

# Recent intra-metropolitan patterns of spatial mismatch: Implications for black suburbanization and the changing geography of mismatch

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[Correction added on 12 October 2022, after first online publication: Color pattern information have been removed from the Figure captions.]

## Abstract

Kain's spatial mismatch hypothesis (SMH) (1968) highlights the segregation of Black population in the inner city as well as the decentralization of jobs, both of which played a role in the poor labor market outcomes for Black residents in the inner city. Demographic and economic changes in U.S. metropolitan areas since the late 20th century have transformed the urban spatial structure. This paper aims to revisit the SMH and investigate whether the spatial pattern of mismatch has changed as a result of geographic shifts in the Black population. This paper specifically examines how the suburbanization of the Black population has affected the geographic patterns of mismatch and whether the mismatch is disappearing in the major U.S. metropolitan areas. Using spatial measures of mismatch, this paper presents intra-metropolitan spatial mismatch patterns that capture the clustering of jobs and the Black population based on their relative distributions, showing that the overall level of spatial mismatch declined in major U.S. metropolitan areas between 2000 and 2015. However, geographical evidence reveals that the spatial mismatch has shifted to the outer suburbs, replicating city-suburb

**Abbreviations:** D, dissimilarity index; GD, general dissimilarity index; LEHD, Longitudinal Employer-Household Dynamics; LODES, LEHD Origin-Destination Employment Statistics; NAICS, North American Industry Classification System; SMH, spatial mismatch hypothesis.

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spatial inequality, implying that although mismatch may have declined in the inner city due to Black suburbanization, spatial mismatch continue to persist in U.S. metropolitan areas in Black suburbs. The findings also demonstrate that although spatial mismatch generally declined in the inner city, it increased in cities with high inner city polarization, particularly New York, Chicago, San Francisco, and Seattle.

## 1 | INTRODUCTION

The spatial mismatch hypothesis (SMH) of John Kain (1968, 1992) proposes that the residential segregation of the Black population in the inner city and the decentralization of jobs to the suburbs both contributed to an increase in the Black unemployment rate in the inner city. Kain's hypothesis focuses on the relationship between residential racial segregation and jobs as sources of disproportionate labor market outcomes. It proposes that the involuntary segregation, the decentralization of low-skilled jobs, and the lack of reliable transportation systems that connect to suburban jobs act as geographic barriers to employment (Ihlanfeldt, 1994; Kain, 1968; Raphael, 1998). The SMH gained popularity among economists and sociologists during the 1970s and 1980s as the inner city was increasingly recognized as an area of disadvantage due to its high concentration of poverty, unemployment, and crime. However, U.S. metropolitan areas have undergone dynamic structural changes and the demographic and economic landscape has changed significantly during the latter half of the 20th century. In particular, Black households gradually began to migrate into the suburbs as housing became more affordable in old and dilapidated inner suburbs (Ellen, 1999; Farley, 1970). By 2010, approximately 51% of the Black population resided in the suburbs (Frey, 2011). Despite Black suburbanization, studies have revealed that Black households remained to reside in neighborhoods that were geographically isolated from other demographic groups and had limited access to social and economic opportunities, mirroring the segregation patterns of the inner city (Lake & Cutter, 1980; Massey & Denton, 1988a; Stoll et al., 2000; Yang & Jargowsky, 2006).

As these trends of suburban segregation continued into the 1980s, discussions arose as to whether the relative decentralization of the Black population to the near-city suburbs could offset the problems of spatial mismatch and unemployment in the inner city (Galster, 1991; Kain, 1985). Instead, the movement of the Black population into the suburbs may perpetuate the problem of spatial mismatch if the population remains segregated in the suburbs in ways that resemble the segregation patterns in the inner city, where housing conditions are poor and there is limited access to social and economic opportunities. Preliminary findings concluded that despite Black suburbanization, the Black population would gain little, if any, from their movement, as they continued to live in highly segregated neighborhoods in the suburbs (Kain, 1985). Despite the changes in the urban structure of metropolitan areas in the United States, the trend of Black segregation and the spatial mismatch with employment opportunities remain as challenges in spatially disadvantaged neighborhoods (Kneebone, 2016; Li et al., 2013; Liu & Painter, 2012; Massey & Tannen, 2018).

Furthermore, an increasing number of studies have emphasized the localized geographical scales needed to measure the spatial patterns of segregation and local variations in the distribution of population groups (Brown & Chung, 2006; Reardon et al., 2008; Wong, 2005). These studies argue that

the systematic approaches in existing studies are “aspatial” measures that fail to address the spatial patterns in measuring geographical distributions. The checkerboard problem is a typical example of aspatial measures, in which the measured level of segregation is insensitive to the spatial configurations (whether the distributions are even like a checkerboard pattern, or are clustered), and the rearrangement of spatial patterns does not affect the segregation level. Therefore, to address this problem, the spatial interactions between the neighboring areal units are captured in this research using the composite count of the Black population and jobs. In this way, the spatial measure of mismatch used in this research addresses the disparate clustering patterns of Black populations and jobs that are spatially isolated from each other (Massey & Denton, 1988a; Reardon et al., 2008). This analysis further identifies the potential clustering of the distributions within the region to assess whether there is a large Black population or a concentration of jobs in the surrounding area.

An advanced understanding of the changing patterns of spatial mismatch is crucial, as it implies that structural disadvantages continue for the Black population even when they migrate into the suburbs, as they face spatial inequalities despite their residence in the region. This research examines the intra-metropolitan spatial pattern of mismatch, focusing on the changing spatial structure of Black residential segregation and the relative distribution of employment opportunities at the local geographical scale of labor market boundaries. In addition to investigating these trends across 12 major U.S. metropolitan areas, this study observes changes in the spatial mismatch between 2000 and 2015 to examine the spatial distribution of the increase and decrease in mismatch within metropolitan areas. These changing patterns of spatial mismatch are important as they imply that spatial mismatch is not anchored to the inner city, which has historically offered disadvantages. Instead, spatial mismatch may continue to perpetuate racial inequality in the suburbs, where the Black population is increasingly relocating. Thus, this research addresses one of the most pressing social problems in the nation: the geography of spatial inequality in the modern landscape of American cities.

## 1.1 | Urban structural changes and spatial mismatch

Since the mid-20th century, urban development trends in metropolitan areas have transformed the landscape of the population and economic dynamics throughout cities and the surrounding suburbs (Galster, 1991; Lee & Leigh, 2007; Martin, 2004). Urban sprawl and continued urban decentralization into suburbs and faraway outlying suburbs have led to an uneven distribution of people and economic activities. At the same time, urban renewal policies such as *smart growth* and transit-oriented developments drew jobs and affluent households back to the inner city, displacing the inner-city Black population into the suburbs (Fischer, 2008; Kneebone, 2016; Yang & Jargowsky, 2006). These changing trends of urban development thus transformed the residential patterns of the Black population in a way that led to a rapid Black migration into the suburbs during the 1970s and the 1980s (Galster, 1991; Logan & Schneider, 1984).

Although, conventionally, residential mobility patterns led to the movement of higher-income Black households into the suburbs, during the 1980s, the proportion of low- and moderate-income Black populations moving to the suburbs surged, particularly in old and decaying suburbs (Kain, 1985; Lake & Cutter, 1980). Various factors have been linked to Black suburbanization, such as decreased levels of housing market discrimination, the availability of subsidized and affordable housing stock, and inner city redevelopment projects that displaced many low-income Black individuals into declining inner suburbs (Goetz, 2011; Massey & Tannen, 2018).

At the same time, suburbanization mirrored the segregation of the Black population that previously existed in the inner city. This resegregation in the suburbs created spatial differentials in local economic

conditions from one neighborhood to the next (Lee & Leigh, 2007; Massey & Tannen, 2018; Yang & Jargowsky, 2006). Thus, despite Black migration to the suburbs, the spatial concentrations of the Black population created physical distance from neighborhoods with growing economies (Gobillon & Selod, 2019; Kneebone & Holmes, 2015), which broadens the socioeconomic disparities between neighborhoods in terms of fiscal capacity, capital investment, public resources, and economic opportunities (Hardy et al., 2018; Jargowsky, 2018; Logan & Molotch, 2007; Massey, 2004). Moreover, recent evidence suggests that these economic opportunities concentrate in a region's "favored quarter," creating enclaves of advantage (Goetz et al., 2019; Howell, 2019). Conversely, racial minorities have become increasingly concentrated in other subsections, creating spatially concentrated disadvantages in the so-called "ghettoized suburbs" (Hu & Giuliano, 2011; Liu & Painter, 2012).

As pioneers in spatial mismatch research, Kain (1985, 1992), followed by Ihlanfeldt (1999) and Galster (1991), foresaw this pattern of continued spatial mismatch between Black suburbs and jobs. These researchers investigated how the locational shift of Black residences into the suburbs could either offset the spatial mismatch, or instead present a "false hope" whereby the problems resulting from discrimination and related forms of disadvantage were simply carried over from the inner city to the suburbs. As a result, a growing body of literature has examined spatial mismatch under changed urban spatial structures, including spatial mismatch resulting from the continued segregation in the suburbs (Hu & Giuliano, 2011; Kneebone & Holmes, 2015; Massey & Tannen, 2018; Theys et al., 2019) as well as the rising urban inequality resulting from the shifting spatial structure of immigrant settlements and low-income households (Bischoff, 2016; Easley, 2018; Liu & Painter, 2012; Reardon & Bischoff, 2011; Stoll & Covington, 2012), revealing strong segregation patterns and an uneven distribution of employment in the U.S. metropolitan areas that create concentrations of disadvantage.

Despite overwhelming evidence that Black households remain the most segregated demographic group (Jargowsky, 2018), research on how the changing spatial structure of cities affects spatial patterns of mismatch and how it affects suburban Black people's access to employment opportunities is scarce. Further, previous studies primarily focused on the effect of job suburbanization on the changing spatial pattern of mismatch, while studies on Black suburbs and employment opportunities among Black suburbanites have been less discussed (Ganning, 2018; Miller, 2018). However, there is increasing evidence of changing job access for the suburban poor as the suburbanization of poverty has been on the rise in the U.S. metropolitan areas (Bischoff & Reardon, 2014; Howell & Timberlake, 2014). Researchers have argued that job access is higher in the city than in the suburbs due to higher employment densities in the city, while suburban jobs tend to be more dispersed (Hess, 2005; Hu, 2015). Even so, the findings suggest that the suburban poor live in neighborhoods with the lowest share of jobs among all suburban areas, and the poor suburbs are disadvantaged in accessing employment opportunities (Raphael & Stoll, 2010). However, studies of the persistence of spatial mismatch among the Black population in the suburbs and how the spatial pattern of mismatch persists remain an unresolved urban issue. Thus, to address this gap in the literature, this paper proposes a geographical approach to examine intra-metropolitan spatial patterns of mismatch and how spatial disparities evolve at the local neighborhood level.

## 2 | METHODS

### 2.1 | Study area and data

The primary sources of population data for this analysis are the U.S. Census 2000 Summary File 1 (SF-1) and the 2011–2015 American Community Survey 5-year estimates at the census tract level. Employment data were derived from the 2002 and 2015 Longitudinal Employer-Household Dataset (LEHD) Origin-Destination Employment Statistics (LODES) datasets that tally total jobs by workplace area (U.S. Census Bureau, 2019). LEHD employment data are aggregated at the census tract level. Since the geographical boundaries of census tracts change over time to reflect population growth or decline, census estimates from 2000 were interpolated to 2010 geographical boundaries using the 2000–2010 Census Tract Relationship File from the Longitudinal Tract Database (LTDB) of Brown University (Logan et al., 2016).

This study focuses on working-age Black individuals between 15 and 64 years to represent the Black population. It was not limited to those who were employed or those who identified themselves as participating in the labor force, since labor force participation can be affected by the availability of jobs in the neighborhood (Hu & Giuliano, 2011). The 2-digit North American Industry Classification System (NAICS) code is used to examine how the spatial trend of mismatch has changed for the jobs that were suburbanized during the post-war metropolitan development. Specifically, jobs in the goods-producing and local service and health care industries are used because these industries make up around 77% of total U.S. jobs; approximately 86.8% of Black workers were employed in the goods-producing and local service and health care jobs (U.S. Census Bureau, 2017). The industry categorizations of Andersson et al. (2018) were used, in which the goods-producing and distribution jobs are industries with the respective NAICS codes (11, 21–23, 31–33, 42, 48–49), and local services and health care jobs are industries with the appropriate NAICS codes (44–45, 56, 62, 71, 72, 81).

Among the largest metropolitan areas in the United States, 12 metropolitan areas were selected for a detailed examination of the spatial pattern of mismatch between the Black population and jobs. These metropolitan areas were selected based on the size of the metropolitan area, data availability, and the representativeness of metropolitan areas in the four census regions of the United States: Northeast, Midwest, West, and South. Regarding data availability, the LEHD LODES dataset for 2002 was not available for several states and territories, including Washington D.C. and Massachusetts; thus, metropolitan areas within these states are not included in the metropolitan areas in this study. The representativeness of the metropolitan areas considers whether the spatial mismatch in the area has been widely studied in the literature, and whether metropolitan areas represent different regional dynamics. Table 1 shows the population trends for 2000 and 2015 and the demographic trends of the Black population in each metropolitan area.

Chicago and Detroit represent metropolitan areas with traditional spatial mismatch features that are characterized by de-industrialization and a highly segregated Black population in the inner city. The “New South” regions include Atlanta and Dallas, which represent areas with immense economic growth and high Black migration patterns between 1980 and 1990 (Keating, 2010; Stoll et al., 2000). The share of the Black population in the two metropolitan areas in the south increased by 51.2% and 46% in Atlanta and Dallas, followed by a 15% increase in Baltimore between 2000 and 2015. The Los Angeles and San Francisco metropolitan areas are representative of the “Sun Belt” states of the West that are characterized by substantial population growth as well as sprawling development patterns. Table 1 shows total population growth in these metropolitan areas, but we note that the Black population declined by 6.5% and 8.4% in Los Angeles and San Francisco, an opposite trend from the other metropolitan areas in the “Sun Belt” region, such as Dallas and Atlanta. Metropolitan

TABLE 1 Key metropolitan area characteristics for 12 selected metropolitan areas in the study

Descriptive characteristics	Northeast			Midwest		
	New York	Philadelphia	Pittsburgh	Chicago	Detroit	Minneapolis
Total population, 2000	18,944,557	5,687,141	2,431,102	9,098,314	4,452,554	3,031,912
Total population, 2015	19,979,950	6,035,680	2,358,926	9,534,008	4,296,416	3,458,790
Total population change	5.5%	6.1%	−3.0%	4.8%	−3.5%	14.1%
Black population, 2000	3,162,433	1,111,136	189,810	1,671,892	1,010,290	155,542
Black population, 2015	3,421,133	1,258,405	193,454	1,613,896	965,338	262,209
Black population change	8.2%	13.3%	1.9%	−3.5%	−4.4%	68.6%
Black population %, 2015	17.1%	20.8%	8.2%	16.9%	22.5%	7.6%
MSA land area (mi <sup>2</sup> )	8293	4602	5281	7197	3889	7637
Total density, 2015 (total population per mi <sup>2</sup> )	2409	1311	447	1325	1105	453

Descriptive characteristics	West			South		
	Los Angeles	San Francisco	Seattle	Dallas	Atlanta	Baltimore
Total population, 2000	12,362,902	4,123,736	3,043,882	5,204,235	4,263,452	2,552,998
Total population, 2015	13,154,457	4,528,894	3,614,361	6,833,420	5,535,837	2,769,818
Total population change	6.4%	9.8%	18.7%	31.3%	29.8%	8.5%
Black population, 2000	944,055	387,491	149,003	707,496	1,210,870	695,514
Black population, 2015	882,607	355,068	201,348	1,032,978	1,831,421	799,814
Black population change	−6.5%	−8.4%	35.1%	46.0%	51.2%	15.0%
Black population %, 2015	6.7%	7.8%	5.6%	15.1%	33.1%	28.9%
MSA land area (mi <sup>2</sup> )	4848	2478	5872	9280	8682	2602
Total density, 2015 (total population per mi <sup>2</sup> )	2713	1828	615	736	638	1065

*Note:* This table shows the total population size, the total number of the Black population for 2000 and 2015, and other key descriptive characteristics, including the land area and total population density for each metropolitan area.

*Source:* 2000 Decennial and 2011–2015 American Community Survey 5-Year Estimates, 2015 Cartographic Boundary File: US Census Bureau.

areas in the Northeast and Midwest are representative of “Legacy Cities,” which are characterized by deindustrialization, high levels of segregation, and population loss since the 1950s. Many legacy cities have gone through modest population growth since then, and although the population growth shows a somewhat varying patterns, the Black population grew in all metropolitan areas, including Philadelphia, Pittsburgh, Minneapolis, and Baltimore, with the highest black population growth in Minneapolis by a rate of 68.6%.

## 2.2 | Identification of neighborhood subareas of the metropolitan area

This study identifies three neighborhood subareas: inner city, inner suburb, and outer suburb. The criteria for determining neighborhood subareas are based on census boundaries and urban development trends, such as population density and housing density by year built (Airgood-Obrycki, 2019;



Cooke & Marchant, 2006; Kneebone & Holmes, 2015; Lee & Leigh, 2007). Place boundaries for the 2015 U.S. Census—a designated governmental unit incorporated under the state as the city—are used to identify the inner city (U.S. Department of Commerce, 1994). In addition, if the name of the city is listed in the official metropolitan area title and it has a population of 100,000 or more, it is identified as an inner city, following Kneebone and Holmes (2015). Census tracts that are not classified as inner cities, but have more than 400 pre-1969 housing units per square mile and any contiguous tracts that have more than 200 pre-1969 housing units per square mile with more than 1000 residents per square mile are identified as inner suburbs (Airgood-Obrycki, 2019; Cooke & Marchant, 2006). Any census tracts not identified as inner city or inner suburbs in the above criteria are labeled outer suburbs.

## 2.3 | Measuring spatial mismatch

Spatial mismatch is defined in this research as a geographical separation between the Black population and jobs within metropolitan areas' local labor market boundaries, measured by the unevenness in the proportional distributions of the two. Previous studies have examined the existence of spatial mismatch by comparing commuting distances/times and gravity-based measures of job accessibility to estimate whether inner-city Black populations are disproportionately disadvantaged in accessing neighborhood job opportunities (Gottlieb & Lentnek, 2001; Grengs, 2010; Parks, 2004). However, although the comparison of commuting times and the number of job opportunities can show whether disparities in job accessibility exist in the city and the suburbs, it does not provide evidence of the extent of spatial disparities between the Black population and job opportunities. The dissimilarity index is commonly used to measure spatial mismatch because it calculates the disproportionality of two groups in each areal unit of a city or metropolitan area (Easley, 2018; Liu & Painter, 2012; Martin, 2004; Massey & Denton, 1988b; Stoll & Covington, 2012). The dissimilarity (D) index takes the following form (Massey & Denton, 1988b):

$$D = \frac{1}{2} \sum_i \left| \frac{x_i}{X} - \frac{y_i}{Y} \right|$$

where  $x_i$  and  $y_i$  are the two groups of interest in the areal unit  $i$ , and  $X$  and  $Y$  are the sums of each group. Thus, this index measures the proportional differences between the two groups in each areal unit to represent the level of unevenness within the geographical area that would have to move to achieve a total even distribution. However, despite the popularity of the dissimilarity index, this index poses challenges in properly including spatial mismatch. Since the index measures unevenness in the distribution of Black populations and jobs within each areal unit (i.e., internal homogeneity), the index fails to capture the spatial distributions of Black individuals and jobs in neighboring areal units within the vicinity or many miles away (Massey & Denton, 1988a; Stoll & Covington, 2012).

Thus, to better identify the spatial distribution of the Black population and jobs of neighboring areas, several other approaches have been suggested that use a distance-based index of dissimilarity (Theys et al., 2019) and a transit time-based index of dissimilarity (Fan et al., 2012; Qi et al., 2018). However, these distance- and time-based measures require intensive computational analysis for larger geographical areas (Massey & Denton, 1988a; Stoll, 2006; Wong, 2004).

Wong (2005) formulated a general spatial segregation measure that considers the spatial distribution of neighboring areas without the undue computational burden, while also effectively capturing the distribution patterns in a region. By using the composite count of the Black population and jobs of each areal unit, the general dissimilarity (GD) index incorporates the spatial interaction of Black

individuals and jobs in the surrounding areas of each areal unit as if they are in the same unit, depending on how one defines the neighborhood. The composite count of the Black population in areal unit  $i$  (i.e., census tract)  $cblack_i$  can be defined as per Wong (2005):

$$cblack_i = \sum_r d(\text{black}_r),$$

where  $\text{black}_r$  refers to the count of the Black population in census tract  $r$ ,  $d(\cdot)$  is a function defining the neighborhood of  $i$ , and  $r$  refers to census tracts within the metropolitan area. A five-mile buffer is used to determine the neighborhood for each census tract and measure the distribution of the Black population and jobs within the local labor market boundary (or local neighborhood environment) based on the assumption that those areas within a five-mile buffer incorporate jobs located up to 10 miles end to end in diameter from the neighborhood boundary. The average commuting distance in the major metropolitan areas in the United States was 7–10 miles from the place of residence to work (Kneebone & Holmes, 2015). The five-mile buffer area is comparable to that of Reardon et al. (2008), who used a 4000-m radius area to measure the macro scale of segregation. The macro scale local environment, thus defined represents an area that people may consider a community, but one smaller than the distance people commute to work. Thus, the five-mile radius area used in this study (which corresponds to around an 8000-m radius area) represents an environment that people would consider a labor market boundary.

With the above composite counts of the Black population and jobs, a general dissimilarity index (GD index) for each metropolitan area can be calculated using

$$\text{GD index} = \frac{1}{2} \sum_i \left| \frac{cblack_i}{\sum_i cblack_i} - \frac{cjob_i}{\sum_i cjob_i} \right|$$

where  $cblack_i$  and  $cjob_i$  are the composite counts of the Black population and jobs, respectively, in the neighborhood environment of census tract  $i$ . The index value represents the disproportionality of the two groups, considering the distributions in the five-mile buffer areas. This index ranges from 0 (complete evenness) to 1 (complete unevenness), indicating the total dissimilarity in the distribution of the Black population and jobs within the local neighborhood environment of metropolitan areas. Multiplying the index by 100 allows the index to be interpreted as a percentage of the Black population or jobs that are mismatched to their local environments.

Since the GD index is bounded between 0 and 1, this index helps measure the overall mismatch for metropolitan areas. However, although it incorporates spatial interactions of neighboring areas, the spatial patterns of mismatch and heterogeneity in the distributions were not shown using the indexed value. Thus, the values of the GD index before summing the absolute differences of the two ratios are used to represent the overrepresentation of the Black population or jobs. Using the differences of the two ratios for each areal unit before they are aggregated in the metropolitan area, the negative values show that there is a surplus of jobs within the neighborhood boundary relative to the share of the Black population, and the positive values represent the overrepresentation of the Black population relative to the proportionate share of jobs.

Thus, in this study, spatial mismatch is identified for the local labor market boundaries that capture the distribution pattern of the Black population and jobs within the neighboring areas using composite counts. It is worth noting that these catchment areas are overlapping boundaries rather than discrete areal units such as census tracts. Thus, the GD index can be interpreted as the difference in the share of



the Black population and jobs in an individual's neighborhood boundary rather than as the share of the population that would have to move to achieve an even distribution in a region. This interpretation is more sensible for real-world applications where employment opportunities are not exclusive to the population within the same census tract, and neighboring census tracts is likely to have greater access to jobs than those located further away.

### 3 | RESULTS

#### 3.1 | Spatial distribution of the black population

To describe the geographic trends of Black suburbanization, the total Black population, the share in each neighborhood subarea, and the percentage changes between 2000 and 2015 in the 12 metropolitan areas are shown in Table 2. From 2000 to 2015, the Black population increased the most in the outer suburbs, followed by the inner suburbs. In nearly all the observed metropolitan areas, the Black population grew in the suburbs while their numbers fell in the inner city. This trend shows that Black suburbanization continues in the 21st century as the Black population migrates further into

**TABLE 2** Trend of Black population in the metropolitan area, by regions, 2000–2015

MSAs	Black population			Share of black			% Change		
	2015 (in thousands)			2015			2000–2015		
	Inner city	Inner suburb	Outer suburb	Inner city (%)	Inner suburb (%)	Outer suburb (%)	Inner city (%)	Inner suburb (%)	Outer suburb (%)
Northeast									
New York	2271	1015.3	134.8	66.4	29.7	3.9	−2.5	8.9	45.4
Philadelphia	661.0	435.9	161.6	52.5	34.6	12.8	1.9	21.0	44.2
Pittsburgh	75.8	101.9	15.7	39.2	52.7	8.1	−15.4	16.4	32.1
Midwest									
Chicago	838.7	590.8	184.4	52.0	36.6	11.4	−19.5	10.0	78.4
Detroit	574.2	307.9	83.3	59.5	31.9	8.6	−26.2	59.1	106.5
Minneapolis	118.4	87.7	56.1	45.2	33.4	21.4	19.5	141.0	196.6
West									
Los Angeles	419.4	391.1	72.2	47.5	44.3	8.2	−13.8	−8.1	47.0
San Francisco	169.5	131.6	54.0	47.7	37.1	15.2	−20.9	−4.2	39.3
Seattle	71.7	90.5	39.1	35.6	45.0	19.4	2.4	60.9	65.9
South									
Dallas	541.0	115.7	376.3	52.4	11.2	36.4	16.7	35.2	136.8
Atlanta	235.8	371.1	1224.5	12.9	20.3	66.9	−6.2	1.1	104.8
Baltimore	391.1	252.6	156.1	48.9	31.6	19.5	−6.3	43.2	54.4
<b>Total</b>	<b>6367.6</b>	<b>3892.2</b>	<b>2557.9</b>	<b>49.7</b>	<b>30.4</b>	<b>20.0</b>	<b>−7.6</b>	<b>14.6</b>	<b>89.7</b>

*Note:* This table shows the trend of Black suburbanization in each of the 12 metropolitan areas in the United States. The total number of Black population in 2015, the share of the Black population, and the percentage changes are summarized by three neighborhood subarea groups (Inner city, Inner suburb, and outer suburb).

*Source:* U.S. Census Bureau, 2000 Decennial and 2011–2015 American Community Survey 5-Year Estimates.

the suburbs. The increase in the outer suburbs is especially notable in the two Southern metropolitan areas, Dallas and Atlanta, where Black suburbanization had been already in process before 2000. The other two are in the Midwest: Detroit and Minneapolis, where the Black population increased the most in the outer suburbs, by approximately 106.5% and 196.6%, respectively. This trend is also shown in San Francisco and Los Angeles, where the Black population declined in both the inner city and the inner suburbs, but their numbers increased in the outer suburbs. This change demonstrates that Black migration to the suburbs is on the rise throughout metropolitan areas across regions. Despite these trends, a large share of the Black population still resides in the inner city. For example, in New York and Detroit, more than half of the Black population (66.4% and 59.5%, respectively) continue to reside in the inner city, followed by the inner suburb. The exceptions were in Atlanta, where approximately 86.9% of the Black population live in the suburbs. Overall, Table 2 shows that the Black suburbanization trend is indeed occurring, but a large share of the Black population continued to live in the inner city in 2015.

### 3.2 | Spatial measure of mismatch

Spatial mismatch was measured using the GD index of Wong (2005). The values of the GD index show the disproportionality between the geographical distribution of the Black population and jobs in each metropolitan area. In addition, because the index considers the spatial interactions among neighboring units within a 5-mile local boundary, the index can identify the clustering of the Black population and jobs and then compute the spatial mismatch, a measure of evenness. Table 3 shows the metropolitan-level spatial mismatch to (1) goods-producing and distribution jobs and (2) local services and health care jobs in 2000 and 2015, as well as the changes over time.

Consistent with the literature, the spatial mismatch to goods-producing and distribution jobs is the highest in Chicago (0.386), followed by Los Angeles, Detroit, New York, and San Francisco. There is approximately 38.6% unevenness (or spatial disparity) in the relative distribution of the Black population and jobs in each local boundary area in Chicago. The metropolitan areas in the Midwest and Northeast are in Rust Belt states that underwent deindustrialization and the decentralization of jobs into the suburbs, while the Black population remained segregated in the inner city. The spatial mismatch between local services and health care jobs is also the highest in these metropolitan areas, suggesting that the Black population in these metropolitan areas faces similar levels of mismatch, although the extent and spatial patterns vary by industry. On average, the spatial mismatch to goods-producing jobs is higher than the mismatch of local service jobs, which is reasonable given that manufacturing and construction jobs tend to be clustered on a smaller geographical scale than local service jobs, which are distributed more evenly across the region. Overall, the metropolitan-level spatial mismatch in Table 3 reveals that large metropolitan areas in the Midwest, Northeast, and the West exhibit the highest levels of spatial mismatch, even when the geographical distribution of the Black population and jobs among neighboring areas are considered.

Between 2000 and 2015, spatial mismatch declined in most metropolitan areas. The changes by the industry show that, on average, spatial mismatch to goods-producing jobs declined by 1.8%, while local services jobs declined by 1.3%. The spatial mismatch to goods-producing jobs fell the most in the Midwest, particularly in Detroit and Minneapolis (−6.8% and −5.9%, respectively), and in the South, in Dallas and Atlanta (−3.8% and −3.3%, respectively). The spatial mismatch to local service jobs also declined the most in Detroit (−6.5%), followed by Pittsburgh and Dallas (−4.5 and −3.3). Except for Pittsburgh, these areas had the greatest Black population growth in the suburbs between 2000 and 2015, as shown in Table 2. This growth implies that the decline in the spatial mismatch

**TABLE 3** Black spatial mismatch indices in the 12 metropolitan areas, 2000 and 2015

Metropolitan area	2000		2015		2000–2015 Change	
	Goods producing	Local services	Goods producing	Local services	Goods producing	Local services
<b>Northeast</b>						
New York City—Newark-Jersey City	0.376	0.351	0.365	0.361	−0.011	0.010
Philadelphia-Camden-Wilmington	0.355	0.227	0.345	0.212	−0.011	−0.016
Pittsburgh	0.302	0.233	0.284	0.188	−0.018	−0.045
<b>Midwest</b>						
Chicago-Naperville-Elgin	0.389	0.401	0.386	0.420	−0.003	0.019
Detroit-Warren-Dearborn	0.447	0.413	0.379	0.348	−0.068	−0.065
Minneapolis-St. Paul-Bloomington	0.263	0.151	0.203	0.137	−0.059	−0.015
<b>West</b>						
Los Angeles-Long Beach-Anaheim	0.393	0.397	0.382	0.372	−0.011	−0.025
San Francisco-Oakland-Hayward	0.348	0.395	0.360	0.390	0.012	−0.005
Seattle-Tacoma-Bellevue	0.256	0.260	0.252	0.305	−0.004	0.044
<b>South</b>						
Dallas-Fort Worth-Arlington	0.351	0.337	0.314	0.304	−0.038	−0.033
Atlanta-Sandy Springs-Roswell	0.341	0.364	0.308	0.349	−0.033	−0.015
Baltimore-Columbia-Towson	0.263	0.161	0.287	0.145	0.024	−0.017
<b>Total</b>	0.340	0.308	0.322	0.294	−0.018	−0.013

*Note:* This table shows the general dissimilarity index in each metropolitan area in the United States. The general dissimilarity index is calculated separately for goods-producing jobs and local services and health care jobs in 2000 and 2015. The 2000–2015 change shows the overall change in the general dissimilarity index in the two periods.

*Source:* 2000, 2011–2015 U.S. Census Bureau and 2002, 2015 LEHD LODES.

in these metropolitan areas is attributable to the suburbanization of the Black population closer to where jobs are located. On the other hand, the spatial mismatch to local service and health care jobs increased the most in Seattle and Chicago and (to a lesser degree) in New York. This change indicates that the spatial separation between the Black population and local service jobs grew in 2015 compared to 2000.

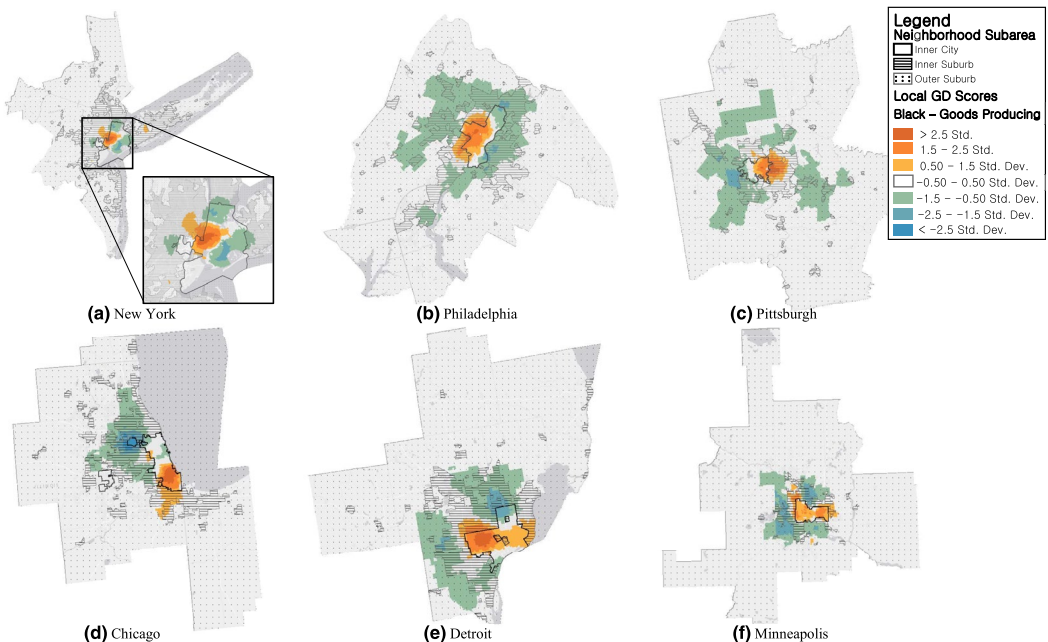
### 3.3 | Intra-metropolitan distribution of spatial mismatch

Although the GD index allows for the measurement of the distribution of the Black population and jobs in the neighboring areas, the index is a global measure at the metropolitan level and cannot reveal the variations in the spatial patterns of mismatch. Understanding the spatial mismatch patterns of each metropolitan area helps to demonstrate the variations in the level of disproportionality in local areas (Wong, 1996). For instance, it may be that spatial mismatch is spread evenly throughout the metropolitan area like a checkerboard pattern, or local concentrations of the Black population and jobs are clustered in different locations. In this way, variations in the intra-metropolitan spatial mismatch patterns can be identified—the geographical location of the mismatch shifts to the suburbs of the tested metropolitan areas. Thus, to show the spatial distribution of the unevenness (the overrepresentation of Black population and jobs), I use the local GD scores, hereinafter referred to as “local

GD scores” which refer to the difference between the two ratios in the calculation of the GD index for each local unit instead of using the absolute differences to indicate the spatial patterns of mismatch. Wong (1996) suggested this method to represent the concentrations of different population groups that show the diversity of segregation patterns that have distinct patterns across regions.

Since local GD scores retain the negative and positive values of dissimilarity, they can reveal whether there is a disproportionate representation of the Black population relative to jobs or vice versa. In this way, areas with (1) an overrepresentation of the Black population, where disproportionate shares of the Black population face shortage of jobs within the local neighborhood boundary, and (2) a surplus of jobs with comparatively small shares of Black population are identified. The latter case reveals a pattern in which Black job seekers are underrepresented in an opportunity surplus area. Thus, both types of spatially mismatched sites are presented—neighborhoods with an overrepresentation of the Black population with a low share of jobs and those with a surplus of job opportunities but a smaller Black population residing within the local neighborhood boundary.

Figures 1 and 2 show the intra-metropolitan spatial patterns of mismatch in the 12 metropolitan areas using the local GD scores for goods-producing and distribution jobs, local services, and health care jobs in 2015. In the subsequent section, the changes in the local GD scores between 2000 and 2015 are presented in Figures 3 and 4 to demonstrate the locations of an increase in disproportionality. The neighborhood subareas are shown using three boundaries: The innermost region is the inner city, the second most centralized region is the inner suburb, and the outermost region is the outer suburb. The degree of spatial mismatch is presented using the standard deviations to show the extent to which the local GD scores of each local neighborhood boundary deviate from the metropolitan average. Negative scores indicate that the share of jobs is higher than the share of Black households, and positive scores indicate that the share of the Black population is higher than the share of jobs.



**FIGURE 1** Spatial pattern of mismatch between the Black population and goods producing jobs, 2015. *Source:* 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODES

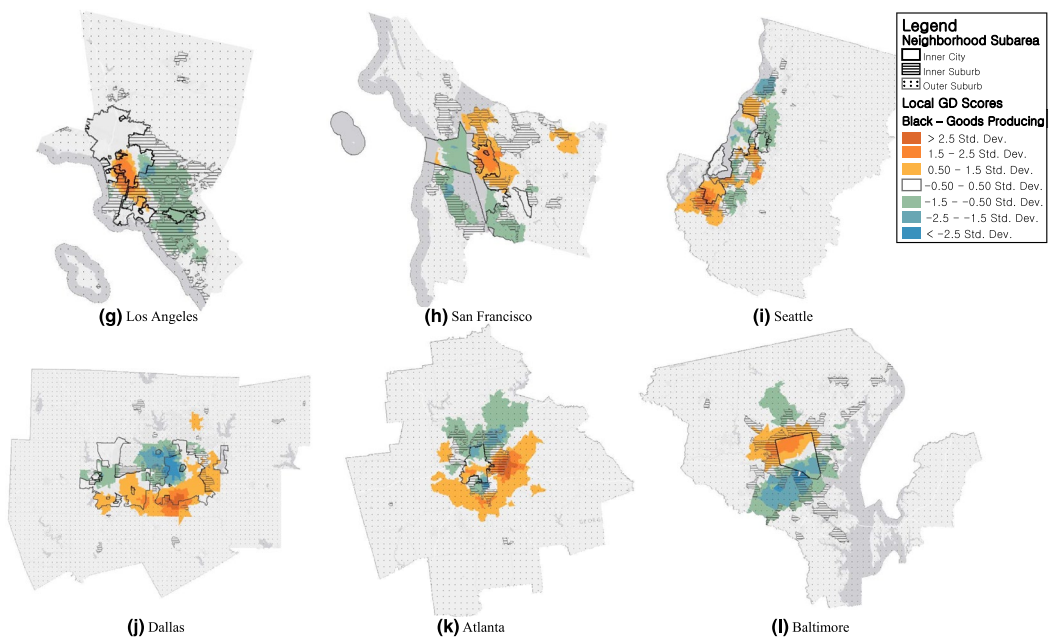


FIGURE 1 (Continued)

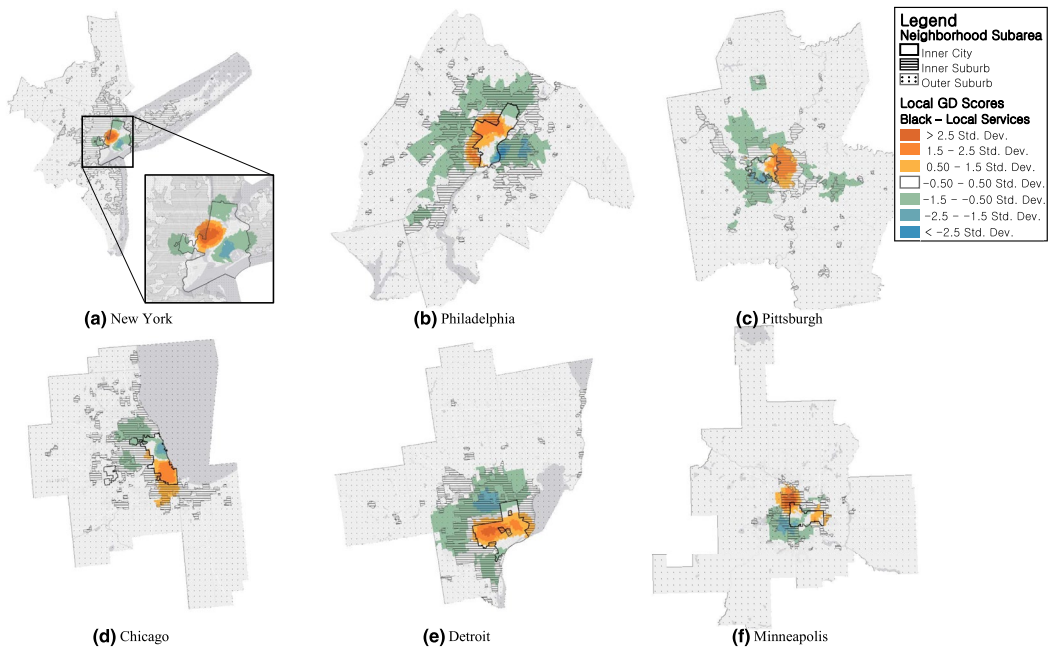


FIGURE 2 Spatial pattern of mismatch between the Black population and local service jobs, 2015. Source: 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODS

The spatial patterns of mismatch to goods-producing jobs shown in Figure 1 show that many metropolitan areas in the Northeast and Midwest display a traditional mismatch pattern whereby the regions with an overrepresentation of the Black population in the inner city are surrounded by job



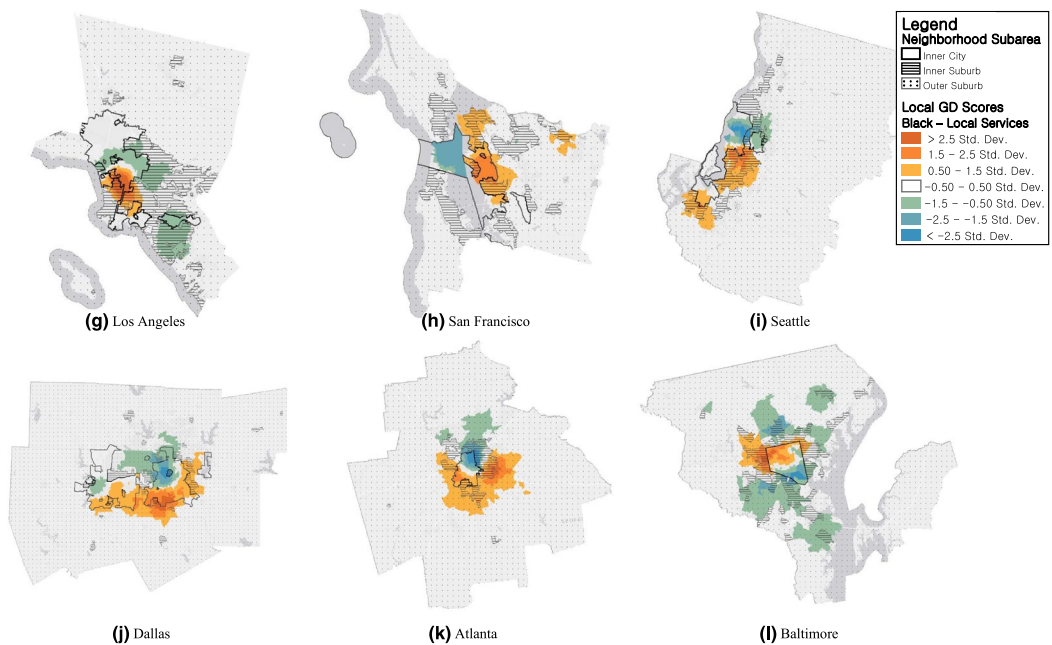
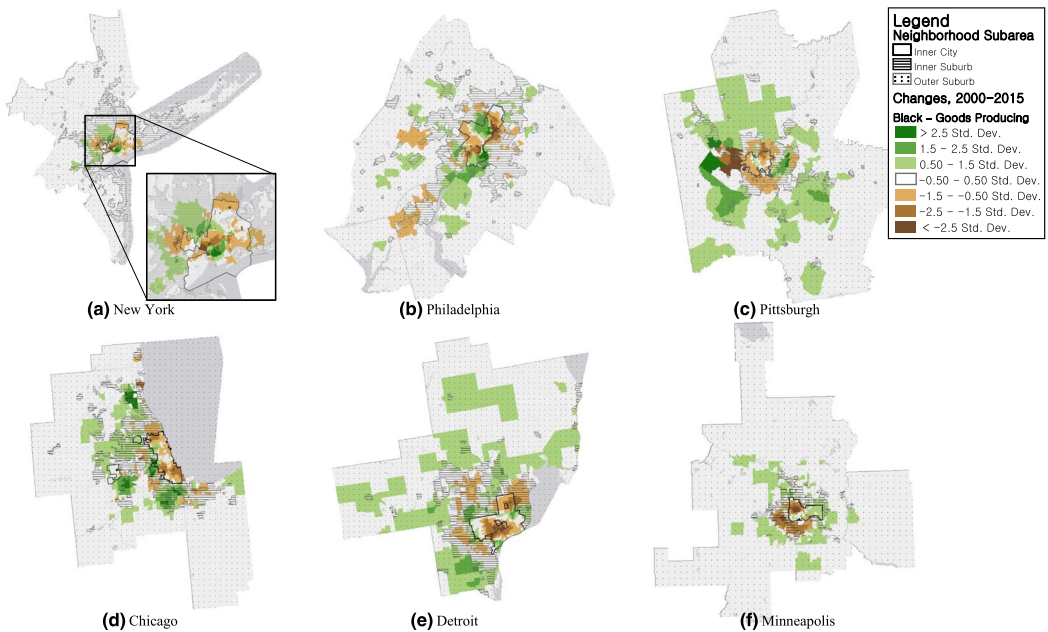


FIGURE 2 (Continued)



**FIGURE 3** Changes in local general dissimilarity scores for the Black population and goods producing jobs, 2000–2015. *Source:* 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODS

opportunities in the suburbs. These are indicated by clusters of Black neighborhoods in the inner city and surrounding job-rich areas in the suburbs of metropolitan areas, as shown in Figure 1b–f Philadelphia, Pittsburgh, Chicago, Detroit, and Minneapolis. In particular, spatial patterns in Chicago



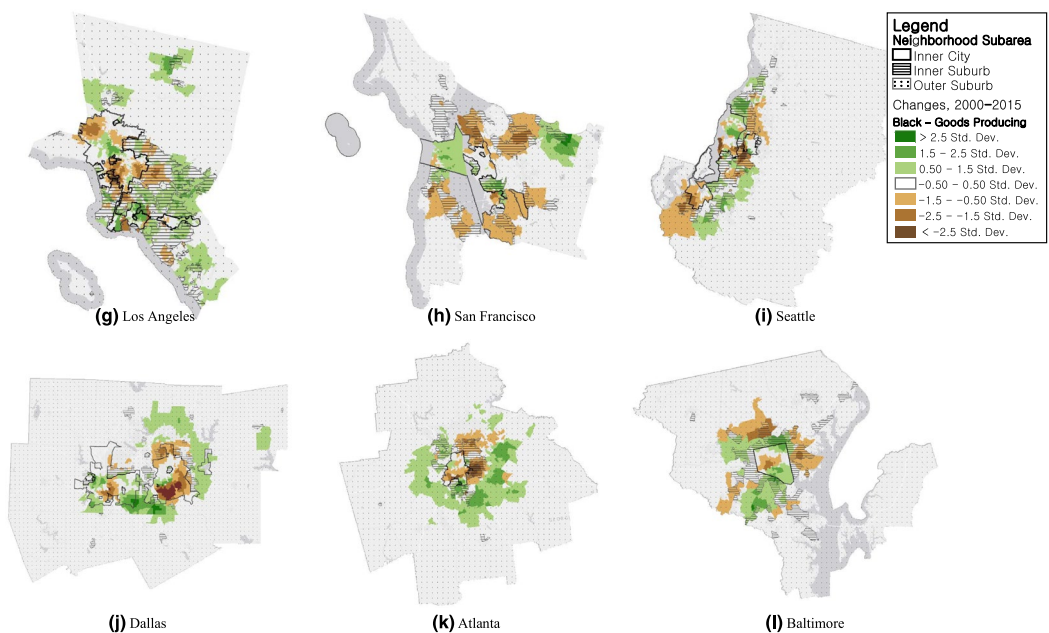


FIGURE 3 (Continued)

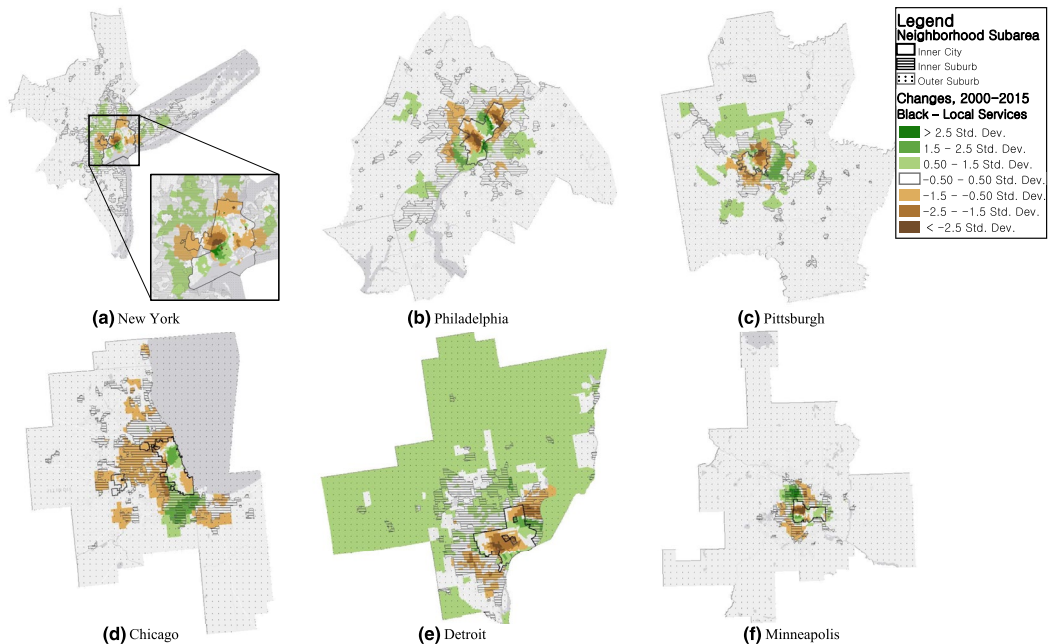


FIGURE 4 Changes in local general dissimilarity scores for the Black population and local service jobs, 2000–2015. Source: 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODS

demonstrate that job surplus neighborhoods are clustered in the northwestern part of the suburbs. In contrast, Black neighborhoods are concentrated in the southern part of the inner city and the southern inner suburb, indicating that the spatial pattern of mismatch in Chicago is even more geographically

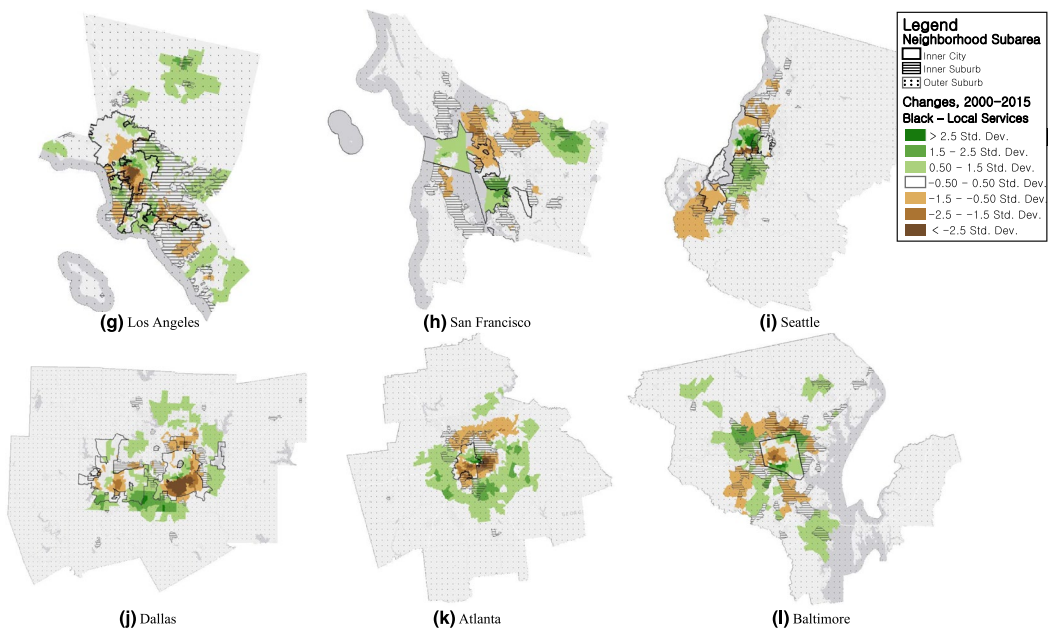


FIGURE 4 (Continued)

separated than in the other metropolitan areas, where job-rich areas surround the inner city boundary. The spatial patterns are not divided by the neighborhood subarea boundaries in the West, but both the Black neighborhoods and the job surplus areas are found within the inner city. These are shown in Figure 1g–i, Los Angeles, San Francisco, Seattle, and Baltimore. In metropolitan areas in the South, there is a distinct pattern of suburb-to-suburb spatial mismatch, whereby Black neighborhoods extend beyond the boundaries of the inner city into the inner and outer suburbs. This pattern is most evident in Figure 1j,k Dallas and Atlanta, where a sizeable Black population has migrated into the southern suburbs, and the spatial pattern of mismatch is divided into north and south. As hypothesized earlier, the spatial pattern of mismatch closely follows the residential segregation of the Black population in the suburbs, creating a suburb-to-suburb spatial mismatch that increases the spatial disparity of the suburbs. The spatial pattern in Figure 1a for New York demonstrates a reverse mismatch whereby job-rich neighborhoods are concentrated in the center of the inner city and Black neighborhoods surround these job centers.

Figure 2 shows the spatial pattern of mismatch between local services and healthcare jobs in the 12 metropolitan areas. The spatial mismatch to local services and health care jobs tends to be more localized in the inner suburbs, when compared to the spatial pattern of mismatch to goods-producing jobs. The traditional spatial mismatch pattern—that is, the inner city concentration of Black and a surplus of suburban job opportunities surrounding the inner city—is shown in Figure 2b,c,e Philadelphia, Pittsburgh, and Detroit. The pattern of inner city polarization is more evident for local services and health care jobs: Both the Black neighborhoods and the job-surplus neighborhoods cluster in the inner cities in metropolitan areas in the South and Chicago, as shown in Figures 2d,g–i Chicago, Los Angeles, San Francisco, and Seattle. These areas represent the inner city spatial disparity, where the locations of Black neighborhoods and the surplus of jobs are geographically concentrated in the inner city. In addition, these metropolitan areas exhibit high levels of class divisions in the inner city, the spatial concentration of affluence and poverty, as noted earlier in the study of Massey and Eggers (1993). Metropolitan areas in the South demonstrate a suburb-to-suburb spatial mismatch

where local service jobs and the Black neighborhood have expanded to the suburbs. These metropolitan areas are shown in Figure 2f,j–l Minneapolis, Dallas, Atlanta, and Baltimore. Figure 2a New York represents a spatial pattern where local service jobs are concentrated within the inner city and Black neighborhoods surround the jobs, similar to the spatial mismatch to goods-producing jobs.

Based on these different spatial patterns of mismatch in the 12 observed metropolitan areas, spatial mismatch is categorized into four major types: (1) traditional spatial mismatch pattern of inner city Black and suburban jobs, (2) inner city spatial mismatch: a polarized urban core, (3) suburb-to-suburb spatial mismatch: Black neighborhoods and job-surplus neighborhoods within the suburb, and (4) the reverse pattern of mismatch: the job concentration is highest in the inner city and Black neighborhoods are located outside the urban core, as shown in New York. Table 4 shows the metropolitan variations in the spatial patterns of mismatch for goods-producing jobs and local service jobs based on the standard deviations of each areal unit that is used to map the spatial patterns of mismatch in Figures 1 and 2. The average of the interquartile ranges (IQR) in each subarea, and the 25th to 75th percentiles are shown. Many metropolitan areas in the Northeast and Midwest regions demonstrate traditional patterns, as discussed in Kain's hypothesis; that is, they represent instances in which the inner city Black population is spatially mismatched from suburban jobs. The IQR also confirms this pattern, in which the extent of Black neighborhoods (standard deviation above the mean) in the inner city is very high, and the inner and outer suburbs exhibit a surplus of jobs (standard deviation below the mean). Since the local GD score is the difference between the two ratios, the mean score is zero. Thus, standard deviation above the mean has a positive value, and standard deviation below the mean has a negative value.

In the West, especially in San Francisco and Seattle, the clusters of job surplus neighborhoods and Black neighborhoods are concentrated in the inner city and extended to the inner suburbs, demonstrating a polarization pattern in the inner city. This polarization is also indicated in Table 4, in which the IQR of the inner city is higher than that of the inner suburb, and the bar graph shows both the Black neighborhoods and the job-rich neighborhoods in the inner city. This trend is stronger for local services and health care jobs, in which the IQR of the inner city is approximately three times that of the inner suburb, which shows higher instances of job-rich neighborhoods than the Black neighborhoods. In the “New South” regions (i.e., Atlanta and Dallas), where a large portion of the Black population had already relocated to the suburbs before the 2000s, the Black neighborhoods are extended to the southern suburb. However, job-rich neighborhoods are concentrated in the northern part of the inner city and suburbs, which implies that the spatial disparity expanded beyond the boundary of the inner city, a suburb-to-suburb mismatch. Finally, New York shows a distinct pattern in which there is a high concentration of jobs in the core of the inner city, while the Black population clusters around the boundary of the inner city. The IQR in New York also confirms this trend, in which the variation is the greatest in the inner city, while the variations in the suburbs are smaller.

### 3.4 | Changes in the distribution of the black population and jobs, 2000–2015

The changes in the absolute local GD scores are displayed in Figures 3 and 4 to demonstrate the changes in the disproportionality of the Black population and jobs within each local neighborhood environment. These changes in absolute local GD scores are used to illustrate whether the disproportions in the distribution of the Black population and job have increased or decreased (for instance, a change from  $-0.3$  to  $0.3$  indicates an increase of  $0.6$ , but the difference in the ratio remains  $0.3$  for both time periods). Thus, by calculating the changes in the magnitude of disproportions, Figures 3 and 4

TABLE 4 Metropolitan variations in the spatial patterns of mismatch in 2015

General Dissimilarity Scores (Black - Goods producing)					
	Interquartile range (IQR)				
Spatial Patterns	Inner City	Inner Suburb	Outer Suburb	Trends	MSA
Traditional	1.55	0.86	0.48	 ■ Inner city ■ Inner suburb ■ Outer Suburb	Philadelphia, Pittsburgh, Chicago, Detroit, Minneapolis
Inner city Polarization	1.70	1.25	0.49		Los Angeles, San Francisco, Seattle, Baltimore
Suburb to Suburb	1.33	1.71	0.49		Dallas, Atlanta
Centralized	1.77	0.25	0.05		New York
General Dissimilarity Scores (Black - Local services)					
	Interquartile range (IQR)				
Spatial Patterns	Inner City	Inner Suburb	Outer Suburb	Trends	MSA
Traditional	1.76	0.77	0.41	 ■ Inner city ■ Inner suburb ■ Outer Suburb	Philadelphia, Pittsburgh, Detroit
Inner city Polarization	2.14	0.78	0.31		Chicago, Los Angeles, San Francisco, Seattle
Suburb to Suburb	1.66	1.47	0.43		Minneapolis, Dallas, Atlanta, Baltimore
Centralized	1.42	0.12	0.04		New York

Note: This table shows metropolitan variations in the spatial patterns of mismatch using the IQR of the local GD scores. Average IQR is computed for each spatial pattern of mismatch using the standard deviations from the mean. The larger the IQR, higher the mismatch in each neighborhood subarea. The third column displays how IQR is distributed, based on the lower and upper bounds using 25th and 75th percentiles. The standard deviation above the mean (IQR in the right-hand side) represents that there are higher shares of Black population than jobs  $\left[ \left( \frac{c_{black_i}}{\sum_i c_{black_i}} - \frac{c_{job_i}}{\sum_i c_{job_i}} \right) > 0 \right]$ , and the standard deviation below the mean (IQR in the left-hand side) represents that there are higher share of jobs than Black  $\left[ \left( \frac{c_{black_i}}{\sum_i c_{black_i}} - \frac{c_{job_i}}{\sum_i c_{job_i}} \right) < 0 \right]$ .

Abbreviations: GD, general dissimilarity; IQR, interquartile ranges.

Source: 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODES.

represent whether the level of mismatch in each areal unit increased or decreased in 2015. Once again, the changes in the spatial patterns using the standard deviations demonstrate the degree of difference from the metropolitan average. In addition to the figures, the magnitudes of changes in the disproportions by neighborhood subarea are summarized in Table 5 to further explain these trends. It shows the sum of the total changes in absolute local GD scores by each neighborhood subarea and the *p*-value of the *t*-test, comparing the local scores in 2000 and 2015.

**TABLE 5** Changes in the level of spatial mismatch by neighborhood subarea, 2000–2015

MSA	Black—Goods producing						Black—Local services					
	Inner city		Inner suburb		Outer suburb		Inner city		Inner suburb		Outer suburb	
	Diff.	<i>p</i>	Diff.	<i>p</i>	Diff.	<i>p</i>	Diff.	<i>p</i>	Diff.	<i>p</i>	Diff.	<i>p</i>
Northeast												
New York	−0.009	***	−0.012	***	−0.002	***	0.024	***	−0.002	**	−0.001	***
Philadelphia	−0.026	***	0.004		0.000		−0.033	***	0.002		−0.001	
Pittsburgh	−0.032	***	−0.013	***	0.010	**	−0.065	***	−0.022	***	−0.002	
Midwest												
Chicago	−0.031	***	0.016	***	0.010	***	0.041	***	−0.003		−0.001	
Detroit	−0.087	***	−0.057	***	0.009	***	−0.069	***	−0.063	***	0.000	
Minneapolis	−0.072	***	−0.040	***	−0.007	*	−0.033	***	0.008		−0.004	
West												
Los Angeles	−0.022	***	−0.004	***	0.003	***	−0.027	***	−0.021	***	−0.002	***
San Francisco	0.043	***	−0.023	***	0.003		0.007	**	−0.019	***	0.002	
Seattle	−0.011	**	−0.005		0.008	**	0.040	***	0.032	***	0.017	***
South												
Dallas	−0.087	***	−0.008	***	0.019	***	−0.066	***	−0.016	***	0.017	***
Atlanta	−0.040	***	−0.045	***	0.019	***	−0.009		−0.034	***	0.013	**
Baltimore	0.002		0.035	***	0.016	***	−0.023	***	−0.005	*	−0.005	**

*Note:* This table shows the changes in the level of spatial mismatch between 2000 and 2015 by the neighborhood subareas. Paired *t*-test is used to calculate the mean difference in the magnitude of local GD scores of each areal unit (local neighborhood boundary) by subareas, and *p* represents whether the changes are statically different from zero. Diff. represents the changes in the total absolute GD scores for each subarea, which indicate changes in the overall level of dissimilarity.

Abbreviation: GD, general dissimilarity.

\*, \*\*, and \*\*\* denotes statistical significance at the 10, 5, and 1 percent. \*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1.

*Source:* 2000, 2011–2015 U.S. Census Bureau; 2002, 2015 LEHD LODES.

Overall, the changes in the spatial mismatch to goods-producing jobs in Figure 3 show that the magnitude of the disproportionality declined in the inner city, while the disproportionality increased in the inner and outer suburbs. The decline in the inner city is most evident in metropolitan areas, as shown in Figure 3e,f,j Detroit, Minneapolis, and Dallas. In these metropolitan areas, the total Black population increased in the suburbs, which lowered the relative share of the Black population in the inner city, resulting in decreased spatial mismatch to goods-producing jobs in the inner city. In Figure 3a,i New York and Baltimore, the spatial patterns show a mixed trend where the magnitude of mismatch declined in some parts of the inner city, while it increased in others. In Figure 3h San Francisco, the overall level of spatial mismatch increased in the inner city. This increase is partly driven by the growing share of jobs in the financial district in the western inner city, while both jobs, and the share of the Black population fell in the eastern part of the inner city. These changes imply that although the suburbanization of goods-producing jobs has decreased the relative share of jobs in the inner city in most metropolitan areas, a metropolitan area with a strong urban core that continued to attract jobs has resulted in an increased mismatch in the inner city.

While spatial mismatch generally declined in the inner suburbs, it increased in metropolitan areas with strong urban cores as shown in Figure 3d,i Chicago and Baltimore. The patterns closely resemble Black migration patterns in these metropolitan areas, in which these areas are where Black



population have moved into, while there is only a slight increase in jobs in the same suburbs. In other metropolitan areas, the spatial mismatch increased in the outer suburbs as shown in Figure 3c,e,j,k Pittsburgh, Detroit, Dallas, and Atlanta. Such an increase in the spatial disparity in the outer suburb implies that both jobs and Black populations have grown in the outer suburbs, but at different locations. Further, the decrease in spatial mismatch is partially due to a decrease in Black population in the inner suburbs, especially in metropolitan areas shown in Figure 3h–k San Francisco, Dallas, and Atlanta. This suggests that the driving force behind the decreased level of mismatch in the inner suburb is due to desegregation—the movement of Black population from the inner suburbs to other parts of the metropolitan area—rather than the migration of Black population into areas of job growth. The changes in the spatial mismatch to local service and health care jobs in Figure 4 show that the spatial mismatch increased in more localized clusters than in the mismatch to goods-producing jobs. Figure 4d,h,i Chicago, San Francisco, and Seattle show that spatial mismatch increased in clusters in the inner city and the inner suburb. This pattern demonstrates an increased spatial disparity within the metropolitan areas with a high concentration of jobs in the inner city, while the Black population moved into the suburbs away from where jobs are concentrated. The disproportionality between the Black population and local service jobs generally declined in localized clusters in the inner city and the inner suburbs in other metropolitan areas. An exception is where there is a high concentration of local service jobs in the inner city, demonstrating an increase in the level of mismatch as the inner city is more polarized.

## 4 | CONCLUSION

This research used local GD scores that take into account the spatial distributions of populations and jobs to demonstrate geographical evidence of the spatial mismatch of 12 metropolitan areas in the United States. In the Northeast and Midwest regions, spatial patterns of mismatch conform to the traditional patterns of mismatch where the Black population is disproportionately concentrated in the inner city, while high concentrations of jobs are found in the suburbs. The findings also demonstrate polarization in the inner city of metropolitan areas including New York, Chicago, and San Francisco. There is a growing spatial disparity at the local level, due to concentration of jobs and Black residential segregation in the inner city, particularly for local services and healthcare jobs. This trend is most notable in metropolitan areas with a strong economic base in the inner city. In Southern metropolitan areas where much of the Black population has suburbanized, the suburbs were divided into the northern and southern suburb, supporting the theory that suburbs have become more mismatched—a geography of mismatch between the suburbs. This is consistent with the finding that segregation is more prevalent in metropolitan areas with more suburbanized Black populations, suggesting that suburban sprawl is associated with increased racial segregation and spatial disparity (Jaret et al., 2006). Based on this, the spatial patterns of mismatch are classified into four major types: (1) traditional pattern of spatial mismatch, (2) inner city polarization, (3) suburb-to-suburb spatial mismatch, and (4) reverse mismatch, where job surplus areas are centralized in the urban core, as shown in New York.

Planning approaches to reduce spatial mismatch have been proposed in the past, including fair housing policy initiatives, providing housing assistance programs that relocate people closer to employment, and improving access to good job opportunities (Fan, 2012; Gobillon et al., 2007; Ihlanfeldt & Sjoquist, 1998). Although the current research does not examine the link between such planning practices and the spatial mismatch directly, the findings suggest that the spatial mismatch is a steady trend in the United States, and the geography of mismatch has extended



beyond the boundary of the inner city. The persistent residential segregation despite Black suburbanization and the geographical concentration of jobs has likely contributed to this trend. Less restrictive land regulations and low tax burdens in Atlanta and Dallas potentially played an important role in the economic development of the northern suburbs rather than the concentration of the Black population and poverty in the south (Harris, 2018; Keating, 2010). In Minneapolis, Fan et al. (2016) and Guthrie et al. (2018) found that the spatial disparity in the northwest and southwest suburbs is closely associated with a decline in the inner suburbs where a significant share of affordable housing has become available, and a high concentration of businesses and planned expansions in the southwest suburbs. As the current study showed a continuing trend of spatial mismatch in the suburbs where the Black population has suburbanized, the resegregation of the Black population presents as a pressing issue that contributes to the spatial inequality in U.S. metropolitan areas.

This study demonstrated different spatial patterns of mismatch in the 12 metropolitan areas and the shifting geography of mismatch to the predominantly Black suburbs. Methodologically, this research utilized a spatial measure of mismatch that incorporates the composite population counts and job counts within neighboring areas of each census tract to capture the extent of spatial mismatch of local labor market boundaries. Setting a five-mile buffer area as the local neighborhood environment for measuring the spatial distributions of the Black population and jobs may be considered an arbitrary geographical scale choice, and a different neighborhood boundary may yield different spatial patterns. Other advanced measures, such as gravity-based measures and transit-based measures of mismatch, may improve the way mismatch is captured within each areal unit. In addition, the 2000 decennial census data and 5-year estimates from the American Community Survey are not directly comparable, and readers should be cautious in interpreting the comparisons of the two time periods. Nevertheless, the findings in this research suggest a novel way to examine the spatial mismatch beyond job accessibility and demonstrate the spatial disparities in the clustering of the Black population and jobs when considering the spatial distributions in neighboring areas.

Inclusionary housing policies and racial and economic integration policies need to be promoted to address the persistence of spatial mismatches. Further, the findings of this research indicate that the spatial pattern of mismatch is particularly evident in metropolitan areas with a strong market concentration that increases the spatial disparity within the inner city and the suburbs. Although the economic concentration in such subcenters can improve the overall productivity and economic growth in the metropolitan area, economic inequality is growing. This finding is consistent with recent studies showing that between-inequalities are declining across metropolitan areas while within-inequalities are growing (Márquez et al., 2019; Theys et al., 2019). Spatial mismatch in the 21st century is a byproduct of continued residential segregation and increased spatial inequality—an unequal distribution of resources and services, housing integration, and suburban development policies to strengthen local neighborhoods and ensure the inclusive growth of a broader region within metropolitan areas. To promote equality of economic opportunities across all neighborhoods, future land-use regulations and housing policies should address ways to achieve stable racial integration for balanced growth that would equal opportunity.

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## CONFLICTS OF INTEREST

The author has no conflicts of interest to declare. There are no relevant financial or nonfinancial competing interests to report. I certify that the submission is an original work and is not under review at any other publication.

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## REFERENCES

- Airgood-Obrycki, W. (2019). Suburban status and neighbourhood change. *Urban Studies*, 56(14), 2935–2952. <https://doi.org/10.1177/0042098018811724>
- Andersson, F., Haltiwanger, J. C., Kutzbach, M. J., Pollakowski, H. O., & Weinberg, D. H. (2018). Job displacement and the duration of joblessness: The role of spatial mismatch. *The Review of Economics and Statistics*, 100(2), 203–218. [https://doi.org/10.1162/rest\\_a\\_00707](https://doi.org/10.1162/rest_a_00707)
- Bischoff, K. (2016). Geography of economic inequality. In *Delivering equitable growth: Strategies for the next administration* (p. 109). Washington Center for Equitable Growth.
- Bischoff, K., & Reardon, S. F. (2014). Residential segregation by income, 1970–2009. In *Diversity and disparities: America enters a new century* (p. 43).
- Brown, L. A., & Chung, S.-Y. (2006). Spatial segregation, segregation indices and the geographical perspective. *Population, Space and Place*, 12(2), 125–143. <https://doi.org/10.1002/psp.403>
- Cooke, T., & Marchant, S. (2006). The changing intrametropolitan location of high-poverty neighbourhoods in the US, 1990–2000. *Urban Studies*, 43(11), 1971–1989. <https://doi.org/10.1080/00420980600897818>
- Easley, J. (2018). Spatial mismatch beyond black and white: Levels and determinants of job access among Asian and Hispanic subpopulations. *Urban Studies*, 55(8), 1800–1820. <https://doi.org/10.1177/0042098017696254>
- Ellen, I. G. (1999). Spatial stratification within US metropolitan areas. In *Governance and opportunity in metropolitan America* (pp. 192–212).
- Fan, Y. (2012). The planners' war against spatial mismatch: Lessons learned and ways forward. *Journal of Planning Literature*, 27(2), 153–169. <https://doi.org/10.1177/0885412211431984>
- Fan, Y., Guthrie, A., & Das, K. V. (2016). *Spatial and skills mismatch of unemployment and job vacancies (CTS 16-05)*. University of Minnesota Center for Transportation Studies.
- Fan, Y., Guthrie, A., & Levinson, D. (2012). Impact of light-rail implementation on labor market accessibility: A transportation equity perspective. *Journal of Transport and Land Use*, 5(3), 28–39. <https://doi.org/10.5198/jtlu.v5i3.240>
- Farley, R. (1970). The changing distribution of Negroes within metropolitan areas: The emergence of black suburbs. *American Journal of Sociology*, 75(4, Part 1), 512–529. <https://doi.org/10.1086/224873>
- Fischer, M. J. (2008). Shifting geographies: Examining the role of suburbanization in blacks' declining segregation. *Urban Affairs Review*, 43(4), 475–496. <https://doi.org/10.1177/1078087407305499>
- Frey, W. H. (2011). *Melting pot cities and suburbs: Racial and ethnic change in metro America in the 2000s* (p. 16). Brookings Institution, Metropolitan Policy Program.
- Galster, G. C. (1991). Black suburbanization: Has it changed the relative location of races? *Urban Affairs Quarterly*, 26(4), 621–628. <https://doi.org/10.1177/004208169102600410>
- Ganning, J. (2018). Change versus decline: The suburbanization of jobs in US shrinking cities. *Population Loss: The Role of Transportation and Other Issues*, 2, 163.
- Gobillon, L., & Selod, H. (2019). Spatial mismatch, poverty, and vulnerable populations. In M. M. Fischer & P. Nijkamp (Eds.), *Handbook of regional science* (pp. 1–16). Springer Berlin Heidelberg. [https://doi.org/10.1007/978-3-642-36203-3\\_7-1](https://doi.org/10.1007/978-3-642-36203-3_7-1)
- Gobillon, L., Selod, H., & Zenou, Y. (2007). The mechanisms of spatial mismatch. *Urban Studies*, 44(12), 2401–2427. <https://doi.org/10.1080/00420980701540937>
- Goetz, E. G. (2011). Gentrification in Black and White: The racial impact of public housing demolition in American cities. *Urban Studies*, 48(8), 1581–1604. <https://doi.org/10.1177/0042098010375323>

- Goetz, E. G., Damiano, A., & Williams, R. A. (2019). Racially concentrated areas of affluence. *Cityscape*, 21(1), 99–124.
- Gottlieb, P. D., & Lentnek, B. (2001). Spatial mismatch is not always a central-city problem: An analysis of commuting behaviour in Cleveland, Ohio, and its suburbs. *Urban Studies*, 38(7), 1161–1186. <https://doi.org/10.1080/00420980120051701>
- Grengs, J. (2010). Job accessibility and the modal mismatch in Detroit. *Journal of Transport Geography*, 18(1), 42–54. <https://doi.org/10.1016/j.jtrangeo.2009.01.012>
- Guthrie, A., Burga, F., & Fan, Y. (2018). Collaboration in mitigating spatial and skills mismatch: Exploring shared understandings between transit planners and workforce professionals. *Journal of Transport and Land Use*, 11(1), 1081–1100. <https://doi.org/10.5198/jtlu.2018.985>
- Hardy, B. L., Logan, T. D., & Parman, J. (2018). The historical role of race and policy for regional inequality. In *Place based policies for shared economic growth*. The Brookings Institution Press.
- Harris, C. (2018). *Lone star slowdown? How land-use regulation threatens the future of Texas*. Manhattan Institute. <https://www.manhattan-institute.org/lone-star-slowdown>
- Hess, D. B. (2005). Access to employment for adults in poverty in the Buffalo-Niagara region. *Urban Studies*, 42(7), 1177–1200. <https://doi.org/10.1080/00420980500121384>
- Howell, A. J., & Timberlake, J. M. (2014). Racial and Ethnic Trends in the suburbanization of poverty in U.S. metropolitan areas, 1980–2010. *Journal of Urban Affairs*, 36(1), 79–98. <https://doi.org/10.1111/juaf.12030>
- Howell, J. (2019). The truly advantaged: Examining the effects of privileged places on educational attainment. *The Sociological Quarterly*, 60(3), 420–438. <https://doi.org/10.1080/00380253.2019.1580546>
- Hu, L. (2015). Job accessibility of the poor in Los Angeles: Has suburbanization affected spatial mismatch? *Journal of the American Planning Association*, 81(1), 30–45. <https://doi.org/10.1080/01944363.2015.1042014>
- Hu, L., & Giuliano, G. (2011). Beyond the inner city: New form of spatial mismatch. *Transportation Research Record*, 2242(1), 98–105. <https://doi.org/10.3141/2242-12>
- Ihlanfeldt, K. R. (1994). The spatial mismatch between jobs and residential locations within urban areas. *Cityscape*, 1(1), 219–244.
- Ihlanfeldt, K. R. (1999). The geography of economic and social opportunity in metropolitan areas. In *Governance and opportunity in metropolitan America* (pp. 213–252). National Academies Press.
- 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. <https://doi.org/10.1080/10511482.1998.9521321>
- Jaret, C., Adelman, R. M., & Reid, L. W. (2006). Suburban sprawl, racial segregation, and spatial mismatch in metropolitan America. *Sociation Today*, 4(2), 1–38.
- Jargowsky, P. A. (2018). The persistence of segregation in the 21st century. *Law and Inequality: A Journal of Theory and Practice*, 36(2), 207–230.
- Kain, J. F. (1968). Housing segregation, Negro employment, and metropolitan decentralization. *Quarterly Journal of Economics*, 82(2), 175–197. <https://doi.org/10.2307/1885893>
- Kain, J. F. (1985). Black suburbanization in the eighties: A new beginning or a false hope. In *American domestic priorities: An economic appraisal* (pp. 253–282). University of California Press.
- 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>
- Keating, L. (2010). *Atlanta: Race, class and urban expansion*. Temple University Press.
- Kneebone, E. (2016). The changing geography of disadvantage. In *Shared prosperity in America's communities* (pp. 41–56). University of Pennsylvania Press.
- Kneebone, E., & Holmes, N. (2015). *The growing distance between people and jobs in metropolitan America*. (Metropolitan Policy Program). Brookings Institute. <https://www.brookings.edu/research/the-growing-distance-between-people-and-jobs-in-metropolitan-america/>
- Lake, R. W., & Cutter, S. C. (1980). A typology of black suburbanization in New Jersey since 1970. *Geographical Review*, 70(2), 167–181. <https://doi.org/10.2307/214438>
- Lee, S., & Leigh, N. G. (2007). Intrametropolitan spatial differentiation and decline of inner-ring suburbs: A comparison of four US metropolitan areas. *Journal of Planning Education and Research*, 27(2), 146–164. <https://doi.org/10.1177/0739456x07306393>
- Li, H., Campbell, H., & Fernandez, S. (2013). Residential segregation, spatial mismatch and economic growth across US metropolitan areas. *Urban Studies*, 50(13), 2642–2660. <https://doi.org/10.1177/0042098013477697>

- Liu, C. Y., & Painter, G. (2012). Immigrant settlement and employment suburbanisation in the US: Is there a spatial mismatch? *Urban Studies*, 49(5), 979–1002. <https://doi.org/10.1177/0042098011405695>
- Logan, J. R., & Molotch, H. L. (2007). *Urban fortunes: The political economy of place*. University of California Press.
- Logan, J. R., & Schneider, M. (1984). Racial segregation and racial change in American suburbs, 1970–1980. *American Journal of Sociology*, 89(4), 874–888. <https://doi.org/10.1086/227947>
- Logan, J. R., Stults, B. J., & Xu, Z. (2016). *Census geography: Bridging data for census tracts across time*. (Spatial Structures in the Social Sciences). Brown University.
- Márquez, M. A., Lasarte, E., & Lufin, M. (2019). The role of neighborhood in the analysis of spatial economic inequality. *Social Indicators Research*, 141(1), 245–273. <https://doi.org/10.1007/s11205-017-1814-y>
- Martin, R. W. (2004). Spatial mismatch and the structure of American metropolitan areas, 1970–2000. *Journal of Regional Science*, 44(3), 467–488. <https://doi.org/10.1111/j.0022-4146.2004.00345.x>
- Massey, D. S. (2004). Segregation and stratification: A biosocial perspective. *Du Bois Review: Social Science Research on Race*, 1(1), 7–25. <https://doi.org/10.1017/S1742058X04040032>
- Massey, D. S., & Denton, N. A. (1988a). Suburbanization and segregation in U.S. metropolitan areas. *American Journal of Sociology*, 94(3), 592–626. <https://doi.org/10.1086/229031>
- Massey, D. S., & Denton, N. A. (1988b). The dimensions of residential segregation. *Social Forces*, 67(2), 281–315. <https://doi.org/10.1093/sf/67.2.281>
- Massey, D. S., & Eggers, M. L. (1993). The spatial concentration of affluence and poverty during the 1970s. *Urban Affairs Quarterly*, 29(2), 299–315. <https://doi.org/10.1177/004208169302900206>
- Massey, D. S., & Tannen, J. (2018). Suburbanization and segregation in the United States: 1970–2010. *Ethnic and Racial Studies*, 41(9), 1594–1611. <https://doi.org/10.1080/01419870.2017.1312010>
- Miller, C. (2018). When work moves: Job suburbanization and black employment. NBER Working Paper, No. 24728.
- Parks, V. (2004). Access to work: The effects of spatial and social accessibility on unemployment for native-born black and immigrant women in Los Angeles. *Economic Geography*, 80(2), 141–172. <https://doi.org/10.1111/j.1944-8287.2004.tb00305.x>
- Qi, Y., Fan, Y., Sun, T., & Hu, L. (Ivy). (2018). Decade-long changes in spatial mismatch in Beijing, China: Are disadvantaged populations better or worse off? *Environment and Planning A: Economy and Space*, 50(4), 848–868. <https://doi.org/10.1177/0308518X18755747>
- Raphael, S. (1998). The spatial mismatch hypothesis and black youth joblessness: Evidence from the San Francisco Bay Area. *Journal of Urban Economics*, 43(1), 79–111. <https://doi.org/10.1006/juec.1997.2039>
- Raphael, S., & Stoll, M. A. (2010). *Job Sprawl and the suburbanization of poverty*. Brookings Institution, Metropolitan Policy Program.
- Reardon, S. F., & Bischoff, K. (2011). Income inequality and income segregation. *American Journal of Sociology*, 116(4), 1092–1153. <https://doi.org/10.1086/657114>
- Reardon, S. F., Matthews, S. A., O'Sullivan, D., Lee, B. A., Firebaugh, G., Farrell, C. R., & Bischoff, K. (2008). The geographic scale of metropolitan racial segregation. *Demography*, 45(3), 489–514. <https://doi.org/10.1353/dem.0.0019>
- Stoll, M. A. (2006). Job sprawl, spatial mismatch, and black employment disadvantage. *Journal of Policy Analysis and Management*, 25(4), 827–854. <https://doi.org/10.1002/pam.20210>
- Stoll, M. A., & Covington, K. (2012). Explaining racial/ethnic gaps in spatial mismatch in the US: The primacy of racial segregation. *Urban Studies*, 49(11), 2501–2521. <https://doi.org/10.1177/0042098011427180>
- Stoll, M. A., Holzer, H. J., & Ihlanfeldt, K. R. (2000). Within cities and suburbs: Racial residential concentration and the spatial distribution of employment opportunities across sub-metropolitan areas. *Journal of Policy Analysis and Management*, 19(2), 207–231. [https://doi.org/10.1002/\(sici\)1520-6688\(200021\)19:2<207::aid-pam3>3.0.co;2-h](https://doi.org/10.1002/(sici)1520-6688(200021)19:2<207::aid-pam3>3.0.co;2-h)
- Theys, T., Deschacht, N., Adriaenssens, S., & Verhaest, D. (2019). The evolution of inter-regional spatial mismatch in the USA: The role of skills and spatial structure. *Urban Studies*, 56(13), 2654–2669. <https://doi.org/10.1177/0042098018803017>
- U.S. Census Bureau. (2017). Annual business survey: Statistics for employer firms by industry, sex, ethnicity, race, and veteran status for the U.S., states, metro areas, counties, and places: 2017.

- U.S. Census Bureau. (2019). LEHD origin-destination employment statistics data (2002–2017). U.S. Census Bureau, Longitudinal-Employer Household Dynamics Program. <https://lehd.ces.census.gov/data/%23lodes>
- U.S. Department of Commerce. (1994). *Geographic areas reference manual (GARM)*. Bureau of the Census.
- Wong, D. (1996). Enhancing segregation studies using GIS. *Computers, Environment and Urban Systems*, 20(2), 99–109. [https://doi.org/10.1016/S0198-9715\(96\)00003-8](https://doi.org/10.1016/S0198-9715(96)00003-8)
- Wong, D. W. (2004). Comparing traditional and spatial segregation measures: A spatial scale perspective. *Urban Geography*, 25(1), 66–82. <https://doi.org/10.2747/0272-3638.25.1.66>
- Wong, D. W. (2005). Formulating a general spatial segregation measure. *The Professional Geographer*, 57(2), 285–294. <https://doi.org/10.1111/j.0033-0124.2005.00478.x>
- Yang, R., & Jargowsky, P. A. (2006). Suburban development and economic segregation in the 1990s. *Journal of Urban Affairs*, 28(3), 253–273. <https://doi.org/10.1111/j.1467-9906.2006.00291.x>

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