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# Minority-White income inequality across metropolitan areas: The role of racial/ethnic residential segregation and transportation networks

Joseph Galaskiewicz[a], Kathryn Freeman Anderson[b], and Kendra Thompson-Dyck[a]

[a]University of Arizona; [b]University of Houston

**ABSTRACT**

Racial/ethnic inequality is a common feature of urban life. This paper attempts to identify spatial structures that contribute to disparities in White and minority incomes. In a study of 49 core based statistical areas (CBSAs) in the U.S., we analyze 2016 data on racial/ethnic income inequality, 2010 data on minority-White segregation, and 2014 data on job accessibility through transit, driving and pedestrian transportation networks. We find that Black and Latino incomes are far lower than White incomes where the former are more segregated and if transit, driving, and pedestrian networks are more efficient, i.e., residents can access a larger proportion of metro area employment opportunities during the morning rush hour. For Latinos, these effects are independent of each other. For Blacks, they are substitutes. We conclude by offering various explanations for why transit and pedestrian networks, in particular, could contribute to racial inequality.

## Introduction

Research has long demonstrated a sizable wage gap between Whites and Blacks and Latinos in the U.S. (Peterson, Snipp, & Cheung, 2017). Although this is the general pattern, it varies by locale (Parks, 2012). With this analysis, we aim to understand these differences in income by race/ethnicity across metropolitan areas by specifically focusing on racial/ethnic residential segregation and urban transportation networks.

From the previous literature on the topic, part of the effect of segregation on income inequality can be accounted for by spatial mismatch theory, which has a long history in economics (Holzer, 1991; Kain, 1968) and sociology (Wilson, 1987, 1996). Spatial mismatch theory posits that jobs, especially those for unskilled workers, are no longer located near the residences of those workers (Kain, 1968). Yet, no study has attempted to understand this problem in light of the challenges that workers may face in getting to their places of employment and how transportation networks may attenuate or exacerbate these effects. The physical infrastructure of cities and transportation networks are obviously important factors in explaining accessibility (Ewing & Cervero, 2010). Ideally, a cheap and efficient transportation network should raise everyone's income (Karner & Niemeier, 2013). Furthermore, opening up the urban landscape so that all residents can access resources could mitigate the harmful effects of segregation on minority incomes, as labor supply can better "access" demand (Covington, 2018; Holzer, Quigley, & Raphael, 2003; Stoll & Covington, 2011). However, different transportation systems may benefit some groups more than others, e.g., a speedier highway system may lead to higher White incomes while a better transit system may lead to higher minority incomes, as different groups are more likely to utilize certain transportation options and may have better access to those options (Sharkey, 2013).

**CONTACT** Kathryn Freeman Anderson kateanderson@uh.edu Department of Sociology, University of Houston, 3551 Cullen Blvd, PGH Building, Room 450, Houston, TX 77204-3012.

Using metropolitan-level data on Black, White, and Latino incomes from 2016, 2010 data on minority-White segregation, and job accessibility scores for three different modes of transportation for 2014, we address three research questions on racial/ethnic income inequality. First, what is the relationship between racial/ethnic minority segregation and income across racial/ethnic groups? Based on the extant literature, we expect that segregation will depress minority incomes while leaving White incomes unaffected thus increasing inequality. Second, what is the relationship between job accessibility and income across racial and ethnic groups? We measure this by examining public transportation, driving, and walking during peak travel times, and we expect that different components of the urban transportation network will benefit different households. A more efficient highway system will increase White household incomes, while a more efficient transit and pedestrian system will increase minority incomes. We expect that the first will lead to greater inequality between Whites and minorities, while the latter will reduce income inequality between Whites and minorities. Finally, how does job accessibility (through these three measures) moderate the relationship between segregation and income across racial/ethnic groups? Here, we expect that improved job accessibility through transit and pedestrian networks will reduce segregation's effects on minority income. We address these questions in a series of OLS regression models using data from the 49 largest core-based statistical areas (CBSAs) in the United States (metropolitan areas). First, we address the extant literature on the topic and our theoretical approach. Then, we discuss our data, methods, and central findings.

## Literature review and theoretical framework

### *Racial/ethnic income inequality*

Research on wage-gap trends over time demonstrates that on average Black, Latino, and Native American workers consistently earn significantly less than their White counterparts (Peterson et al., 2017). Some of this difference is reduced after accounting for human capital factors, yet variables such as education explain only part of the income gap (Peterson et al., 2017). Also, this is not absolute. For example, the gap is stronger for men than for women, as traditional women's work is undervalued in general (Catanzarite, 2003). Moreover, these patterns have only minimally changed since the Civil Rights Movement of the 1960s (Peterson et al., 2017). Although this is the pattern that we observe over time in the U.S., some metropolitan areas, states, or regions, experience greater minority-White income inequality than other locations (Parks, 2012). Here, we focus on the metropolitan area as our unit of analysis where we observe substantial differences in terms of the racial/ethnic gap in wages and overall household income.

In the extant literature on the topic, researchers point to a number of macro-economic factors that can depress minority wages and lead to greater differences in income between minorities and Whites. Chiefly, globalization, deindustrialization, and automation have led to stagnant or even lower wages for many low-skilled workers, while benefiting high-skilled workers (Bluestone & Harrison, 1982; Freeman & Katz, 1994; Wallace, Gauchat, & Fullerton, 2011). This may further exacerbate earning differences between minorities and Whites given that the former are more likely to be in the low-skilled category and the latter in the high-skilled category (Bound & Freeman, 1992; Volscho & Fullerton, 2005; Wilson, 1987). Additionally, we have seen the decline of union employment (which is more likely to be in the manufacturing sector), which could also contribute to depressed wages for working people, as well as a larger racial/ethnic income gap (Kornrich, 2009; Wilson, 1987). In terms of a regional/metropolitan area story, this could account for differences across cities as certain locations have experienced globalization, deindustrialization, and automation at a much higher rate. In these places, income differences between minorities and Whites should be the greatest.

Beyond broad changes to the economy, and as it relates to race more specifically, scholars have noted that the local racial/ethnic composition is also related to the racial/ethnic wage gap. Such work

has found that metropolitan areas with a higher percentage of minority residents tend to have a larger gap in incomes between groups (Beggs, Villemez, & Arnold, 1997; Blalock, 1956; Burr, Galle, & Fossett, 1991; Cohen, 2001; Huffman & Cohen, 2004; Moller, Alderson, & Nielsen, 2009; Parks, 2012; Tienda & Lii, 1987). This is especially the case for Black Americans. These scholars argue that this is likely due to perceived group competitive threat, which then leads to greater retaliation and discriminatory actions meant to limit the wages and job opportunities for racial/ethnic minorities with respect to Whites. Immigration and changes in immigration also play a role in this process with mixed findings. In some cases, a larger percentage of foreign born individuals depresses wages of minorities, while in other cases it bolsters minorities' wages, depending on race and human capital factors (McCall, 2001; Parks, 2012; Wang, 2008). For example, McCall (2001) found that an increase in immigration led to a significant reduction in wages for Latino and Asian workers, but had no effect on Black wages.

### *Residential segregation and spatial inequality*

Beyond the relative percentages of racial/ethnic minorities, in this analysis we focus on racial/ethnic residential segregation as it relates to the wage gap. Previous work has found that racial/ethnic residential segregation produces certain negative impacts on communities, with wages being no exception. Within this body of work, the focus has been on how racial/ethnic and class segregation restricts the access of minorities to jobs, services, and consumer goods. Indeed, research has found that levels of racial/ethnic residential segregation are correlated with racial/ethnic income inequality (Massey & Denton, 1993; Wang, 2008). For example, Wang (2008) found that although higher levels of Black residential segregation were not statistically significantly associated with lower wages for Black workers, it significantly contributed to higher wages for all other groups, broken up by race and gender, thus contributing to a greater racial/ethnic income gap.

Part of the effect of segregation on income inequality can be accounted for by spatial mismatch theory (Holzer, 1991; Kain, 1968; Wilson, 1987, 1996). These scholars have argued that in the past several decades, there is a growing spatial mismatch between the physical locations of jobs, and where low-skill, low-wage, often Black employees live, as these jobs have steadily moved out to the suburbs with deindustrialization (Kain, 1968). As such, these patterns have contributed to deepening poverty in urban Black segregated communities and greater income inequality in comparison to Whites (Wilson, 1987). However, according to Mouw (2000, p. 730) "30 years of empirical research has yielded little consensus about the magnitude of the effect of employment relocation on the racial/ethnic gap in unemployment and earnings." His own work showed that the out-migration of jobs in Detroit led to an increase in black unemployment in the inner city but explained only about one-quarter of Detroit's 15-point gap between Black and White unemployment. In contrast, in Chicago job growth in the downtown area enhanced inner city Blacks' access to jobs and unemployment rates went down. However, in both cases the location of job growth and decline mattered for Black unemployment.

Recent research has focused on residents' spatial access to a wide variety of urban amenities, which can include employment opportunities, but also include access to organizational resources that can enhance human capital (e.g., job training, drug rehabilitation, schools), free up time to work (e.g., day care for the young and elderly), and contribute to better health (e.g., supermarkets, clinics, physician offices). It is clear that minorities have more limited access than Whites. Wilson's (1987) classic work, *The Truly Disadvantaged*, researched areas of concentrated poverty on the South Side and West Side of Chicago in the 1980s. He showed that many of the organizations that were present in other neighborhoods of the city were absent in predominately Black neighborhoods of concentrated poverty. Small and McDermott's (2006) research on a national sample of metropolitan areas showed that as the proportion Black in a community increased, the amount of organizational resources decreased—independent of wealth or poverty. They argued that race, and not poverty, was the key component in explaining a community's institutional completeness and residents' access

or exposure to organizational resources. Other work has affirmed these findings and demonstrated that both poor and minority communities, largely conceptualized as Black neighborhoods, are more likely to lack a wide variety of community resources, which may contribute to quality of life and worker well-being, such as food resources, fitness and recreation, and health care facilities (Anderson, 2017; Beaulac, Kristjansson, & Cummins, 2009; Gaskin, Dinwiddie, Chan, & McCleary, 2012; Moore, Roux, Evenson, McGinn, & Brines, 2008; Walker, Keane, & Burke, 2010). The import of these finding for this study is that segregated minority neighborhoods often lack access to valued services, both employment opportunities and supplemental services supporting worker well-being, which may exacerbate the minority-White wage gap.

### *Transportation networks and accessibility*

Underlying much of the current work on spatial inequality in access to resources, employment or otherwise, is the idea that people are more likely to access some job or amenity if it is located nearby. However, the transportation infrastructure can help overcome the limitations of what is immediately available to people in their neighborhoods, provided that it is efficient and effective at moving people about the urban area. Previous work has demonstrated that the physical infrastructure of cities and transportation networks are important in explaining accessibility (Cao, Mokhtarian, & Handy, 2007; Ewing & Cervero, 2010; Kawabata & Shen, 2007). Moreover, land use, especially multi-use zoning, can help position individuals and families closer to employment opportunities and amenities needed for daily life (Duany, Plater-Zyberk, & Speck, 2000; Ewing & Cervero, 2010; Jacobs, 1961). Thus, this work demonstrates the effect of urban planning on behaviors and outcomes. For the purposes of this paper, the efficiency of transportation networks is measured in terms of job accessibility, i.e., the number of job opportunities accessible by car, transit, or on foot within a given amount of time.

Previous studies have focused on the methodological challenges of adequately measuring travel burden and accessibility (Nicholls, 2001), and there are numerous accessibility measures in geography (El-Geneidy & Levison, 2006). Broadly, researchers have examined accessibility using both infrastructure-based models, as well as activity-based models (Geurs & Ritsema van Eck, 2001). Infrastructure-based models focus on the ability of the transportation infrastructure to move people about the urban area in order to access needed points (El-Geneidy & Levison, 2006; Kwan, 1998). The activity-based approaches emphasize the activities that individuals engage in, and how they move about the urban area in order to accomplish those activities (Geurs & Ritsema van Eck, 2001). All of these approaches are heavily dependent on the urban design, the location of facilities and residents, land use variables, the transportation networks that connect them, and points of access (e.g., on/off ramps, subway station locations, pedestrian bridge entries, etc.) (Baradaran & Ramjerdi, 2001; Geurs, van Wee, & Rietveld, 2006). The focus here, though, is on the consequences of accessibility rather than on the nuances of measuring accessibility. Thus, we examine job accessibility, as measured by access to jobs, at the metropolitan level for three different transportation forms: public transportation, driving, and walking (measures discussed in detail below).

Moreover, the focus of this study is how accessibility relates to minority and White incomes and racial inequality. This effect can be direct or it can be indirect by reducing the impact of segregation on minority incomes. Compared to other social variables, such as gender and socio-economic status that have been studied rather extensively with regard to travel patterns and accessibility, relatively little attention has been paid to race/ethnicity in general and racial segregation in particular (Akar, Chen, & Gordon, 2016; Kwan, 1999; Manaugh, Miranda-Moreno, & El-Geneidy, 2010; McCray & Brais, 2007). Indeed, research on transportation equity has shown that planners do not often consider the impact on or of racial/ethnic dynamics in the city (Karner & Niemeier, 2013).

Theoretically, there may be two ways of considering this problem. Ideally, a cheap and efficient transportation network should benefit those who are restricted to living in segregated neighborhoods. Linking together the urban landscape so that all can access resources that only the privileged could access before, should have a "leveling" effect on earnings and quality of life (Ewing & Cervero,

2010). Indeed, Title VI of the Civil Rights Act of 1964 mandates that agencies, including urban planning and transportation authorities, cannot discriminate (Karner & Niemeier, 2013; Larson, 2018). Furthermore, empirical research has shown that improved accessibility and public transportation has appreciable benefits for people living in those areas, including social and economic conditions, employment, and even home values (Baum-Snow & Kahn, 2000; Covington, 2018; Sanchez, 2002, 2008). An efficient network should compensate minorities for the negative effects of segregation on their incomes and raise their incomes to be more equal to Whites. This, of course, assumes that transit, driving, and pedestrian networks are constructed in a way that can better move minorities out of segregated neighborhoods to job opportunities and amenities.

However, some research has shown that a consequence of building better transportation networks is the opposite, it exacerbates income inequality. We know that different racial/ethnic groups tend to rely on different modes of transport. For instance, recent Census figures demonstrate that Blacks, Latinos, and the poor are less likely to own a private vehicle compared to non-Latino Whites, and are more likely to use public transit or walk in their work commutes (U.S. Census Bureau, 2008–2012). Thus, the number of jobs accessible through highways, streets, and roads versus public transportation or pedestrian trails will affect different groups differently. Rather than being built to give the poor and minorities better access to resources across the urban landscape, in the United States, roads, highways, and transit were often built with the intent to benefit wealthier and White urban residents. The hub and spoke design of many early transit and later highway networks was oriented from the start to accommodate the out-migration of wealthier (and mostly White) residents into the suburbs by enabling them to live on the outskirts of the metropolitan area and still work in the central cities (Duany et al., 2000; Leinberger, 2008; Sharkey, 2013). Employment opportunities expanded in suburban areas, but transit networks were not redesigned to carry inner city residents to these new sites, further perpetuating these inequalities in job opportunities and income (Duany et al., 2000; Holzer et al., 2003; Sanchez, 2002). For example, case studies in Oakland (Golub, Marcantonio, & Sanchez, 2013) and Portland (Goodling, Green, & McClintock, 2015) have documented over time the ways in which transportation resources were disproportionately directed toward Whiter and more affluent areas of the city. Other quantitative studies of single cities have shown the effects of this in that low income, declining, and minority areas often have lower accessibility compared to other parts of the urban area, including areas that are more suburban (Bereitschaft, 2017; Grengs, 2001; Lee, Vojnovic, & Grady, 2017; McKenzie, 2013; Vojnovic et al., 2014).

On the other hand, with the revitalization of downtown employment and gentrification, inner city neighborhoods become more spatially advantaged and access to low skill service jobs by less educated workers should increase (Brown-Saracino, 2017). However, this assumes that poor and/or minority residents are not displaced and lose this advantage (Goodling et al., 2015; Kawabata & Shen, 2007). Furthermore, while new light rail transit, walkways, and bike paths (e.g., in the West) may help inner city residents access downtown jobs, they do little to transport poor and minority populations to job sites in the suburbs. Thus, they may have greater utility for the young middle class residents who now inhabit inner city neighborhoods (Grengs, 2001; Lubitow, Rainer, & Bassett, 2017; McKenzie, 2013).

With these considerations in mind, we aim to expand our understanding of how the transportation system and accessibility relate to urban inequality by examining racial/ethnic residential segregation and the racial/ethnic wage gap. To be sure, transportation geographers have extensively studied the transportation infrastructure and the movement of workers to their places of employment, but they have not studied how these networks interact with residential segregation to explain racial/ethnic income inequality. Moreover, most of the extant work (reviewed above) on differences in access to transportation resources typically focus on a single city, rather than comparisons across cities with few exceptions. One study examined wage inequality by public transportation across metropolitan areas and found that public transportation reduces wage inequality (Sanchez, 2002), but this did not factor in the racial gap in earnings. Another multi-city study found that automobile

access and public transportation lowered racial disparities in unemployment across the 100 largest metropolitan areas, but this study did not examine wages specifically (Covington, 2018). Some limited work focusing on a single city has examined commute times and transportation, and the racial/ethnic earnings gap (Myers & Saunders, 1996), but none have examined differences in transportation networks across metropolitan areas.

### Hypotheses

As we described above, there has been limited research on the effects of racial/ethnic segregation on the differences in minority to White earnings. However, it is not difficult to make the argument that groups that are segregated and do not have ready access to all facilities across the metropolitan landscape, because of restrictions on where they can live, should be at a disadvantage vis-à-vis the dominant group. Thus, segregation will result in lower minority incomes, while having little effect on White incomes. As a result, minority segregation should lead to greater inequality between minorities and Whites.

*H1: Racial/ethnic residential segregation will have a negative effect on the percentage of minority to White median household income.*

As noted, since more efficient transportation networks provide residents access to more jobs we expect that incomes should be higher in CBSAs that have more efficient transportation systems. Workers are better able to be matched to jobs that can pay them a premium wage. However, our literature review showed that minorities and Whites often use different forms of transportation. Whites are more likely to use automobiles, while minorities are more likely to use public transit systems or pedestrian walkways. Thus improvements in different types of transportation systems would benefit different groups. A more efficient transit and/or pedestrian network will increase minority incomes but will not affect White incomes, while a more efficient roadway network will increase White incomes but will not affect minority incomes. The former will reduce minority/White inequality, while the latter will exacerbate it.

*H2a: A more efficient transit or pedestrian network will have a positive effect on the percentage of minority to White median household income.*

*H2b: A more efficient roadway network will have a negative effect on the percentage of minority to White median household income.*

We extend this literature by arguing that the negative effects of segregation on racial/ethnic income equality may be moderated by the accessibility to jobs through the urban transportation network. On the one hand, transportation networks that provide better access to jobs for minorities, e.g., transit and walkways, should help overcome the negative effects of segregation. That is, we have a *mitigating* effect. More specifically, if racial/ethnic segregation imposes a cost on minorities who are forced to live in segregated communities, which results in their earning less than Whites, then the presence of a highly accessible transportation network that they can use may mitigate some of these negative effects by enabling those who live in segregated areas to access more effectively employment beyond their neighborhoods. This also implies that in metropolitan areas that lack these facilities the effects of residential segregation should be stronger, since it is more difficult for segregated residents to travel beyond their neighborhoods.

*H3: Where the transit and/or pedestrian network provides better access to employment opportunities, the effect of segregation on the percentage of minority to White income should be less, as minority incomes catch up to White incomes in segregated communities.*

On the other hand, improvements in networks that benefit the dominant group, e.g., roadway networks, may substitute for segregation as a source of inequality. In segregated communities, the average incomes of minorities should be lower than in integrated communities regardless of the efficiency of the roadway network. However, in integrated communities, minorities in cities with better roadway networks will be earning less than Whites. Thus efficient roadway networks can offset gains relative to Whites due to integration, effectively lowering the effect of segregation on minority incomes. The result is a *substitution* effect. In integrated communities the average incomes of minorities should be higher than in segregated communities, but because roadways benefit Whites more than minorities, better roadways may sustain minority/White inequality.

*H4: Where the roadway network provides better access to employment opportunities, the effect of segregation on the percentage of minority to White income should be less as White incomes far outstrip minority incomes in integrated communities.*

To understand better Hypotheses 3 and 4, see Figure 1a,b. Hypothesis 3 argues that segregation's negative effects on minority to White income equality would be mitigated (or reduced) if transit and pedestrian networks could access more jobs, i.e., the slope would be flatter as more jobs become accessible, and steeper where fewer jobs are accessible. This is illustrated in Figure 1a. That is, the interaction term should be positive (as the network gets more efficient, the negative effect of segregation on minority incomes decline). In this scenario, transportation networks liberate minorities from living in segregated areas. The result is that minority incomes better match White incomes. On the other hand, more efficient roadway networks—which should increase White incomes—could sustain inequality even though minority incomes would be higher in less segregated communities. Thus even though Black incomes are higher in integrated areas,

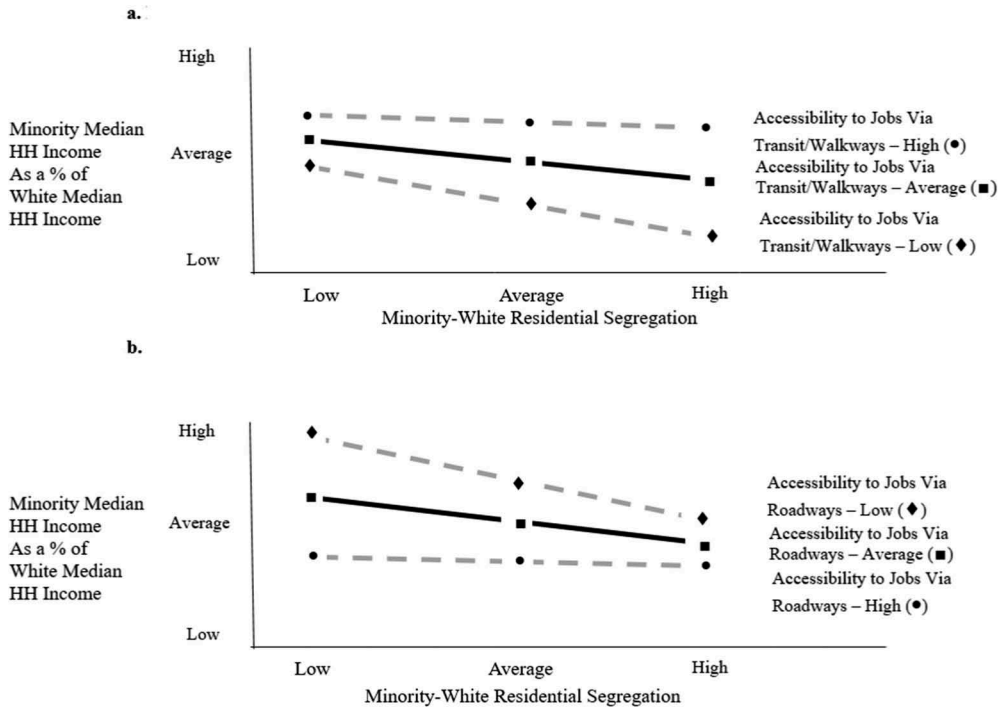


**Figure 1.** (a) Hypothesized interaction among efficiency of transit and pedestrian networks, residential segregation, and minority income as a percent of White household income (H3). (b) Hypothesized interaction among efficiency of the roadway networks, residential segregation, and minority income as a percent of White household income (H4).

minority incomes as a percentage of White incomes would remain unchanged. Again, the interaction term should be positive, but instead of raising Black incomes, better roadways raise White incomes. In Figure 1b, we suggest that the ratio of minority to White incomes will still be low if in integrated areas the roadway system is more efficient. In this respect, the variable effects on inequality are substitutable.

## Data and methods

### *Data*

In order to examine the association between urban transportation networks and urban income inequality, we combine several data sources at the metropolitan-level. Specifically, our units of analysis are the 50 largest core-based statistical areas (CBSAs) in the United States as defined by the Office of Management and Budget (OMB). We use the metropolitan area as the unit of analysis in order to better understand these differences in income across regions, and the metropolitan area best reflects the full economic scope of an urban area, as many suburbs still look to the urban core for employment opportunities and resources. Moreover, in order to study the effect of broad-scale transportation networks, the metropolitan area is most appropriate. Most transportation systems, especially driving and public transportation, are developed at the metropolitan-level, as the central purpose of most systems is to effectively move workers in and out of the central business district to circulate them around town and to carry them to and from the suburban outlying areas. Thus, if we want to understand the impact of transportation networks, this is the scale where planning occurs. First, for data on segregation, racial/ethnic income inequality, and other social and demographic variables (a variable for the new economy, percent foreign born, percent Black, and percent Latino), we use data from the 2010 Census and the 2010 and 2016 American Community Survey (ACS). We also supplement these Census sources with data from John Logan's effort out of Brown University called the American Communities Project, which includes calculated measures for segregation based on the full 2010 Census (Logan, 2011). We combine these data with 2014–2015 transportation data from the "Access Across America" project from the Center for Transportation Studies at the University of Minnesota (Owen & Levinson, 2014; Owen, Murphy, & Levinson, 2015a; Owen, Murphy, & Levinson, 2015b). These include three measures on job accessibility, or the number of jobs accessible through the public transportation, driving, and pedestrian infrastructure of 49 of the 50 largest metropolitan areas in the U.S. (details on these measures below). Unfortunately, data for Memphis, Tennessee, was not available due to problems of data compatibility. A complete list of all 49 metropolitan areas and their values for our main dependent and independent variables for this analysis can be found in Appendix A.

### *Dependent variables*

For this analysis, the dependent variables reflect minority-White income inequality, or specifically the median household incomes of Blacks and Latinos as a percent of White median household incomes measured at the metropolitan-level in 2016. As such, values below 100% indicate that Black and Latino households earn incomes that are below that of White households, whereas values at or near 100% indicate income parity between Whites and their minority counterparts. However, in Appendix A we see that in no metropolitan area did the values for either Blacks or Latinos household incomes exceed 100%.

### *Independent variables*

As the main substantive variables in this analysis, we include two central measures. The first is for minority-White residential segregation. In order to measure racial/ethnic residential segregation, we use the Black-White dissimilarity index and the Latino-White dissimilarity index using the 2010 Census figures (Source: American Communities Project at Brown University; Logan, 2011).

Although the index of dissimilarity is the most commonly used measure of segregation, some work suggests that exposure indices, such as the Black and Latino isolation indices, are better measures to capture the social isolation from segregation and the negative social effects it could produce (Massey & Denton, 1988). However, there is a higher correlation of percent Black and Latino and the respective isolation indices (.826 and .933) than between percent Black and Latino and the respective dissimilarity indices (.395 and .345). To reduce multicollinearity in our analyses, we used the indices of dissimilarity. As noted below, we also ran a robustness check substituting the isolation index for the dissimilarity measure in our regressions.

In order to measure the accessibility to jobs, we use a series of measures from the "Access Across America" project as noted above. For this, we use three such measures, which reflect transit, driving, and pedestrian capabilities. For each type of travel, the "Access Across America" project computed an index counting the number of jobs accessible within a certain time (e.g., 10, 20 … 60 minutes) by a certain mode of travel (e.g., public transit, car, walking) between 7 and 9 a.m. on a weekday. Scores were determined by a weighted average of accessibility, giving a higher weight to closer jobs.[1] In our analysis, we used the weighted average number of jobs that were reachable in 30 minutes.[2] We then divided these numbers by the total number of jobs in the CBSA as reported by the Longitudinal Employer-Household Dynamics (LEHD), which is a U.S. Census product. Our measure exceeds 100% in some cases. This is because the denominator is based on the number of jobs in the CBSA while the numerator is the number of jobs accessible from different blocks in the CBSA, which could include jobs outside the CBSA. Thus, the higher the score for these measures, the better the transportation system is for gaining access to employment opportunities.

## Control variables

We also include a number of metropolitan-level control variables in order to account for other urban dynamics that may influence this association. This includes percent foreign born, percent Black, percent Latino, percent manufacturing jobs, a measure of "new economy" jobs, and Midwest location. Earlier we reviewed the role that the foreign born might play in affecting earnings. The extant literature is unclear on whether they benefit or detract from Black and Latino earnings. The variable we used was the percent of the population that is foreign born in 2010. The next two demographic variables, percent Black and Latino (2010), were included because the effect of segregation should be independent of how much a group is represented in a population. Also, our literature review noted that the presence of a minority group in an urban area affects the gap in incomes between groups. We know there is typically a correlation between segregation measures and the size of a group, however, we wanted to isolate the effects of the spatial variable (segregation) and demographic variable.

We also created a "new economy" variable. This variable aimed to measure the presence of a post-industrial workforce in the metropolitan area. As noted in our literature review, this type of economy should benefit Whites more than minorities because of differences in educational levels. We added up the percentage of jobs that were in finance, information, and professional occupations (2010). We also included the percent manufacturing jobs (2010), since minorities benefit from employment in this sector. Finally, we included dummy variables for being located in different regions of the country. We settled on a dummy for being located in the Midwest, since that had a negative effect on Black household incomes. The descriptive statistics for all variables can be found in Appendix B.

## Models

To test the hypotheses, we used Black household income as a percentage of White household income and Latino household income as a percentage of White household income as our dependent variables. We also included interaction terms to test if the effects of segregation on these ratios are contingent on the efficiency of the transportation network. We centered our segregation scores (the

index of dissimilarity for Blacks and Latinos) and computed z-scores for the variables indicating the accessibility of the three modes of transportation: transit, driving, and walking before computing the interaction terms. We limited the number of control variables because of the small size of our sample. Additional controls were analyzed in Appendix D to check on the robustness of our findings. We used ordinary least squares (OLS) regression for this analysis and presented the mean variance inflation factor (VIF) scores for each model we estimated.

## Results

### *Results*

In Table 1, columns 1–3, Black median household income as a percentage of White median household income is the dependent variable.[3] In segregated metro areas Black incomes are much lower than White incomes, while in integrated areas, incomes are more equal. This supports Hypothesis 1. However, the more jobs people can access through the transit system and pedestrian walkways, the *lower* the percentage of Black to White household incomes. That is, Black incomes are worse relative to Whites in cities with more accessible transit and pedestrian networks. The accessibility score for roadways was marginally significant for Blacks, and the sign was negative. The first two findings contradict Hypothesis 2a, and the third gives tentative support to Hypothesis 2b.

Examining the three interaction terms for Black incomes (columns 1–3), all three are statistically significant and positive. The impact of segregation on the differences in Black-White earnings is weaker in metro areas with a more developed transportation system (i.e., transit, driving, and walking scores are high).

In order to know if these findings support our hypotheses, we examine the effects presented in Table 1, column 1, graphically. We predicted different ways in which transit, roadway, and pedestrian networks could reduce the effect of segregation on income inequality. The graph of our first set of results, focusing on transit networks and Black-White differences is presented in Figure 2 for illustrative purposes.[4] In this figure the slope describing the effect of Black dissimilarity on Black-White earnings becomes flatter as transit systems improve. We also see that in CBSAs with poor transit networks, the effect of segregation on income inequality is stronger. This is the case for roadway and pedestrian networks as well. The end result is that Black-White income inequality is about the same in integrated communities where transit, roadway, and pedestrian networks can access more jobs as in segregated communities. It seems that better access to jobs through transit, roadways, and pedestrian networks does not reduce inequality, but rather offsets the beneficial effects of integration on inequality. While the results for roadway networks support Hypothesis 4 (and the graph is similar to Figure 1b), the results for transit and pedestrian networks refute Hypothesis 3 (see Figure 1a).

In Table 1, columns 4–6 we see the same analysis but this time we look at Latino-White income differences. In all three models, Latinos earn less than Whites if Latinos are more segregated from Whites. This parallels the finding for Blacks and supports Hypothesis 1. We also see that in metropolitan areas where residents can access more jobs through the transit, roadway, or pedestrian networks, Latinos earn less than Whites. This parallels our findings for Blacks, supports H2b, but does not support H2a. Looking at the three interactions, none were significant at the .05-level. Thus, there was no support for Hypotheses 3 or 4. Latino segregation and the efficiency of transit, automobile, and pedestrian transportation networks increased the disparities between White and Latinos independently of one another.

It is also important to note the effects of our control variables. In Table 1, the percent of "new economy" jobs, the percent foreign born, the percent Black, and the percent Latino had no significant effects on the differences between minority and White median household incomes.

**Table 1.** OLS with Black HH income as a % of White HH income (2016) as dependent variable, N = 49 CBSAs.

| | 1 | 2 | 3 | | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Model | Black HH income as % of White HH income | Black HH income as % of White HH income | Black HH income as % of White HH income | | Latino HH income as % of White HH income | Latino HH income as % of White HH income | Latino HH income as % of White HH income |
| Black dissimilarity[a] | −.282** | −.446** | −.409*** | Latino dissimilarity[a] | −.807*** | −.833*** | −.842*** |
| % Jobs Accessible by Transit[b] | −5.389*** | | | % Jobs Accessible by Transit[b] | −2.495* | | |
| % Jobs Accessible by Car[b] | | −1.998# | | % Jobs Accessible by Car[b] | | −2.511* | |
| % Jobs Accessible Walking[b] | | | −4.164*** | % Jobs Accessible Walking[b] | | | −3.514*** |
| Black dissimilarity * % Jobs Accessible by Transit | .210** | | | Latino dissimilarity * % Jobs Accessible by Transit | .040 | | |
| Black dissimilarity * % Jobs Accessible by Car | | .206* | | Latino dissimilarity * % Jobs Accessible by Car | | .153 | |
| Black dissimilarity * % Jobs Accessible Walking | | | .186** | Latino dissimilarity * % Jobs Accessible Walking | | | .223# |
| % New Economy Jobs[a] | .719* | .231 | .263 | % New Economy Jobs[a] | −.167 | −.170 | −.321 |
| % Foreign born[a] | .058 | .134 | .075 | % Foreign born[a] | .122 | −.003 | .160 |
| % Black[a] | .020 | .230# | .142 | % Latino[a] | .055 | .142 | .058 |
| Constant | 56.3*** | 57.4*** | 56.8*** | Constant | 66.6*** | 66.8*** | 66.6*** |
| F | 12.0*** | 4.7*** | 8.1*** | F | 10.2*** | 11.0*** | 14.4*** |
| $R^2$ | .631 | .403 | .538 | $R^2$ | .594 | .610 | .674 |
| Adjusted $R^2$ | .578 | .317 | .471 | Adjusted $R^2$ | .535 | .554 | .627 |
| VIF (mean) | 1.36 | 1.43 | 1.27 | VIF (mean) | 1.90 | 1.83 | 1.81 |

*** = $p < .001$; ** = $p < .01$; * = $p < .01$; # $p < .10$

[a]Scores are centered at their mean.

[b]Scores are z-scores for 30 minutes of travel

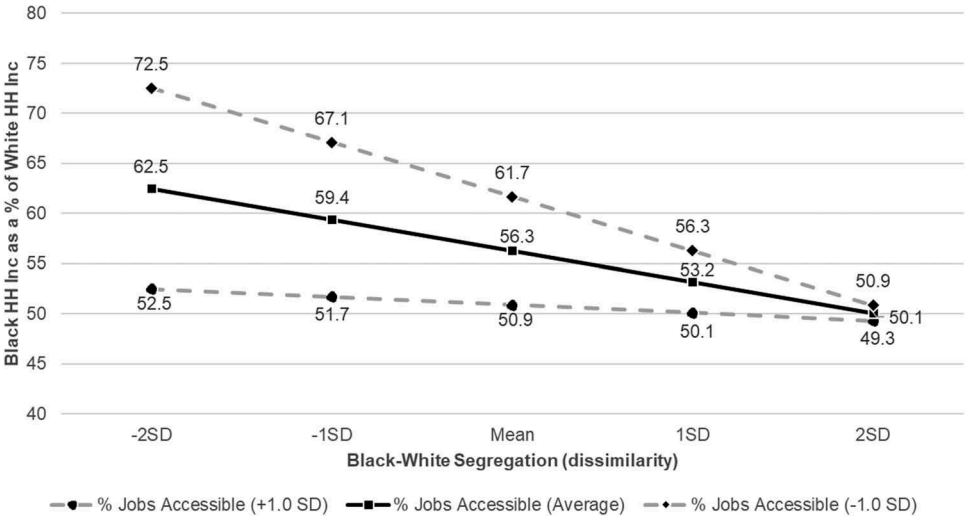


**Figure 2.** Black income as a % of White income regressed on Black-White segregation by the % of jobs accessible through the transit network.

## *Further analyses*

To understand the mechanisms underlying our results in Table 1, we examine Black, Latino, and White median household income as the dependent variables instead of percentages. As the measure for income inequality is measured using a ratio of minority to White incomes, it is important to disaggregate their component parts in order to better understand what is driving this association. Turning to Tables 2 and 3, we see clearly that Black and Latino incomes are lower in metro areas where Blacks and Latinos are more segregated. As expected, White incomes are unrelated to the levels of Black segregation. Thus, the effect of segregation on minority-White income inequality is that minority incomes are less in segregated metropolitan areas, but White incomes are neither higher nor lower.

Tables 2 and 3 also look at who benefits in metro areas with better transit, driving, or pedestrian networks. We find that Black and Latino incomes are unrelated to the efficiency of transit, roadway, and pedestrian networks (at the .05-level). In contrast, efficient transit and pedestrian networks are positively related to White incomes, while efficient roadway networks are not. Finally, none of the interaction effects are significant at even the .10-level.

The control variables exhibited interesting results. While we thought that the percent of "new economy" jobs would bolster White incomes, we did not expect that they would bolster Black and Latino incomes. However, they did. Percent foreign born also had a positive effect on White, Black, and Latino incomes. However, the percent Black or Latino had little effect on anyone's incomes.

Our findings can be summarized quite easily. One source of inequality is due to segregation. In segregated areas, Blacks and Latinos earn less than in integrated areas. Thus inequality is due to lower Black and Latino incomes, while White incomes are unaffected. Another source of inequality appears to be rooted in the urban design. In areas with better transit and pedestrian networks, Whites earn more than in areas with less efficient networks. Thus inequality is due to higher White incomes while minority incomes are unaffected. Both segregation and the transportation systems contribute to inequality, but in different ways.

However, this does not yet account for the substitution effects we found in Table 1 for Black-White income differentials. To shed light on this we graphed the predicted incomes of Blacks and Whites from Table 2, columns 1 and 4.[5] Figure 3 presents two sets of regression results in the same graph, one for White incomes and one for Black incomes. The extent of inequality is reflected in the differences between White

**Table 2.** OLS with income (2016) measures as the dependent variable, N = 49 CBSAs.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | Black med HH income | Black med HH income | Black med HH income | White med HH income | White med HH income | White med HH income |
| Model | b | b | b | b | b | b |
| Black dissimilarity[a] | −205.3* | −254.7** | −224.8* | −23.2 | 97.6 | 112.3 |
| % Jobs Accessible by Transit[b] | −1085.6 | | | 5373.7*** | | |
| % Jobs Accessible by Car[b] | | −897.7 | | | 611.7 | |
| % Jobs Accessible by Walking[b] | | | −925.5 | | | 3831.3** |
| Dissimilarity *Accessibility | 95.1 | 100.3 | 70.6 | −84.0 | −77.2 | −91.0 |
| % New Economy Jobs[a] | 1655.6*** | 1614.3** | 1577.7*** | 2112.4** | 2738.6*** | 2615.5*** |
| % Foreign born[a] | 356.4** | 387.9** | 371.1** | 612.6** | 562.4* | 621.0** |
| % Black[a] | 157.8 | 198.8# | 185.7 | 235.3 | 17.5 | 116.7 |
| Constant | 41,562.6*** | 42,061.3*** | 41,751.5*** | 74,133.5*** | 73,742.4*** | 73,916.4*** |
| F | 11.0*** | 11.5*** | 10.7*** | 17.2*** | 11.0*** | 14.5*** |
| $R^2$ | .611 | .622 | .605 | .711 | .610 | .674 |
| Adjusted $R^2$ | .556 | .568 | .548 | .670 | .555 | .627 |
| VIF (Mean) | 1.36 | 1.43 | 1.27 | 1.36 | 1.43 | 1.27 |

*** = $p < .001$; ** = $p < .01$; * = $p < .01$; # $p < .10$
[a]Scores are centered at their mean.
[b]Scores are z-scores for 30 minutes of travel.

**Table 3.** OLS with income (2016) measures as the dependent variable, N = 49 CBSAs.

| | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| | Latino med HH income | Latino med HH income | Latino med HH income | White med HH income | White med HH income | White med HH income |
| Model | b | b | b | b | b | b |
| Latino dissimilarity[a] | −555.8*** | −493.3*** | −550.4*** | −11.5 | 132.7 | 46.4 |
| % Jobs Accessible by Transit[b] | 1219.3 | | | 4372.2** | | |
| % Jobs Accessible by Car[b] | | −1479.0# | | | 258.6 | |
| % Jobs Accessible by Walking[b] | | | −313.8 | | | 2957.0* |
| Dissimilarity *Accessibility | −48.2 | 245.7* | 141.5 | −17.8 | 239.2 | 50.4 |
| % New Economy Jobs[a] | 1227.8** | 1452.0*** | 1316.8** | 2154.5*** | 2555.8*** | 2502.0*** |
| % Foreign born[a] | 497.0* | 559.7** | 576.5** | 728.4** | 950.5** | 821.2** |
| % Latino[a] | −44.1 | −68.8 | −70.8 | −149.7 | −288.4# | −204.4 |
| Constant | 48,905.3*** | 49,113.7*** | 48,775.1*** | 74,108.4*** | 74,364.0*** | 74,060.9*** |
| F | 9.6*** | 11.4*** | 9.6*** | 16.4*** | 12.8*** | 14.4*** |
| $R^2$ | .579 | .619 | .578 | .701 | .646 | .673 |
| Adjusted $R^2$ | .519 | .565 | .517 | .659 | .595 | .626 |
| VIF (Mean) | 1.90 | 1.83 | 1.81 | 1.90 | 1.83 | 1.81 |

*** = $p < .001$; ** = $p < .01$; * = $p < .01$; # $p < .10$
[a]Scores are centered at their mean.
[b]Scores are z-scores for 30 minutes of travel.

and Black incomes. The results are simple to summarize: Whites earned more in cities with more efficient transit networks, although the differences are somewhat less in segregated communities. In contrast, the efficiency of the transit networks had little effect on Black incomes in segregated contexts, although it is somewhat more pronounced—and negative—in integrated communities. Together this produced the significant positive interaction effect in Table 1, column 1. Putting these two sets of findings together, the

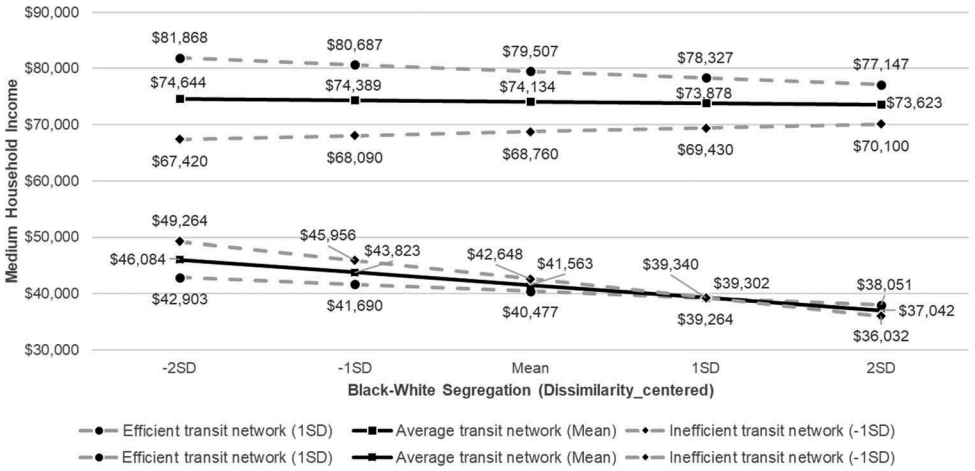


**Figure 3.** Black and White incomes by levels of segregation and efficiency of transit network.

differences in Black-White incomes can be either due to segregation or the efficiency of the transit system. In segregated areas, Black incomes are so low that the differences between Blacks and Whites is great no matter the transit system. However, in integrated areas, Black incomes are higher, but Whites earn much more than Blacks if the transit system is highly developed. In this respect, Whites maintain their advantage over Blacks even though Blacks are certainly better off than in segregated contexts.

### *Robustness tests*

Finally, we conducted several robustness tests. As a check on the choice of the dissimilarity measure, we re-ran the analysis using the Black and Latino isolation indices as a robustness test. These results can be found in Appendix C. We found no substantial differences using different measures, although the results are less pronounced using the isolation index. We also varied the travel times substituting the number of jobs accessible in 20 minutes and 40 minutes for the 30-minute measures. Again, we found no substantial differences, and the effects of segregation, the three measures of access, and the interactions between access scores and the dissimilarity indices were all about the same as in Table 1 (results available upon request).

Finally, we considered whether minority-White income inequality can vary by region and if inequality is affected by the percent manufacturing jobs. We categorized our 49 metro areas into four regions: the Northeast, the Midwest, the South, and the West.[6] We found that only Black-White income differences were significantly lower in the Midwest. We re-ran our analysis adding a dummy variable for the Midwest and the percent manufacturing jobs. The results in Appendix D showed that percent manufacturing had no effect on inequality, but region did explain some variance in Black-White income inequality. Nonetheless the effects of segregation, job accessibility through the three transportation networks, and the interactions between segregation and networks remained essentially the same.

## Discussion and conclusion

### *Discussion*

Our results show that Black and Latino household incomes tend to be lower than White incomes in metropolitan areas that are more segregated. Our subsequent analysis showed that this is due to minorities having much lower incomes when segregated from Whites. However, Whites suffered no losses from being in metro areas where they are integrated or segregated from minorities. This

confirmed Hypothesis 1 that segregation leads to inequality and sheds light on the mechanisms behind the effect in that the disparity is driven by lower minority incomes. This, however, is in contrast to Wang's (2008) finding that segregation bolstered the wages of other groups, while having no statistically significant effect on Black wages. Here, we find the opposite.

We expected that more efficient transit and pedestrian networks would lessen inequality with Whites, because this would benefit minority incomes. However, we found that more efficient transit and pedestrian systems enhanced inequality for both Blacks and Latinos, because they raised White incomes. The efficiency of the roadway network exacerbated inequality for Latinos and Blacks, but only at the .10-level for the latter. Thus there was no support for H2a (transit and pedestrian networks would lessen inequality) and some support for H2b (roadway networks would increase inequality).

When we tested for our interaction effects, we found that segregation had less of an effect on Black-White income inequality, the more jobs people can access through the transit system, by car, or on foot. But, we found no comparable effects for Latinos. But upon inspection we found that better transit and pedestrian networks did not raise Black income; rather they raised White incomes. Thus segregation and transit/pedestrian networks were substitutes in sustaining Black-White inequality. When segregation was high, efficiencies in the three networks had a much weaker effect on Black-White inequality as segregation depressed Black incomes. When segregation was low, transportation efficiencies increased inequality as they benefited White incomes. Thus both contributed to inequality but in different ways.

Finally, we found that the percentage of finance, information, and professional jobs had a positive effect on all incomes. The effect was stronger for Whites than Blacks or Latinos, but all three groups earned more if there were more of these jobs. In contrast, the percent of manufacturing jobs in the metro area had little effect on any group's income. We also found that the percent foreign born raised everyone's incomes, an unexpected but important finding. The combined impact of percent foreign born and new economy jobs suggests that wealthier households are drawn to more global cities. A potentially important result of this research is that researchers become aware that there are many factors at work explaining urban inequality and not just residential segregation or labor market conditions.

## *Conclusions and limitations*

An important paper by Kwan (1998) presented an overview of various measures of accessibility, but for some reason the urban inequality literature has not capitalized on these. By focusing on job accessibility though transportation networks, we hope to enlighten researchers that urban systems are highly dynamic—people move around—and that this has important consequences in explaining income inequality. In other words, while it is common knowledge that people's capacity to access valued resources differs, we should be aware that this is not only a function of where they live. It also depends upon the quality of the metropolitan transit, pedestrian, and roadway systems.

Two issues deserve further comment. First, why do efficient transit and pedestrian networks benefit Whites but not minorities? We suspect that urban redevelopment may explain the association between transit and pedestrian networks and White incomes. One possibility is that developers try to create mixed land use zones, which includes both employment sites and residences. This can happen in the central city, in suburbs, or edge cities on the periphery of the metro areas, but in predominantly White areas. City and suburban governments may then invest in transit and walkways surrounding white collar employment sites to connect residences to employment (Golub et al., 2013; Goodling et al., 2015; Larson, 2018). Alternatively, urban planners can built transit networks that extend the reach of the cities' existing networks to distant suburbs. This shortens the trip from the periphery to the center but does not benefit inner city residents. It simply duplicates the wheel

and spoke pattern of the roadway system. In either case the design of the transportation network would benefit Whites more than minorities.

Second, why did we find an interaction effect for Blacks but not for Latinos? First, we should recognize that both were negatively affected by segregation and that neither benefited from the efficiency of transit and pedestrian networks. The difference was that for Latino these operated independently, while for Blacks the two were substitutes. While the similarities between the groups are more impressive than the differences, these differences still need to be explained.

The urban social experiences of Black versus Latino segregation in the U.S. may matter. Blacks are far more likely to be subject to racial/ethnic residential segregation and suffer from a variety of negative consequences from it, as compared to Latinos (Massey & Denton, 1989). For instance, in our data, the average Black dissimilarity index is fully eleven points higher on average than the Latino dissimilarity index. And, relatedly, the gap in incomes when compared to Whites is not as stark for Latinos. Thus the social experience of Black metropolitan residents may simply be harsher than in the case of Latinos. With a macro-level study such as this with a small sample size, it may be more difficult to capture the impact of the various transportation systems for Latinos. This is an empirical question and an important consideration for further research.

There are several limitations to our study. First, it is difficult to establish causality. Our basic demographic data (including segregation scores) were for 2010, our transportation measures were for 2014, and our dependent variables were measured in 2016. This is a good start, but it could be that the wealth of an area, measured by household incomes, could result in better transportation networks. That is, in cities where Whites earn more, cities can spend more (or are pressured to spend more) on improving transit and pedestrian networks. Or wealthier Whites are attracted to cities that have better transit and pedestrian networks. We tried to address this by including a lagged variable for household incomes (2010), but when we ran the model, all of the effects of segregation were absorbed in this regressor and neither segregation nor transportation network performance had much of an effect on 2016 incomes. That is, almost all of the variation in 2016 household income was explained by 2010 household income.

Second, we do not have commuting times for Blacks, Latinos, and Whites separately. It was not possible for us to obtain these data, and future research should take into account these commuting times. This would more convincingly demonstrate that commuting times had an effect on differences in minority-White earnings. We also only have data on job accessibility through transportation networks for 49 of the largest U.S. metropolitan areas and not for the full scope of metropolitan areas in the U.S. Therefore, our conclusions can only apply to this smaller subset of the American urban experience, which is in larger metropolitan areas. Presumably, transportation systems and the ability of individuals to quickly move about their city would be quite different for individuals living in medium- to small-sized cities as the metropolitan area is simply smaller. However, this is an empirical question that remains to be tested.

Finally, the ultimate dependent variable is a household's income. Ideally, we would have data on the household level including the household's commuting times via different transportation modes. Then we would use a measure of neighborhood segregation, at level two, to see if it had any effect on household's commuting times and incomes. Again, we encourage future researchers to gather these kind of data. However, these data were not available to us for this analysis.

Although there is still much work to be done, our findings advance the literature in several ways. First, we show that the spatial organization of the urban community matters for people's life chances. Patterns of inequality exist, but they are as rooted in space as in personal or household characteristics. Second, urban systems should be studied as dynamic systems. Where things are is important, but equally important is how well people can access them through spatial networks. Looking for bias in the urban infrastructure is an important advance for urban sociology, in particular, which tends to view the urban community as a static system.

## Notes

1. More specifically, they followed these steps in measuring accessibility. The data were Census blocks in the United States, the number of working people in each block, the number of jobs in each block, the transit schedules, and walking times. For each Census block in the United States, they calculated travel time from the centroid to all other blocks within 60km for multiple departure times (at 1-minute intervals), between 7 and 9 a.m. on some weekday. They then calculated cumulative "opportunity accessibility to jobs" for each block and departure time, using thresholds of 10, 20, …, 60 minutes. They then averaged accessibility for each block over 7– 9 a.m. period. The average accessibility for each included CBSA over all blocks, was weighted by number of workers in each block. They had data for 49 of the 50 metro areas as Memphis was missing data on this variable.
2. We did a robustness check using different times, however, 30 minutes yielded the most pronounced results (tables of results available upon request).
3. We conducted preliminary analyses to see if population density affected Black income as a percentage of White income or Latino income as a percentage of White income or negated the effect of segregation, the accessibility of transit, walking, or driving transportation networks, and the interaction between segregation and accessibility. In these models (available upon request), population density played no role, and so we dropped it from subsequent analysis because of our small sample size.
4. The graphs for the other two models involving Black-White incomes are similar and available upon request.
5. The figures depicting the results for roadway networks and pedestrian networks were comparable in explaining variation in Black incomes, although not as stark as for transit networks. The figures are available upon request.
6. We used the Census regions of the United States: https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

## About the authors

***Joseph Galaskiewicz*** is Professor of Sociology at the University of Arizona and the Director of the Certificate Program in Computational Social Science in the College of Social and Behavioral Sciences. He has authored and coauthored several books and published widely in major sociological, management, and nonprofit journals. He is currently working on an NSF funded study of the spatial distribution of establishments that provide services and activities on Saturday in the Phoenix urbanized area and the effect this has on what children do that day.

***Kathryn Freeman Anderson*** is an Assistant Professor in the Department of Sociology at the University of Houston. Her research lies at the intersection of the sociology of health and illness, urban sociology, race/ethnicity, and organizations and is generally focused on understanding the social sources of health disparities in the United States. In particular, she examines the role of race/ethnicity and urban neighborhood dynamics to analyze how these factors may affect individual-level health. Her recent work has been published in *Social Problems, Population Review*, and *Race and Social Problems*.

***Kendra Thompson-Dyck*** conducts research with the Southwest Institute for Research on Women (SIROW) at the University of Arizona. Trained as a sociologist, her research interests and expertise include juvenile justice/delinquency, urban studies, organizations, and spatial analysis. Broadly, her research considers how neighborhoods impact well-being, especially for youth involved in the juvenile justice system.

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# Appendices

## Appendix A. Core-Based Statistical Areas (CBSA) and their values on main variables for analysis, N = 49 CBSAs

| CBSA | B-W Income Inequality | L-W Income Inequality | B-W Dissim | L-W Dissim | Transit Score | Driving Score | Walking Score |
|---|---|---|---|---|---|---|---|
| Atlanta, GA | 63.84 | 67.03 | 58.35 | 49.45 | 0.31 | 35.85 | 0.14 |
| Austin, TX | 61.88 | 69.86 | 48.40 | 43.23 | 1.29 | 71.77 | 0.71 |
| Baltimore, MD | 59.59 | 77.83 | 64.31 | 39.76 | 1.40 | 62.97 | 0.54 |
| Birmingham, AL | 60.55 | 76.36 | 65.22 | 44.52 | 0.55 | 64.60 | 0.43 |
| Boston, MA | 53.21 | 51.30 | 61.50 | 59.58 | 1.95 | 41.77 | 0.44 |
| Buffalo, NY | 45.80 | 47.96 | 70.99 | 50.74 | 1.67 | 81.62 | 0.98 |
| Charlotte, NC | 62.16 | 64.48 | 53.08 | 47.64 | 0.76 | 69.16 | 0.36 |
| Chicago, IL | 46.65 | 66.02 | 75.15 | 56.32 | 1.19 | 30.11 | 0.33 |
| Cincinnati, OH | 49.56 | 77.83 | 66.90 | 36.87 | 0.59 | 60.06 | 0.34 |
| Cleveland, OH | 48.10 | 68.27 | 72.56 | 52.26 | 0.92 | 63.86 | 0.42 |
| Columbus, OH | 56.03 | 65.41 | 59.95 | 41.45 | 1.13 | 74.65 | 0.49 |
| Dallas, TX | 57.71 | 61.16 | 55.49 | 50.27 | 0.33 | 45.06 | 0.17 |
| Denver, CO | 62.38 | 64.41 | 59.37 | 48.78 | 1.50 | 79.64 | 0.66 |
| Detroit, MI | 51.93 | 76.93 | 73.95 | 43.27 | 0.33 | 54.82 | 0.21 |
| Hartford, CT | 57.83 | 51.56 | 62.32 | 58.36 | 1.77 | 103.23 | 0.87 |
| Houston, TX | 58.02 | 56.68 | 60.61 | 52.51 | 0.47 | 43.00 | 0.22 |
| Indianapolis, IN | 51.23 | 56.31 | 64.50 | 47.26 | 0.81 | 73.71 | 0.41 |
| Jacksonville, FL | 65.74 | 87.29 | 52.06 | 27.59 | 0.73 | 66.72 | 0.40 |
| Kansas City, MO | 54.10 | 67.56 | 58.64 | 44.37 | 1.27 | 112.94 | 0.69 |
| Las Vegas, NV | 60.50 | 74.12 | 35.87 | 42.02 | 0.91 | 93.22 | 0.57 |
| Los Angeles, CA | 54.08 | 61.94 | 65.22 | 62.15 | 0.74 | 43.30 | 0.27 |
| Louisville, KY | 55.26 | 69.11 | 56.24 | 38.69 | 1.15 | 73.46 | 0.54 |
| Miami, FL | 61.74 | 70.48 | 63.95 | 57.36 | 0.64 | 43.97 | 0.30 |
| Milwaukee, WI | 42.23 | 57.47 | 79.61 | 57.03 | 2.30 | 86.12 | 1.01 |
| Minneapolis, MN | 44.03 | 64.82 | 50.19 | 42.50 | 1.00 | 59.89 | 0.35 |
| Nashville, TN | 63.22 | 68.00 | 54.95 | 47.86 | 0.68 | 51.13 | 0.40 |
| New Orleans, LA | 45.67 | 58.40 | 63.33 | 38.28 | 1.86 | 64.80 | 1.08 |
| New York, NY | 54.11 | 51.68 | 76.89 | 62.00 | 2.48 | 31.80 | 0.57 |
| Oklahoma City, OK | 50.94 | 67.70 | 48.95 | 47.01 | 0.88 | 75.81 | 0.64 |
| Orlando, FL | 60.04 | 69.05 | 49.29 | 40.20 | 0.48 | 71.67 | 0.31 |
| Philadelphia, PA | 49.59 | 50.50 | 67.04 | 55.06 | 1.27 | 36.71 | 0.37 |
| Phoenix, AZ | 65.34 | 71.37 | 41.31 | 49.34 | 0.52 | 57.81 | 0.27 |
| Pittsburgh, PA | 55.10 | 94.23 | 63.07 | 28.56 | 1.19 | 38.56 | 0.37 |
| Portland, OR | 52.12 | 73.07 | 40.90 | 34.26 | 1.85 | 67.78 | 0.70 |
| Providence, RI | 61.93 | 54.81 | 50.81 | 60.11 | 1.29 | 61.66 | 0.88 |
| Raleigh, NC | 62.15 | 55.75 | 41.36 | 37.13 | 0.84 | 104.80 | 0.79 |
| Richmond, VA | 57.76 | 68.20 | 51.64 | 44.88 | 1.12 | 69.21 | 0.61 |
| Riverside, CA | 74.00 | 80.21 | 43.96 | 42.36 | 0.28 | 37.96 | 0.17 |
| Sacramento, CA | 57.16 | 71.93 | 54.45 | 38.85 | 1.10 | 70.51 | 0.66 |
| St. Louis, MO | 54.95 | 77.83 | 70.65 | 30.65 | 0.57 | 51.52 | 0.30 |

(*Continued*)

(Continued).

| CBSA | B-W Income Inequality | L-W Income Inequality | B-W Dissim | L-W Dissim | Transit Score | Driving Score | Walking Score |
|---|---|---|---|---|---|---|---|
| Salt Lake City, UT | 37.88 | 68.60 | 34.04 | 42.89 | 2.60 | 120.12 | 1.16 |
| San Antonio, TX | 64.68 | 64.95 | 47.74 | 46.08 | 1.05 | 67.49 | 0.45 |
| San Diego, CA | 64.74 | 65.18 | 48.37 | 49.61 | 0.93 | 62.39 | 0.48 |
| San Francisco, CA | 40.48 | 61.09 | 59.29 | 49.59 | 3.54 | 56.45 | 1.17 |
| San Jose, CA | 53.93 | 58.51 | 38.59 | 47.62 | 1.99 | 125.91 | 1.01 |
| Seattle, WA | 57.00 | 71.23 | 45.65 | 32.80 | 1.66 | 46.51 | 0.69 |
| Tampa, FL | 75.07 | 76.93 | 54.32 | 40.67 | 0.58 | 54.45 | 0.32 |
| Virginia Beach, VA | 64.58 | 73.17 | 46.89 | 32.17 | 0.64 | 55.36 | 0.46 |
| Washington, DC | 59.97 | 61.07 | 61.02 | 48.30 | 1.73 | 43.04 | 0.46 |
| **Mean** | **54.46** | **66.65** | **56.92** | **45.72** | **1.16** | **64.47** | **0.53** |

## Appendix B. Descriptive statistics for variables used

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Black median HH income as % of White HH income '16 | 49 | 56.46 | 7.87 | 37.88 | 75.07 |
| Latino median HH income as % of White HH income '16 | 49 | 66.65 | 9.60 | 47.96 | 94.23 |
| Black median HH income '16 | 49 | 41,627.5 | 8845.7 | 27,412.0 | 69,246.0 |
| Latino median HH income '16 | 49 | 48,818.2 | 8726.6 | 28,939.0 | 70,999.0 |
| White median HH income '16 | 49 | 74,076.3 | 14,407.6 | 54,295.0 | 121,344.0 |
| Black dissimilarity '10 | 49 | 56.92 | 11.01 | 34.04 | 79.61 |
| Latino dissimilarity '10 | 49 | 45.72 | 8.64 | 27.59 | 62.15 |
| % Jobs Accessible by Transit '14 | 49 | 1.16 | 0.68 | 0.28 | 3.54 |
| % Jobs Accessible by Car '14 | 49 | 64.47 | 22.26 | 30.11 | 125.91 |
| % Jobs Accessible by Walking '14 | 49 | 0.53 | 0.27 | 0.14 | 1.17 |
| % New economy jobs '10 | 49 | 21.98 | 2.83 | 16.20 | 29.10 |
| % Manufacturing jobs '10 | 49 | 9.66 | 3.30 | 3.30 | 18.60 |
| % Foreign born '10 | 49 | 13.69 | 8.73 | 3.10 | 38.80 |
| % Black '10 | 49 | 15.18 | 8.57 | 1.82 | 34.29 |
| % Latino '10 | 49 | 15.86 | 13.18 | 1.27 | 54.06 |
| Midwest (0 = no/1 = yes) | 49 | 0.20 | 0.41 | 0.00 | 1.00 |

## Appendix C. OLS with Black HH income as a % of White HH income (2016) as dependent variable, N = 49 CBSAs

| | 1 | 2 | 3 | | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Model | Black HH income as % of White HH income | Black HH income as % of White HH income | Black HH income as % of White HH income | | Latino HH income as % of White HH income | Latino HH income as % of White HH income | Latino HH income as % White HH income |
| Black isolation[a] | −.284*** | −.370*** | −.381*** | Latino isolation[a] | −.744*** | −.774*** | −.768*** |
| % Jobs Accessible by Transit[b] | −4.944*** | | | % Jobs Accessible by Transit[b] | −2.795* | | |
| % Jobs Accessible by Car[b] | | −1.528 | | % Jobs Accessible by Car[b] | | −2.379# | |
| % Jobs Accessible by Walking[b] | | | −4.191*** | % Jobs Accessible by Walking[b] | | | −3.383** |
| Black isolation * % Jobs Accessible by Transit | .101* | | | Latino isolation * % Jobs Accessible by Transit | .076 | | |
| Black isolation * % Jobs accessible by car | | .091# | | Latino isolation * % Jobs Accessible by Car | | .147 | |
| Black isolation * % Jobs Accessible Walking | | | .066 | Latino isolation * % Jobs Accessible Walking | | | .218* |
| % New Economy Jobs[a] | .771* | .152 | .235 | % New Economy Jobs[a] | −.213 | −.303 | −.643 |
| % Foreign born[a] | .000 | .010 | −.035 | % Foreign born[a] | −.011 | −.159 | −.006 |
| % Black[a] | .420* | .696** | .622** | % Latino[a] | .870** | .999*** | .978*** |
| Constant | 56.8*** | 57.0*** | 56.8*** | Constant | 66.6*** | 66.9*** | 67.0*** |
| F | 11.7*** | 3.5** | 7.7*** | F | 4.6*** | 4.7*** | 6.8*** |
| $R^2$ | .626 | .334 | .523 | $R^2$ | .394 | .404 | .491 |
| Adjusted $R^2$ | .573 | .239 | .455 | Adjusted $R^2$ | .308 | .319 | .419 |
| VIF (mean) | 2.07 | 2.11 | 1.96 | | 4.41 | 3.97 | 4.15 |

*** = $p < .001$; ** = $p < .01$; * = $p < .01$; # $p < .10$

[a]Scores are centered at their mean.

[b]Scores are z-scores for 30 minutes of travel.

## Appendix D. OLS with Black HH income as a % of White HH income (2016) as dependent variable, N = 49 CBSAs

| | 1 | 2 | 3 | | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Model | Black HH income as % of White HH income | Black HH income as % of White HH income | Black HH income as % of White HH income | Model | Latino HH income as % of White HH income | Latino HH income as % of White HH income | Latino HH income as % of White HH income |
| Black dissimilarity[a] | −.146# | −.294* | −.248** | Latino dissimilarity[a] | −.716*** | −.757*** | −.759*** |
| % Jobs Accessible by Transit[b] | −4.878*** | | | % Jobs Accessible by Transit[b] | −2.402* | | |
| % Jobs Accessible by Car[b] | | −1.767 | | % Jobs Accessible by Car[b] | | −2.502* | |
| % Jobs Accessible Walking[b] | | | −4.395*** | % Jobs Accessible Walking[b] | | | −3.632*** |
| Black dissimilarity * % Jobs Accessible by Transit | .140* | | | Latino dissimilarity * % Jobs Accessible by Transit | −.025 | | |
| Black dissimilarity * % Jobs Accessible by Car | | .162* | | Latino dissimilarity * % Jobs Accessible by Car | | .158 | |
| Black dissimilarity * % Jobs Accessible Walking | | | .128* | Latino dissimilarity * % Jobs Accessible Walking | | | .182 |
| % Manufacturing jobs[a] | −.301 | −.527 | −.279 | % Manufacturing jobs[a] | −.277 | −.293 | −.135 |
| Midwest (1 = yes; 0 = no) | −6.162* | −2.597 | −5.479* | Midwest (1 = yes; 0 = no) | 1.621 | 2.291 | −.444 |
| Constant | 57.6*** | 57.7*** | 57.8*** | Constant | 66.4*** | 66.4*** | 66.7*** |
| F | 17.4*** | 6.1*** | 12.9*** | F | 11.8 | 12.1 | 15.7 |
| $R^2$ | .669 | .414 | .600 | $R^2$ | .579 | .585 | .646 |
| Adjusted $R^2$ | .630 | .346 | .553 | Adjusted $R^2$ | .530 | .537 | .605 |
| VIF (mean) | 1.45 | 1.50 | 1.41 | VIF (mean) | 1.30 | 1.34 | 1.25 |

*** = $p < .001$; ** = $p < .01$; * = $p < .01$; # $p < .10$

[a]Scores are centered at their mean.

[b]Scores are z-scores for 30 minutes of travel.