2012, Tables S0801 and B08006, available on American Factfinder.

Vojnovic, I., Kotval-K, Z., Lee, J., Ye, M., Ledoux, T., Varnakovida, P., et al. (2014). Urban built environments, accessibility, and travel behavior in a declining urban core: The extreme conditions of disinvestment and suburbanization in the Detroit region. *Journal of Urban Affairs, 36*(2), 225–255. https://doi.org/10.1111/juaf.12031

Wang, Q. (2008). Race/ethnicity, gender and job earnings across metropolitan areas in the United States: A multilevel analysis. *Urban Studies, 45*(4), 825–843. https://doi.org/10.1177/0042098007088470

Weinberg, B. A. (2004). Testing the spatial mismatch hypothesis using inter-city variations in industrial composition. *Regional Science & Urban Economics, 34*, 505–532.

Wilson, W. J. (1996). *When work disappears: The world of the new urban poor*. New York: Random House.

Yang, T.-C., Park, K., & Matthews, S. A. (2020). Racial/ethnic segregation and health disparities: Future directions and opportunities. *Sociology Compass*. https://doi.org/10.1111/soc4.12794